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THE MALE AND LARVA OF PSOROPHORA (JANTHINOSOMA) HORRIDA (DYAR AND KNAB) AND A NEW SPECIES OF PSOROPHORA FROM THE UNITED STATES (Diptera: Culicidae)

By LOUIS M. ROTH [1]

Second Lieutenant, Sanitary Corps, Army of the United States

Dyar and Knab (1908) described *Aedes horridus* from a series of 56 females taken from 7 states (Arkansas, Maryland, Mississippi, Oklahoma, Tennessee, Texas, Virginia). In 1906 these writers had described *Janthinosoma champerico* from Guatemala, a species close to *Janthinosoma lutzii* Theobald. Howard, Dyar and Knab (1917) listed *Psorophora champerico* and *Psorophora horridus* as distinct species. Felt (1904) described what he thought to be the male of *Janthinosoma lutzii* Theob., and Dyar and Knab, believing this to be the male of *P. horridus*, placed *Janthinosoma lutzii* Felt (nec. Theob.) as a synonym of *P. horridus*. They copied Felt's photograph of the genitalia. In 1928 Dyar made *horridus* a synonym of *champerico* and assumed that the male figured by Felt was the male of *Psorophora champerico* D. and K. Again Dyar's drawing was apparently copied from Felt's photograph. Matheson (1934) described a most bizarre type of genitalia for a male from Fayetteville, Arkansas of what he believed to be *Psorophora horridus* (D. and K.). Rozeboom (1939) described what he thought was the larva of *horrida* from Tulsa, Oklahoma, since reared males had genitalia similar to Matheson's Arkansas specimens. Matheson (1934) stated that "the male genitalia figured by Felt (1904) and copied by Howard, Dyar and Knab (1917) and by Dyar (1928) as representing the male of *P. horridus* is undoubtedly that of *Psorophora lutzii* Theob. or *Psorophora ferox* Humb. (*posticata* Wied.). This conclusion is in agreement with the descriptions and figures given by Bonne and Bonne-Wepster

[1] This work was done at the Fourth Service Command Medical Laboratory, Fort McPherson, Georgia. The author wishes to thank Dr. Alan Stone for his valuable suggestions, and Dr. E. A. Chapin for the use of the laboratory and specimens at the United States National Museum, Washington, D. C. Further appreciation is expressed, for their assistance, to Lt. Roy W. Chamberlain, Mrs. Edna Roth, SP-3, and Miss Winona Gilstrap, SP-3, all of the Fourth Service Command Medical Laboratory.

(1925). *Psorophora horridus* (D. and K.) should remain as a distinct species. *P. champerico* D. and K. is probably identical with *P. lutzii* Theob. but no definite conclusion should be reached until the male has been discovered. Should it prove identical with that of *P. horridus* then *horridus* would become a synonym of *champerico* D. and K."

In 1943 three males of *P. horrida*, identified by color, from Montgomery, Alabama, were received at the Fourth Service Command Medical Laboratory, and their genitalia proved to be practically identical to that of *Psorophora ferox* (Humb.). Since then a total of 21 males have been obtained, representing 5 states (Alabama, Mississippi, North Carolina, Oklahoma and South Carolina), and all agree in that their genitalia are similar to *ferox*. Apparently two distinct species of *Psorophora*, occurring in the United States, have been confused under the name *horrida*.

Matheson (1934) stated that Felt's photograph is either that of *lutzii* or *ferox*. Although the genitalia are very similar an examination shows a distinct difference in the claspers (dististyle) of the two species, that of *lutzii* being decidedly less swollen medially than *ferox*. Bonne and Bonne-Wepster (1925, Figs. 55, 56) show this in their drawings, although their descriptions merely state (for both species) that the clasper is "small at base, greatly inflated beyond the middle, extreme tip slender, recurved with an articulated spine." Gordon and Evans (1922) briefly described the genitalia of *lutzii* and stated that the sidepieces, tenth sternites and aedeagus is as in *P. posticatus* (now *P. ferox*). They did not mention the clasper. Cerqueira (1939) figures the genitalia of *lutzii* and shows that the clasper swelling is moderate. Felt's photograph, which shows the claspers clearly, is undoubtedly not *lutzii*. There are also distinctive color differences between the South American species (*champerico* and *lutzii*) and our United States *horrida* (and the new form). The chief difference is the golden- or sulphur-yellow mesonotal markings in the tropical, as compared with the white or creamy-white scales of our own species. For this reason I believe that at the moment *champerico* and *lutzii*[2] are not involved, the

Howard, Dyar and Knab (1917) write that "the only male specimen of this species [*P. horridus*] which we have had was dissected by Dr. E. P. Felt and unfortunately destroyed so that problem being to decide which of the males represents *horrida;* Matheson's type with the peculiar genitalia or the one having the *ferox*-like genitalia.

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[2] After examining females of both species, I believe that *champerico* and *lutzii* are two distinct species. Not only are certain color differences present but the proboscis and palpi of *champerico* are distinctly longer than those of *lutzii*. The same relationship between the palpal segments apparently exist here, as with the two species (*horrida* and the new form) described later.

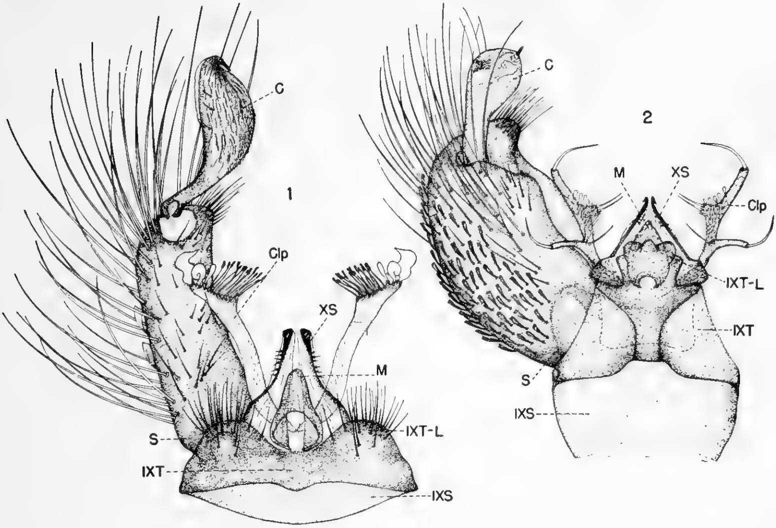


Fig. 1, Male genitalia of *Psorophora horrida* (D. and K.); Fig. 2, Male genitalia of *Psorophora longipalpis* n. sp. (drawn to smaller scale than Figure 1). *Explanation of symbols:* (C) clasper, (Clp) claspette, (M) mesosome, (IXS) ninth sternite, (IXT) ninth tergite, (IXT–L) lobe of ninth tergite, (XS) tenth sternite, (S) sidepiece.

we have been unable to prepare a description of that sex." The color differences between *horrida* and *ferox* are so distinctive that it is improbable that Felt was dealing with the latter. Since the males received from southeastern states have shown *horrida* markings and *ferox*-like genitalia, I believe that Felt's original description was actually that of a southeastern *horrida*. Unfortunately no locality data is given for his specimen.

A study of three adult males having the unusual genitalia (Arkansas, Oklahoma, South Dakota) revealed that femoral knee spots are completely lacking, while these markings are very distinct in the eastern form. The absence of knee spots also holds true for two females which were reared, by Rozeboom, with the Oklahoma male. There are other minor differences in female markings and a distinct difference in length and shape of palpi is present between the eastern and western species (in both male and female). Dyar and Knab's (1908) original description of *Aedes horridus* describes the legs as "deep violet scaled, the basal two-thirds of the femora yellowish, the knees silvery white . . ." In 1917 they again described the knees of *P. horridus* as being narrowly silvery white-scaled.

Of the original 56 female specimens (Cotype No. 11999) used by Dyar and Knab, 41 were available at the United States

National Museum. An examination of these cotypes showed that both species were represented although the majority of them were the eastern form. Thirty-four specimens agreed with the original description while 7 (all from Texas) lacked knee spots and were similar in other characters to the Oklahoma females. Apparently the original description of *horrida* was based mainly on eastern material and therefore a lectotype (Corinth, Mississippi, VIII–14–04, Coll. H. S. Barber) agreeing with that description was selected from the cotypes.

The genitalia figured by Felt (1904) is assumed to be that of *Psorophora horrida* (D. and K.) (Fig. 1). Matheson's male (Fig. 2) therefore represents a new species and this midwestern form which has been confused with *horrida* is now named *Psorophora longipalpis*. Rozeboom's (1939) "*horrida*" larva also becomes a synonym of *longipalpis*.

The maxillary palpi project from beneath the clypeus and according to Snodgrass (1943) each consists of four segments in female mosquitoes. When the head is cleared in KOH and mounted on a slide, the female palpus (of *horrida* and *longipalpis*) show the first two segments small and almost completely fused, the junction being indicated by a slight constriction and also by a break in pigmentation. The second and third segments appear partly fused also but the joint here is more distinct than that between the preceding segments. The fourth segment articulates freely with the third. In the present description the female palpus is regarded as composed of four segments in spite of the fact that some specimens possess a small setose projection at the tip of the fourth segment (Figs. 8, 16). This structure may represent a sensory organ or possibly a fifth segment since Marshall (1938) states that the palpus is composed of five segments. In unmounted specimens (i. e. those not cleared in KOH) the dense covering of scales and setae obscures most of the palpal joints so that segments one and two may appear as a single segment. However, the joints between segments two and three, and three and four are distinct and the terminal segment can be easily separated from the preceding ones. The small projection at the tip of the fourth segment, when present, doesn't influence the length of the palp since it is hidden by the overlapping scales.

Edwards (1941) regarded the male palpus as composed of three segments, neglecting the rudimentary basal segment and the incomplete division of the shaft (segments two and three) into two segments. In the present study, the male palpus is considered composed of five segments. These are a small basal segment articulating more or less freely with two elongated segments that are practically completely fused, their joint being indicated by a small nude (without scales), slightly distorted area; and freely articulating penultimate (fourth) and terminal (fifth) segments.

Psorophora (Janthinosoma) horrida (D. & K.)

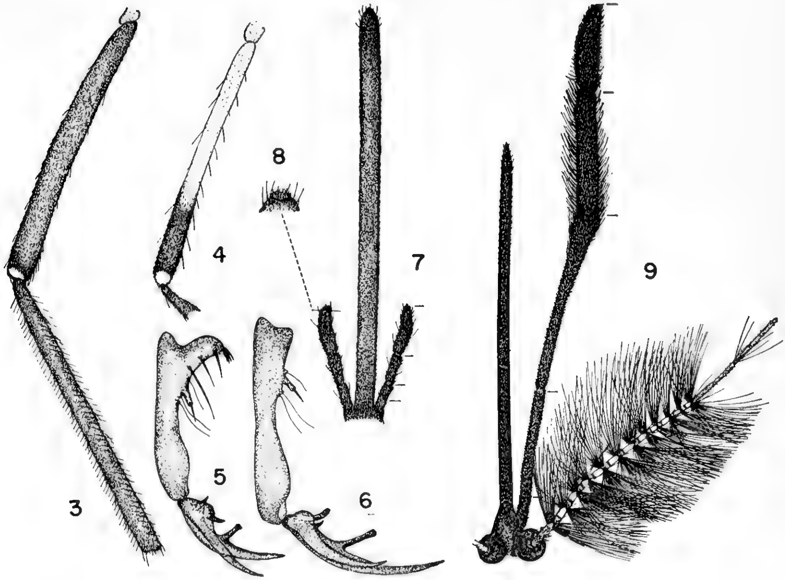
Aedes horridus Dyar and Knab, 1908, Proc.U. S. Nat. Mus. 35:56 (in part).

Psorophora horridus (Dyar and Knab): Howard, Dyar and Knab, 1917, Mosq. No. and Cent. Amer. and W. I., 2:561 (in part).

Psorophora (*Janthinosoma*) *horridus* (Dyar and Knab): Dyar, 1922, Proc. U. S. Nat. Mus., 62:36 (in part).

Male.—Head: Proboscis uniformly dark scaled, long, almost equal in width throughout. Palpi (Fig. 9) longer than proboscis, with dark appressed scales, some of these roughened; integument of joint between second and third segments dark [3]; last two palpal segments distinctly broader than the preceding ones, the penultimate segment with long black bristles. Antennae (Fig. 9) reaching to about the apex of the third palpal segment or a little beyond; last two antennal segments short, both not as long as the combined preceding segments; hairs of whorls very numerous and long; tori black, globose and bare. Clypeus black, nude. Vertex clothed with broad recumbent whitish scales, some lanceolate ones in the occipital region, and many erect forked dark (very few pale) scales; recumbent scales along the margin of eye, broad and pale; ocular and vertical setae long and black, frontal setae pale. *Thorax:* Mesonotum with a broad median band of bronzy dark narrow scales and short bristles; sides with very broad, flat white scales (some creamy scales along the dividing line of median dark band and lateral white scales) and long, mostly dark, setae; a few long narrow white scales intermixed with the broad ones at the posterior third of the mesonotum; some medial broad white scales surrounding the antescutellar area. Scutellum trilobate, clothed with pale scales, the lobes with long black bristles. Pleural sclerites sparsely scaled, otherwise without significant differences from that described later for the female. *Legs:—Prothoracic leg*—coxa with a patch of white scales,with or without a few apical dark scales; outer surface of femur with some yellow scales basally, the remainder violet-scaled, inner surface with violet scales at the apical fourth remainder yellowish; white femoral knee spot present; tibia and tarsus with dark appressed scales and some short suberect bristles; last tarsal segment (Fig. 5) scaled and setose, narrowed medially, with a basal projection, along the posterior margin, bearing several short and long spines; at least one elongated papillary projection, slightly before the middle along the posterior margin, bearing a short bristle; some long hairs from enlarged tubercles, near the papilla; large tarsal claw with a small basal tooth and a longer medial one (apex of tooth rounded or slightly enlarged); smaller tarsal claw with a small acute tooth near the base. *Mesothoracic leg* (Fig. 3)—coxa with a patch of white scales, with or without a few

[3] In *ferox* males, the junction between palpal segments two and three is very distinct because the color of the integument of this nude area is decidedly paler (creamy white) than the rest of the palpal integument. The joint actually appears as a pale ring. In *horrida* males the color of the integument is the same for the entire length of the palp and therefore the joint between segments two and three is very indistinct. Since the genitalia of these two species are very similar, the color of the integument in this region is a good diagnostic character particularly in badly damaged specimens which have lost their distinctive color markings.



Figs. 3–9, *Psorophora horrida* (D. and K.) adult characters. 3, Femur (with knee spot) and tibia (with long setae) of mesothoracic leg of male; 4, Femur (with knee spot) of metathoracic leg of female; 5, Last tarsal segment and tarsal claws of prothoracic leg of male (scales and majority of setae not indicated); 6, Last tarsal segment and tarsal claws of mesothoracic leg of male (scales and majority of setae not indicated); 7, Palpi and proboscis of female; 8, Tip of fourth palpal segment (greatly enlarged) of female; 9, Antenna, proboscis and palp of male.

apical dark scales; femur violet-scaled on outer surface, inner with yellow scales extending to apical third, remainder dark-scaled; white femoral knee spot present tibia with dark appressed scales and numerous long outstanding suberect setae; tarsus with dark appressed scales and sparse short bristles; last tarsal segment (Fig. 6) scaled and setose, narrowed medially; at least one long papillary projection bearing a bristle, before the middle along the posterior margin; several long hairs from enlarged tubercles around the projection; large tarsal claw with a short basal spine (apically rounded) and a longer medial tooth, usually roundly truncate or slightly enlarged at the tip; smaller tarsal claw with a short basal tooth. *Metathoracic leg*—coxa with a basal patch of white scales; femur with about the basal half of the inner and outer surfaces yellow-scaled, remainder violet; white femoral knee spots present; tibia with roughened suberect dark scales and numerous long setae; tarsus with short suberect setae and roughened scales on the first two segments, the last two segments and sometimes the tip of the third white-scaled, remainder dark-scaled; last tarsal segment without papillary projections, not narrowed medially; both tarsal claws small, about the same size, each with a medial pointed tooth. *Abdomen:*—dorsum of first segment yellow-scaled the others with violet-blue scales and some apical lateral patches of white or creamy scales; sternites with pale scaling restricted mostly to the apical portion and violet scales to the basal part of the segment; eighth sternite all dark-scaled.

Male Hypopygium (Fig. 1):—*Sidepiece* (*Basistyle*) about three times as long as wide, roundly truncate at the apex, inner apical margin with a slight rounded projection bearing a group of setae; surface of sidepiece, with microtrichia, scaled and bearing long stout and short slender setae. *Clasper* (*Dististyle*) expanded medially to more than twice the width at the base (from side), constricted apically and bearing a short stout retrorse terminal spine; surface rugose, with a few setae from round openings; inner portion bearing microtrichia, outer apical margin with a thin clear membranous area. *Claspette* slender, well separated from the sidepiece; apical portion bent laterad and bearing three flattened appendages at the apex, one of these short and rounded, the other two, large, curled, contorted and acute leaflets; numerous apical marginal and submarginal slender, distally feathered setae. *Lobes of ninth tergite* connected by a broad sclerotized band, each lobe mound-like, covered with fine microtrichia and bearing numerous long slender setae from distinct tubercles. *Ninth sternite* with a group of setae, medially on the posterior margin. *Tenth sternite* (*Paraproct*) membranous, spicular, supported by two sclerotized strips bearing one or more small denticles apically; several small setae occur on the subapical region. *Mesosome* (*Phallosome*) open ventrally and closed on the dorso-apical half; basal portion wide, the part beyond the middle tapering towards the apex.

(In non-flattened specimens the apical portion of the claspette with its setae are curved upwards in a dorsal direction showing the feathered tips of the appendages. In this position the claspettes of *horrida* appear somewhat shorter than those in *ferox* and usually the tip of the apical contorted leaflet (in *horrida*) does not reach the hollow region, on the sidepiece, which holds the clasper. However when the specimen is flattened under a cover slip the setae can be clearly seen from the side, the claspette is somewhat elongated and the distal curled leaflet may reach the apical hollow or go beyond. In non-flattened specimens of *ferox* the claspette appears to be longer and have less of a dorsal curvature, while the distal contorted leaflet usually reaches, or goes beyond, the base of the apical hollow on the sidepiece. In some specimens this leaflet may actually reach the apex of the sidepiece itself. However these differences are probably subject to variation and cannot be used to safely separate the genitalia of *ferox* from *horrida*.)

Female:—Head: Proboscis long, slender of uniform width throughout, labellae long and conical, uniformly dark-scaled. Palpi (Fig. 7) short, the dark scales and setae giving a roughened appearance; segment four about equal in length, or only a little longer than the first three combined, its sides usually gently curved, base slightly constricted and apex roundly tapered (clearly seen in KOH treated specimens); tip of fourth segment sometimes with a small knob-like projection. Antennae slender, segments pilose, hairs of whorls sparse and long; tori globose with a patch of pale broad scales on the inner surface. Vertex with broad appressed white to creamy scales, some narrow ones on occipital region and a patch of flat broad violet black ones on each side; forked erect scales mostly yellowish, a few dark ones near the patch of flat dark scales; ocular and vertical setae mostly dark, frontal setae pale; scales along margins of eyes pale, mostly broad. *Thorax:* Mesonotum with a broad median band of dark narrow scales and short dark bristles; sides of disc with broad white to yellowish-white scales and long and short dark and pale setae; some broad white to yellowish-white scales surrounding the antescutellar area. Scutellum trilobate, pale-scaled. Anterior and posterior pronotal lobes and postspiracular plate with numerous broad white scales and pale and dark setae; subspiracular area nude or nearly so; propleural plate with broad white scales; sternopleural and mesepimeral plates with nude apical regions, the remainder covered with broad recumbent white scales; meron, nude and dark. *Legs: Prothoracic leg:*—Integument of coxa pale, with a dense patch of white scales and with or without a few dark ones apically; outer surface of femur mostly violet-scaled with some yellowish scales near the base, inner surface with violet scales at the apical third, the remainder yellowish; white femoral knee spots present; tibia and tarsus with dark appressed scales and some short suberect setae. *Mesothoracic leg:*—Integument of coxa darker than fore or hind coxa with a patch of scales similar to that on the fore coxa; femur violet-scaled on the outer surface, inner with yellowish scales extending to the apical third; white femoral knee spot present; tibia and tarsus with dark appressed scales and short suberect setae. *Metathoracic leg:*—Integument of coxa pale, with a basal patch of white scales; femur with a little more than the basal half of the inner and outer surfaces yellowish-scaled, remainder violet; white femoral knee spot present (Fig. 4); tibia with dark appressed slightly roughened scales and short suberect setae; last two tarsal segments white-scaled, the others dark; scales on first two segments roughened. The amount of yellow scales on the femur is somewhat variable as is the scaling of the hind tarsal segments. Usually the white scales (with an occasional dark scale) are restricted to the last two tarsal segments only, although specimens are found with the apex of the third segment white. Sometimes the fourth segment will have some dark scales in definite patterns as follows: (a) dark scales on base and apex of the ventral surface, with or without a few medial dark scales; (b) entirely dark-scaled, or nearly so, on one side only (dorsal or ventral); (c) entirely dark, or nearly so, ventrally, and partly dark-scaled dorsally; (d) dark-scaled on apical ventral half or third; (e) dark-scaled on both dorsal and ventral apical half; (f) almost entirely dark-scaled (very few white scales); (g) almost entirely dark-scaled; fifth segment with some dark scales; (h) almost entirely dark-scaled ventrally and dark-scaled basally and apically on the dorsal surface; fifth with dark basal and apical rings. (a and b are not uncommon while the others occur rarely). *Abdomen:*—Dorsum of first segment pale-scaled, remainder mostly violet-scaled; segments two to six (sometimes seven) with patches of pale lateral apical scales, the patches larger on the posterior segments; sternites of segments one to three almost entirely yellow, segments four to six with dark scales basally and yellow scales apically, the seventh segment almost entirely violet-scaled.

Larva (Fig. 10):—Head wider than long, bulging laterally. Antennae spinulate, slightly curved, gradually tapering distally, shorter than (rarely as long as) head; a small multiple tuft (7 or more branches) just beyond the middle usually not reaching the apex of the antenna; 1 short and 3 long spines at the tip. Lower head hairs usually triple, sometimes double; upper head hairs double or triple; head hairs short, with branches all about the same diameter and length,

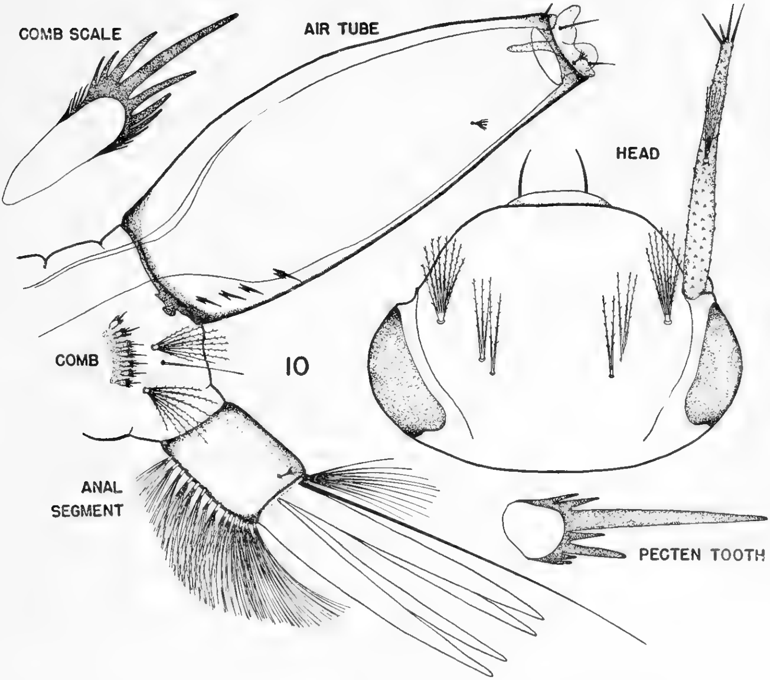


Fig. 10, *Psorophora horrida* (D. and K.) fourth instar larval characters.

usually reaching about the middle of the preantennal tuft, or a little beyond the base of the antenna, never beyond the preclypeus. Preantennal tuft with 5 or more branches (usually more than 7) and generally not reaching beyond the preclypeus. Antennal, preantennal and head hairs finely frayed.

Lateral abdominal hairs longer on first two segments than on succeeding segments (these are small and often difficult to see on segments IV to VII); multiple on segments I and II; usually 3, sometimes 4 branched on segments III to VI (rarely single on segment VI); 2 or 3 branched on segment VII.

Comb scales of eighth abdominal segment usually 7, but from 5 to 8 in number (variable on either side of the same specimen and sometimes in a partial double row), arising from the posterior margin of a weakly sclerotized plate. Individual comb scale with a large central spine and several smaller ones on each side. A single simple hair arises between two multiple tufts (branches frayed) posterior to the lateral comb.

Air tube inflated, generally more than three times as long as wide at the base. Usually 5, but from 2 to 8 pecten teeth (variable on either side of the same specimen) arise basally; the apical pecten teeth often with several smaller spinules at the base; however, the number of these basal spinules on each pecten tooth is variable. A minute multiple ventral tuft, whose branches are usually smaller than the length of a pecten tooth, arises ventro-laterally on the apical third.

Dorsal preapical spine about one-half to two-thirds the length of a pecten tooth. Dorsal apical hair about one and one-half to two times longer than the dorsal preapical spine; other apical hairs (ventral) short, one pair single the other with several fine branches a short distance from the base.

Anal segment longer than wide, ringed by plate; ventral brush consisting usually of 14 tufts (sometimes 15, rarely 13 or 16 tufts) which perforate the plate along the mid-ventral line; dorsal brush a long hair and a multiple tuft on each side; lateral hair small and multiple, branched a short distance from the base; 4 tapering anal gills, longer than the anal segment.

Lieutenant Charles B. Eaton has reared *horrida* and recorded data on the biology of this species. The larval description is based on material kindly supplied by him. The information concerning the habits of *horrida*, given in the following paragraphs, is taken practically verbatim from a personal letter of Lt. Eaton's, dated October 12, 1944.

Collections of *P. horrida* on the Fort Benning Reservation have been made at intervals during the last two years. The species was first taken on June 22, 1943, and again on July 1 and 10 of the same year. During 1944 the species has been collected, on several occasions, in a locality which is the only natural breeding site thus far discovered for *horrida* on the reservation. This site is located in the Alabama Area, State of Alabama, immediately northeast of the Alabama Landing Strip, and about a mile southwest of the Chattahoochee River, at a point which marks the boundary between the states of Georgia and Alabama. While the species may be present in other parts of Fort Benning, records of some 15,000 mosquitoes collected at this military installation during 1943 and 1944 fail to indicate its occurrence outside the Alabama Area.

P. horrida breeds locally in temporary pools, that exist under cover of partial shade, following prolonged rains. The breeding site dries out completely and remains dry for several weeks at intervals throughout the year. However, when the area is flooded after these dry periods, the eggs hatch and the larvae seem to develop with great rapidity. The adults emerge in large numbers. Collection records indicate that the great majority of a given generation of *horrida* emerge almost simultaneously. Once an emergence has occurred it is almost impossible to find larvae of the species, even when the breeding places are not completely dried up. The adult females rest on low vegetation, close to the ground. When disturbed they swarm hungrily upward on the intruder and lose no time in biting. The duration of the adult stage under natural conditions is not definitely known but field collection records indicate that the life span of the females is probably about a month. In the first emergence that occurred this season *horrida* females began to appear in numbers about May 10, and disappeared in mid-June. Following the second emergence, which began about August 15 the females were numerous until the second week in September. Nothing is known of the life span of the males, but presumably it is of short duration.

Adults are commonly associated with the following other species: *Psorophora ferox*, *P. varipes*, *P. cyanescens*, *P. ciliata*, *Aedes vexans*, *A. mitchellae*, *A. dupreei*, *A. sticticus*, and *A. atlanticus or tormentor*. The foregoing records are based on collections, at the breeding site (*horrida*), of adults made simultaneously with collections of *P. horrida* as the mosquitoes alighted on the body or clothing of the collector. The determination of species associated in the larval stage with *P. horrida* has been hampered by the confusion existing in the separation of this species and *P. ferox;* however, larvae of *Aedes vexans*, *A. atlanticus*, *A. dupreei*, and *P. ferox* have been collected in association with larvae subsequently determined as *horrida*.

Since larvae of *horrida* proved to be difficult to collect in their native habitat, an attempt was made to rear them from the egg stage. Following the emergence that occurred in mid-August little difficulty was experienced in finding females to provide the eggs. On August 21, approximately 35 females were captured and transported to the laboratory where they were confined in groups of 3 to 6 in pint jars covered with cheese cloth. About an inch of moist sand was placed in the bottom of each jar to provide a site for egg deposition. Prior to the initial confinement each mosquito was allowed to feed to repletion on human blood. Few of the mosquitoes appeared to have fed before and nearly all took blood readily. Throughout their confinement the females were allowed to feed on humans every 2 or 3 days. The maximum number of blood meals taken by any one female was 9, and the minimum number 4. The average length of survival of the adult females after being caged was 9½ days, with a maximum of 16 days and a minimum of 2 days.

Since no males were present in the collection, fertilization of the females presumably took place in the field prior to their capture. A number of females died in the cages before egg deposition began, and it may be that these females had not mated. Oviposition was observed on several occasions. In some cases the eggs were strewn out on the surface of the soil, but usually they were tucked away in tiny crevices behind particles of soil about 1 mm. from the surface, where they were invisible from above. The newly laid eggs are creamy-white in color but become black in a short time, and seem to be sticky. Hatching of the eggs seems to be stimulated by a previous drying period. In a rearing jar flooded 2 days after oviposition began, tiny larvae were not observed until 6 days after the water had been added. In other jars not flooded immediately larvae appeared, in several instances, within 15 minutes after flooding.

The larvae of *horrida* are bottom feeders, but just what their natural food consists of could not be determined. In the laboratory, pulverized dog biscuit and a yeast suspension were supplied for food. Larvae developed to the fourth instar on this diet with reasonable success; however, these mature larvae were not particularly robust individuals, and a large percentage were unable to pupate successfully. Under the conditions of the study there was a wide range in the length of time spent in the larval stage. The shortest period required for development from egg to pupa was 8 days, while the longest period was 18 days. The number of individuals to successfully reach the pupal stage was not sufficient to furnish a valid average. As noted above, however, field collections indicate that the range in development time is much narrower than the rearings indicate and it is probable that most of the larvae pupate within 7 days or less in their native habitat.

A total of 9 *P. horrida* adults, with associated larval skins, have been reared through from the egg stage at this writing. Of this number 6 were males and 3 were females. The length of the pupal period varied from 1 to 3 days in these rearings, with most of the adults emerging within 2 days.

The male records of *Psorophora horrida* are listed below: ALABAMA: Maxwell Field, Montgomery, V–6, 8–43 (light Trap) 3; Alabama Area of the Fort Benning Reservation (northeast of Alabama Landing Strip and about a mile southwest of the Chattahoochee River at a point which marks the boundary between the states of Georgia and Alabama), V–3–44 (C. B. Eaton) 4 (reared from larvae); IX–12, 13, 14, 16, 21–44; X–4–44 (C. B. Eaton) 6 (reared from eggs); MISSISSIPPI: Camp Shelby, Hattiesburg, V–25–44 (C. D. Michener) 1; NORTH CAROLINA: Camp Sutton, Monroe, VII–26–43, 1. OKLAHOMA: Dawson, Tulsa Co., V–15–44, 5. SOUTH CAROLINA: Myrtle Beach Bombing Range, Horry Co., VIII–16–43 (light Trap), 1.

Female specimens of *P. horrida* have been examined from the following localities [4] (specimens received at the Fourth Service Command Medical Laboratory, and those borrowed from the Seventh Service Command Laboratory, Fort Omaha, Nebraska; Dr. Robert Matheson, Cornell University; Dr. H. B. Hungerford, University of Kansas; and Dr. F. A. Fenton, Oklahoma, A. and M. College). ALABAMA: Town Creek; Mobile; Selma; Gadsden; Montgomery; Tuskegee; Florence; Alabama Area of

[4] *Horrida* females have been taken fairly commonly throughout the southeastern states; only towns or counties are listed, and no collection data is given for the numerous specimens examined.

the Fort Benning Reservation. Arkansas: Little Rock (1) [5]; Fort Smith (2); Helena (1); Danville (2); Vanburen (2); Strong; Scott. District of Columbia: Washington. Georgia: Macon; Welleston; Augusta; Rome; Fort Oglethorpe. Illinois: Elizabeth. Indiana: Lafayette. Iowa: Algona; Folletts, Clinton Co. Kansas: Coffeyville; Fort Riley; Independence; Junction City; Lawrence. Kentucky: Meade Co. Louisiana: Baton Rouge. Maryland: Plummers Island (1). Mississippi: Aberdeen; Corinth (2; one of these is designated as the lectotype); Jackson (2); Westpoint (1); Grenada; Meridian; Hattiesburg; Biloxi; Columbus; Greenwood; Clinton; Centerville. Missouri: Charleston, Mississippi Co.; Jefferson Barracks; Rosecrans Field, Buchanan Co. North Carolina: Monroe; Fayetteville; Maxton; Rockingham; Goldsboro. Ohio: Marion County. Oklahoma: Wister (3); Sherwood; Gore; Eagletown. South Carolina: Columbia; Sumter; Horry Co. Tennessee: Rives (3); Chattanooga (1). Texas: Denison (1); Dallas (8); Greenville (3); Kirbyville. Virginia: Woodstock (1).

Larval specimens of *Psorophora horrida* have been examined from: Alabama: Alabama Area of the Fort Benning Reservation, IX–16–44 (C. B. Eaton) 36 (reared from eggs); IX–9, 10, 13, 14, 15, 19, 20–44, X–3–44 (C. B. Eaton) 9 fourth instar exuviae (reared from eggs). Mississippi: Hattiesburg, IV–6–43, 4.

Psorophora (Janthinosoma) longipalpis, new species

Aedes horridus Dyar and Knab, 1908, Proc. U. S. Nat. Mus. 35:56 (in part).

Psorophora horridus (Dyar and Knab): Howard, Dyar and Knab, 1917, Mosq. No. and Cent. Amer. and W. I., 2:561 (in part).

Psorophora (*Janthinosoma*) *horridus* (Dyar and Knab): Dyar, 1922, Proc. U. S. Nat. Mus., 62:36 (in part); Matheson, 1934, Proc. Ent. Soc. Wash. 36:41–43 (describes male).

Psorophora (*Janthinosoma*) *horrida* (Dyar and Knab), Rozeboom, 1939, Jour. Para., 25:145–147 (describes larva).

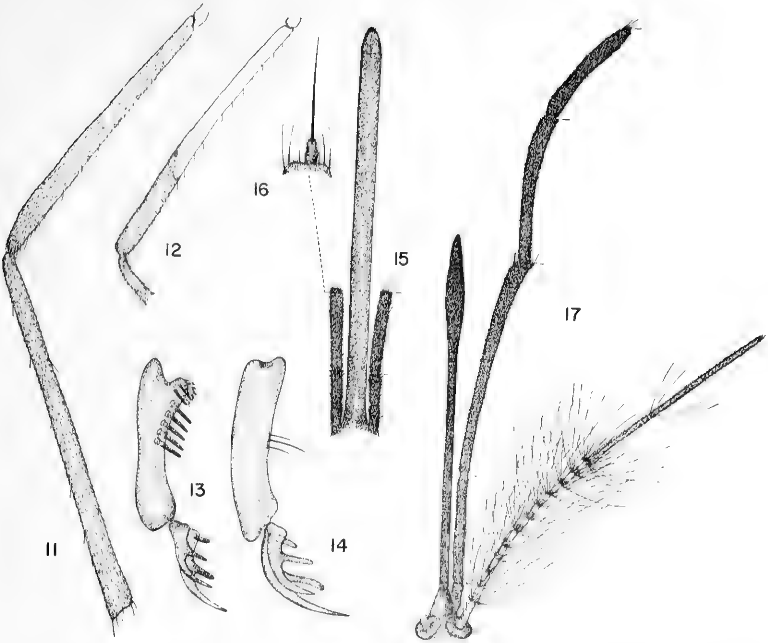
Psorophora horrida (D. and K.), King, Bradley and McNeel, 1942, USDA, Misc. Pub. 336:51, 79 (in part; use Rozeboom's larval description); Rozeboom, 1942, Oklahoma Agr. and Mech. Col. Agr. Exp. St. Technical Bulletin No. T–16:45.

Holotype Male.—Head: Proboscis long, slender, uniformly dark-scaled, with a distinct apical swelling, labellae long and conical. Palpi (Fig. 17) longer than proboscis, with dark appressed scales, the last two segments little, if any, enlarged; third segment with a few long bristles at the apex, penultimate and terminal segments without long setae. Antennae (Fig. 17) reaching well beyond

[5] The parentheses indicate that these specimens were among Dyar and Knab's original cotype material and the figure shows the number present. The total number of specimens examined, other than this cotype material, is not shown although several hundred have been seen.

the apex of the third palpal segment; last two antennal segments elongated, both longer than the preceding segments combined; hairs of whorls numerous (but distinctly fewer than in *P. horrida*) and long; tori dark, globose and with a patch of pale scales on the inner side; vertex clothed with both lanceolate and broad recumbent white scales and some pale and dark erect forked scales; a patch of flat violet-black scales on each side flanked on top by broad recumbent white scales and broad yellowish ones on bottom; recumbent pale scales along margin of eye narrow; frontal setae pale and long, ocular and vertical setae dark. *Thorax:* Mesonotum with a broad median band of narrow bronzy-brown scales and short dark setae; sides with very broad, flat white scales and long, mostly dark, setae; a few broad white scales, medially on the antescutellar area. Scutellum trilobate, clothed with pale scales, the lobes with long black bristles. Pleural sclerites and coxae as described later for the female. *Legs: Prothoracic leg:*—outer surface of femur with some yellowish scales basally, remainder violet-scaled; inner surface with yellowish scales running the entire length; femoral knee spot absent; tibia and tarsus with dark appressed scales and very few short suberect bristles; last tarsal segment (Fig. 13) scaled and setose, narrowed medially with a small basal projection on the posterior margin, bearing numerous small pointed scales and some large spines; a row of several large stout spines on the basal half along the posterior margin; large tarsal claw with a small basal and larger medial tooth; smaller claw with a long medial, tapered, apically rounded tooth. *Mesothoracic leg* (Fig. 11):—femur violet-scaled on outer surface, inner with some yellowish scales extending to the apex; femoral knee spot absent; tibia with dark recumbent scales and some very short suberect setae (no long bristles); tarsus with dark appressed scales; last tarsal segment (Fig. 14) scaled and setose, nearly of equal width throughout, with some long hairs arising from enlarged tubercles, about the middle of the posterior margin; large tarsal claw with a small basal, apically-rounded tooth and a larger medial one; smaller tarsal claw with a long medial tooth (one specimen lacked this medial tooth on the smaller claw). *Metathoracic leg*:—femur with about the basal half of the inner and outer surfaces yellowish-scaled, remainder violet; femoral knee spot absent; tibia with dark scales little roughened, and some some short suberect setae; last two tarsal segments and sometimes tip of third, white-scaled; dark suberect scales on first two segments, only slightly roughened, plus some short erect setae (the hind legs appear much less shaggy than *horrida*); both tarsal claws about equal in size and each with a medial, basally broad and apically pointed, tooth. *Abdomen:*—dorsum almost entirely violet-blue-scaled, a few apical lateral pale scales. Sternites nearly entirely yellow-scaled, except for the entire eighth and the basal medial part of the seventh segments which are violet-scaled. Bulbous sidepieces of the genitalia covered with violet scales and long pale setae.

Male Hypopygium (partly after Matheson, 1934) (Fig. 2):—*Sidepiece* cylindrical, short, stout at least half as wide as long with long and short setae and numerous recumbent and suberect scales; apex with a stout finger-like process projecting medially and clothed with slender hairs; inner face of each sidepiece with a large depression for housing the claspettes. *Clasper* short, narrowed at base and gradually expanded and rounded distally, terminating in a short spine; surface only slightly rugose; a small projection bearing several short setae on the



Figs. 11–17, *Psorophora longipalpis* n. sp. adult characters (drawn to same scale as Figures 3–9). 11, Femur (without knee spot) and tibia (without numerous long setae) of mesothoracic leg of male; 12, Metathoracic femur (without knee spot) of female; 13, Last tarsal segment and tarsal claws of prothoracic leg of male (scales and majority of setae not indicated); 14, Last tarsal segment and tarsal claws of mesothoracic leg of male (scales and majority of setae not indicated); 15, Palpi and proboscis of female; 16, Tip of last palpal segment (greatly enlarged) of female. 17, Antenna, proboscis and palp of male.

outer margin below the tip. *Claspettes* each with two divergent branches terminating in a long comparatively stout recurving spine; the larger branch with a small extension bearing two spines and numerous short slender setae and small flattened leaflets on and around the extension; the smaller branch with a slight projection, at the base bearing a short spine. *Mesosome* cone-shaped, open ventrally closed almost entirely dorsally, with a narrow marginal flange around the small basal opening. *Tenth sternites* with lateral supporting sclerotized strips ending in a short denticle. *Ninth segment* narrowed and retracted largely within the eighth. *Lobes of ninth tergite* projecting medially, without setae, the apical margin invaginated and sometimes bearing a central tooth-like projection; basally the lobes give off lateral projections which converge to form a dark band down the center. *Ninth sternite* with a medial area bearing a group of slender setae on the posterior margin.

Female:—Head: Proboscis dark-scaled, long and slender, almost uniform in width, labellae long and conical. Palpi (Fig. 15) comparatively long, dark-scaled, roughened, setose, the fourth segment elongated, and more than one and one-half times longer than the preceding segments combined; sides of segment four parallel, of uniform width throughout (clearly seen in KOH treated specimens) and roundly truncate at tip; tip of fourth segment usually with a small setose projection which may or may not bear a long bristle (Fig. 16). Antennae slender, segments pilose, hairs of whorls, sparse and long; tori globose with a patch of flat pale scales on the inner surface. Vertex with both broad and narrow recumbent white scales, a patch of broad flat violet scales on the sides flanked by broad flat white or creamy scales on top and broad yellowish-white scales on bottom; white erect forked scales, numerous over a large area, some dark ones usually restricted to the occipital region; scales along margin of eye mostly narrow and recumbent; frontal setae pale, ocular and vertical setae dark. *Thorax:*—Mesonotum black with a broad median band of narrow dark bronzy-brown scales and a few short dark setae; sides with broad flat white to yellowish scales; supraalar setae long and dark; lanceolate pale scales intermixed with the broad ones at the posterior third of the mesonotum; some broad pale scales and long dark setae, surrounding the antescutellar area. Scutellum trilobate, the lobes with long black bristles and pale scales. Anterior and posterior pronotal lobes with long dark setae and a few broad pale scales; postspiracular plate with a few pale scales and setae; subspiracular area wide, sometimes a few pale scales; sternopleural and mesepimeral plates with nude apical regions the remainder covered with broad recumbent white scales; propleural plate with broad flat white scales; meron, nude and dark. *Legs: Prothoracic leg:*—Integument of coxa yellow with a dense patch of broad white scales and pale setae; outer surface of femur with yellow scales basally, remainder violet-scaled; inner surface with yellow scales reaching apex; suberect setae numerous; femoral knee spot absent; tibia and tarsus with dark scales and suberect setae. *Mesothoracic leg:*—Integument of coxa brown with pale scales apically and violet scales basally (rarely all pale-scaled); outer surface of femur violet-scaled with yellow scales reaching almost to the apex on the inner surface; femoral knee spot absent; tibia and tarsus with dark scales and suberect setae. *Metathoracic leg:*—Integument of coxa yellow, nearly nude with a few yellowish scales and setae; femur with yellow scales reaching the apical third (both surfaces); femoral knee spot absent (Fig. 12); tibia and first three tarsal segments dark-scaled, roughened, last two segments and sometimes the tip of the third white-scaled. The fourth hind tarsal segment may rarely have some dark scales intermixed with the white scales. *Abdomen:*—Dorsum of first segment yellow-scaled, the other segments violet-scaled with small yellowish lateral apical patches distinct on segments four to six (sometimes seven); sternite of segment seven dark, the others mostly yellow-scaled except for some dark ones basally on segment six and sometimes five.

Larva (largely after Rozeboom, 1939) (Fig. 18):—Head broader than long, bulging laterally. Antennae spinulate, curved, somewhat swollen basally and tapering distally, longer than head; a small multiple tuft (5 to 7 branches) beyond the middle; one short and 3 long spines at the tip. Upper and lower head hairs double, long, the tips reaching to or beyond the preclypeus. (In the two specimens seen, one branch on each head hair was shorter and more slender than the other). Antennal, preantennal, and head hairs with very fine, short lateral branchlets.

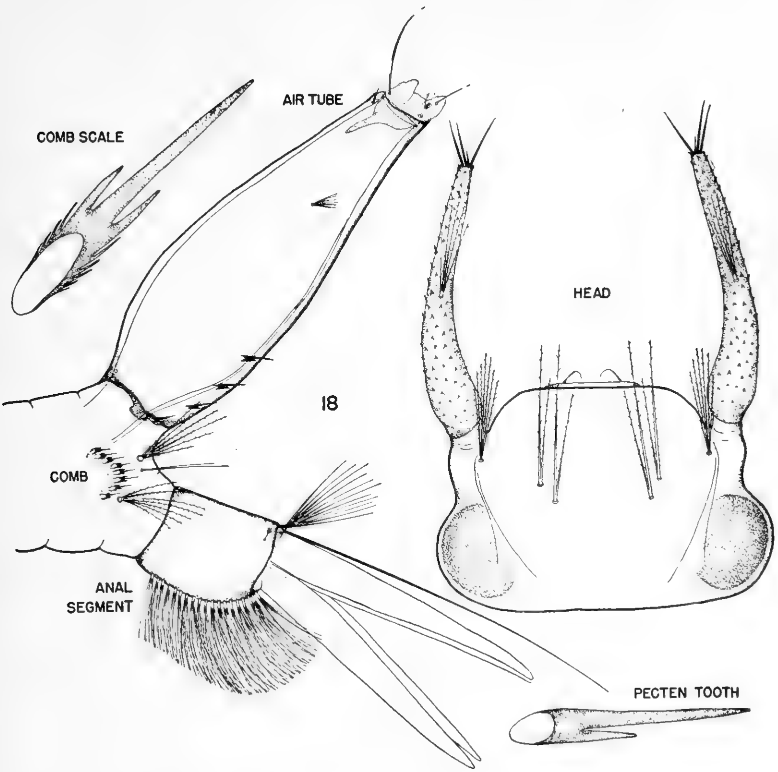


Fig. 18, *Psorophora longipalpis* n. sp. fourth instar larval characters (drawn to same scale as Figure 10).

Lateral abdominal hairs multiple; long on first two segments and shorter on succeeding segments. On segment III these hairs have 3 to 7 branches, while on segments IV ,V and VI, they have 3 to 5, rarely 2, branches.

Comb scales of eighth abdominal segment seven in number, arranged in an arc at the posterior edge of a weakly sclerotized plate. Each scale has a long central spine flanked on each side by 1 or 2 smaller, stout ones; several more slender spinules below the stout ones, on each side. Posterior to the comb scales are 3 hairs, the outer 2 multiple (with branches frayed) and the middle one double or single (without lateral branchlets).

Air tube inflated, about 3 or more times as long as the width at the base, with 3 or 4 short pecten spines on the basal third; a very small, multiple ventral tuft laterally on about the apical third; branches of the ventral tuft very fine and may be as long as a pecten tooth; dorsal preapical spine about one-third the length of a pecten tooth; dorsal apical hair about 6 or more times as long as the dorsal preapical spine; other apical hairs (ventral) consisting of 2 long single hairs and a shorter multiple pair.

Anal segment longer than wide, ringed by plate; ventral brush consisting of 19 or 20 (2 specimens) tufts which pierce the plate along the mid-ventral line. Dorsal brush a long hair and a multiple tuft on each side. Lateral hair very small, usually split apically into several branches, but occasionally it may be single. Anal gills long and tapering.

Rozeboom (1939) records some observations regarding the habits of *longipalpis*. The larvae breed in heavily shaded, temporary rain pools. None were taken in nearby puddles exposed to the sun. Other species associated in the same pools with *longipalpis* were *Psorophora confinnis*, *P. signipennis*, *P. cyanescens*, *P. ferox*, *Aedes vexans*, *A. trivittatus*, and *Anopheles punctipennis*. Except for *ferox*, *longipalpis* appeared to breed a little more slowly than the other species.

Holotype: Male (terminalia on slide), Fayetteville, Arkansas, August 24, 1933 (H. H. Schwardt) deposited in the U. S. National Museum.

Paratypes: KANSAS: Parsons, Labette Co., VI–2–43, 1 female. MISSOURI: Atherton, Jackson Co., June (C. F. Adams), 1 female; Rosecrans Field, Buchanan Co., VI–23–44 (C. E. Norland) 3 females. OKLAHOMA: Dawson, V–15–44, 3 males, 3 females; Tulsa, VIII–1–38 (Rozeboom) 1 male (terminalia on slide), 2 females; Henryetta, VI–28–34 (C. A. Sooter), 2 females. SOUTH DAKOTA: Springfield, VI–25–24, 1 male (terminalia on slide), VI–27–24, 1 female. TEXAS: Bastrop Co., VI–1–44, 1 female; Brazos Co., VIII–3–43, 1 male; Brownsville, VIII–29–16 (M. M. High), 8 females, VIII–30–16 (M. M. High) 1 female; Harris Co., VIII–6–43 (Ogden), 6 females, XI–1–39, 1 female; Victoria, VIII–13–02 (W. E. Hinds), 5 females, VI–11–07 (R. A. Cushman), 8 females, VI–14–07 (J. D. Mitchell), 7 females.

The following specimens were among Dyar and Knab's original cotypes (No. 11999) and all are from TEXAS: Cypress Bayou, Orange Co., VIII–23–03 (J. D. Mitchell), 1 female; Dallas, VI–28 (H. S. Barber), 1 female; Denison, VI–24 (H. S. Barber), 3 females; Greenville, VI–30–04 (H. S. Barber), 2 females.

All but the following specimens are deposited in the United States National Museum: 1 male, 7 females in the Laboratory of the Texas State Board of Health; 1 male and 1 female at Cornell University; 3 females at the Seventh Service Command Laboratory, Fort Omaha, Nebraska; 1 female at the University of Kansas; 1 female at the Oklahoma A. and M. College; 3 males and 3 females at the Oklahoma State Health Department, Oklahoma City, Oklahoma.

Discussion

In spite of the fact that the genitalia of *horrida* and *ferox* are similar, the larval and adult (color) differences are so constant

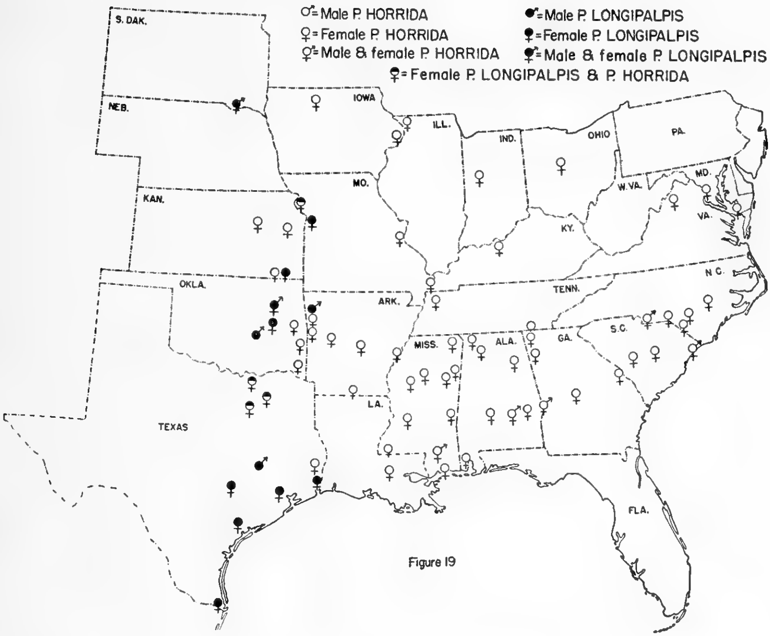


Fig. 19, Map showing the distribution of *Psorophora longipalpis* n. sp. and *Psorophora horrida* (D. and K.), based on an examination of males and females of both species. (The five males of *P. horrida*, from Tulsa County, Dawson, Oklahoma, were received too late to be included in the map).

that both should remain as distinct species. It is not unusual to find two different species with similar male genitalia. *Psorophora confinnis* (L.-Arr.) and *P. discolor* (Coq.) are easily separated by color yet their male genitalia are very similar, and examples of species with genitalia similarities and color differences are found in other genera.

In general *longipalpis* is a larger and more robust species (adults and larvae) than *horrida*. The chief differences between these two species are summarized in Table 1. *Longipalpis* females can be separated at once from *horrida* by the absence of femoral knee spots, longer palpi (particularly the elongated fourth palpal segment), and the greater amount of yellow scales on the abdominal sternites. The males of the two species are separated not only by the remarkably different genitalia (*longipalpis* may be recognized macroscopically by their bulbous sidepieces; Rozeboom, 1939) but by the differences in palpi, antennae and legs, as described in the text and Table 1. The larvae of *horrida* can be distinguished from both *longipalpis* and *ferox* by their short antennae and short head hairs. *Longipalpis* is separated from *ferox* by the multiple lateral abdominal hairs on segments IV to VI. These are double on segment IV and single on V and VI, in *ferox*. Although the base of the antenna of *longipalpis* is apparently slightly more swollen than in *ferox*, Rozeboom (1939) believes that this character is not a satisfactory one.

Unfortunately the records of *P. longipalpis* are scarce and for this reason the known distribution of this species as shown in Figure 19 is spotty. The records for *P. horrida* however are fairly complete, particularly for the southeastern states. Based on examinations of male and female specimens, Figure 19 shows the distribution of both species. *Horrida* is predominantly an eastern species while *longipalpis* appears to be a midwestern form and from available specimens, has not been recorded farther east than Atherton, Missouri, Fayetteville, Arkansas, and Orange County, Texas. However *horrida* has been taken as far west as Fort Riley, Kansas, and Denison and Dallas, Texas. This has resulted in an area where both species overlap. Further collections are necessary in these midwestern states before an exact distribution picture can be drawn.

Psorophora horrida has not been recorded from Montana (Mail, 1934), Nebraska (Tate and Wirth, 1942; Tate and Gates, 1944), Minnesota (Owen, 1937) and Utah (Rees, 1943). Records of *P. horrida* taken from available literature are as follows:

LOCALITY	AUTHORITY
INDIANA—	
Dyar, Clark Co.; Marion Co.; Vigo Co. .	Christensen and Harmston (1944)
IOWA—	
Schick General Hospital.	Seventh S. C. Laboratory
Des Moines; Follets [7], Clinton Co.; Dubuque, Dubuque Co.; Shenandoah, Page Co.; Ames, Story Co.; Washington, Washington Co.; Sioux City, Woodbury Co.	Rowe (1942 a, b)
KANSAS—	
Antlers, Alva, Byars, Blue, Checotah, Durant, Eagletown[7], Goodland, School, Grant, Golden Gore[7], Henryetta[6], Hugo, Moon, Nelson, Perkins, Ripley Bluffs, Shawnee[6], Stillwater, Summerfield, Sawyer, Sherwood [7], Tulsa [6], [7], Valliant, Westville.	Rozeboom (1942)
Atchinson Co.; Manhattan.	Hill (1939)
Concordia POW Camp; Camp Dodge; Fort Leavenworth.	Seventh S. C. Laboratory

TABLE 1.—Chief differences between males, females and larvae of *P. horrida* (D. & K.) and *P. longipalpis*, n. sp.

	Structure	*Psorophora longipalpis*, new species		*Psorophora horrida* (D. & K.)	
		Male	Female	Male	Female
ADULT	Palpi	Last two segments about same width as previous ones; no long bristles on penultimate segment (Fig. 17).	Terminal segment more than 1.5 times longer than the preceding segments combined (Fig. 15).	Last two segments distinctly enlarged, the penultimate segment with long bristles (Fig. 9).	Terminal segment little, if any, longer than the preceding segments combined (Fig. 7).
	Antennae	Comparatively lightly feathered; torus with a patch of pale scales on inner surface (Fig. 17).		Heavily feathered; torus nude. (Fig. 9).	
	Legs	Femoral knee spots absent; mid- and hind-tibiae without long setae (Fig. 11); tarsal claws of fore and mid legs as in Figures 13 and 14.	Femoral knee spots absent (Fig. 12); hind coxae nearly nude with only a few dispersed yellow scales.	Femoral knee spots present; mid- and hind-tibiae with numerous long suberect setae (Fig. 3); tarsal claws as in Figures 5 and 6.	Femoral knee spots present (Fig. 4); hind-coxae with a basal patch of white scales.
	Abdomen		Majority of sternites largely yellow-scaled.		Majority of sternites with basal portion violet-scaled, apical portion yellow.
	Genitalia	Figure 2		Figure 1	
LARVA	Head	Antennae longer than head; upper and lower head hairs long, reaching beyond the preclypeus (Fig. 18).		Antennae shorter than (rarely as long as) head; head hairs short, not reaching the preclypeus (Fig. 10).	
	Air Tube	Dorsal apical hair 6 to 7 times longer than dorsal preapical spine (Fig. 18).		Dorsal apical hair about 1.5–2.0 times length of dorsal preapical spine (Fig. 10).	

LOUISIANA—	
Baton Rouge [7]; Camp Claiborne, Rapides Parish; Leesville, Vernon Co.	Bradley, Fritz and Perry (1944)
MISSOURI—	
Camp Clark; Jefferson Barracks [7]; Fort Leonard Wood.	Seventh S. C. Laboratory
Spanish Lake; Creve Coeur Lake; Gumbo; Wicks; Columbia; Acres.	Adams and Gordon (1943)
NEBRASKA—	
Fort Omaha	Seventh S. C. Laboratory
SOUTH CAROLINA—	
Columbia [7], Richland Co.	Bradley, Fritz and Perry (1943)
TEXAS—	
Southeastern part of state [6], [7]	McGregor and Eads (1943)

The South Carolina and Indiana records are probably *horrida*. Practically all (see footnotes 6 and 7) of the other records were taken from regions where both species may possibly occur and therefore these should be considered doubtful until specimens from these localities are re-examined.

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[6] Specimens seen from these localities have been *longipalpis*. The positive male records from Shawnee (Fig. 19) are based on Rozeboom's description of specimens seen near Shawnee on July 11, 1940. He states "even in their resting places the males could be identified by the bulbous terminalia." These were undoubtedly *longipalpis* since *horrida* males do not have bulbous terminalia.

[7] Specimens examined from these localities have been *horrida*.

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A NEW PLANT BUG FROM PERU, WITH NOTE ON A NEW GENUS FROM NORTH AMERICA (Miridae: Hemiptera)

By Tsai-Yu Hsiao

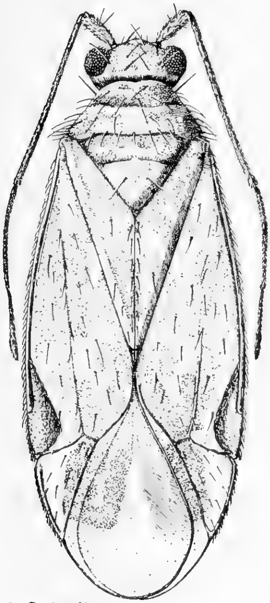
Through the courtesy of Dr. R. I. Sailer of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, I have had the opportunity of studying a series of mirid specimens from Peru. These specimens are of particular interest because of the peculiar antennae of the males. The abnormality of antennae is generally rare among the Miridae, especially in the subfamily Orthotylinae to which this series belongs. A careful study of the literature reveals no description of such an antennal structure as is possessed by the specimens at hand. In 1907, Reuter established the genus *Hyalochloria* with two species, *H. caviceps* and *H. unicolor* from Jamaica (Ofv. Fink. Vet. Soc. Forh., 49 (5): 18). Both species were described from female specimens. According to the female characters the present series should belong to this genus. The male antennal structure is undoubtedly a generic character with possible specific variations. In 1916, Van Duzee described a third species, *Hyalochloria bella*, from California (Univ. Calif. Publ., Div. Ent. Tech. Bul. 1 (4) : 218), based on one male and four females, without mentioning any unusual character of the antennae. The assumption therefore follows that *H. bella* V. D. is either not congeneric with *Hyalochloria* or that the present series represents an undescribed genus. Through Dr. Sailer's effort I have had the opportunity of examining one female specimen of *caviceps* (collected from the type locality) and four female specimens of *bella* (collected from San Bernardino Co., Calif., a county neighboring the type locality) borrowed from the California Academy of Science. Although no male of either species is available at the present time it can be definitely stated that the Peruvian series belongs to a new species of *Hyalochloria* and that *H. bella* Van Duzee represents a new genus, both of which are herewith described. I wish to acknowledge my indebtedness to Mr. Arthur D. Cushman of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, for the execution of the accompanying illustrations.

Hyalochloria denticornis, new species

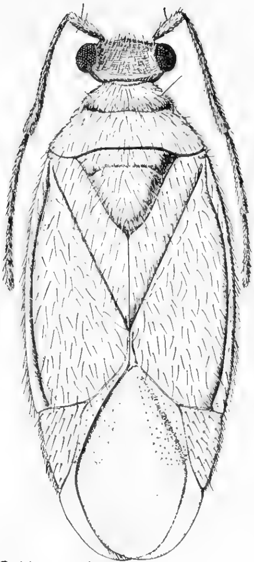
(Figs. 3 and 4)

Male.—Body ovate, length 2.6 mm., width 1.25 mm., semi-transluscent, stramineous with dark markings, clothed all over with long simple concolorous pubescence.

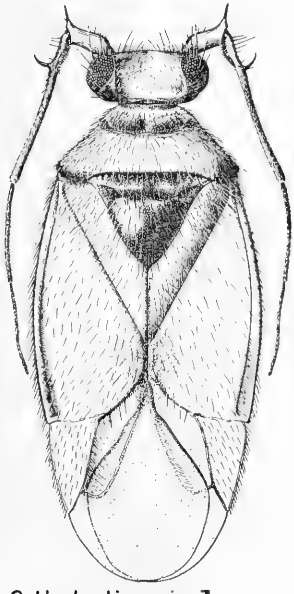
Head vertical, broad, width across eyes 0.65 mm., length seen from above 0.14 mm., height at base seen from side 0.3 mm. Vertex and frons broadly



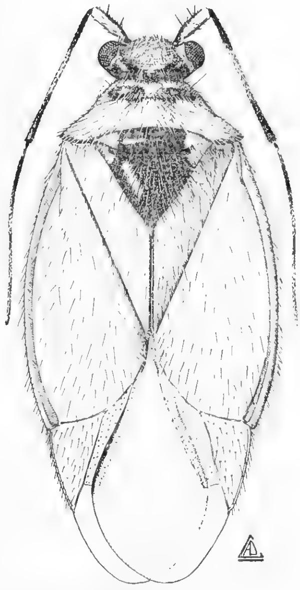
1 S. bella



2 H. caviceps



3 H. denticornis ♂



4 H. denticornis ♀

and conspicuously excavated between eyes, width of vertex 0.37 mm., narrowly but distinctly marginate. Clypeus moderately prominent, curved backward apically, base placed on a straight line between bases of antennae, obsoletely discrete from frons; jugum and lorum discrete; gena high, about one-half as high as the eye seen from side; gula approximately one-third the length of bucculae. Eyes seen from above small, removed from apex of pronotum, forming a collum behind them, seen from the side large, vertically reniformed, occupying about two-thirds of the height of head, covered sparingly with long simple hairs; collum dark brown excepting the parts behind the eyes, gradually narrowed posteriorly. Rostrum long, length 1 mm., reaching middle of abdomen, apical fourth brownish, segment I distinctly thickened, slightly surpassing base of head.

Antennae moderately thick and long, inserted at apex of interior margin of eye, length of segments, I : II : III : IV = 0.25 mm. : 0.88 mm. : 0.5 mm. : 0.5 mm.; segment I sparingly clothed with simple pubescence intermixed with a few long hairs, incrassate at basal portion, dark at base, with a long stout apical spine on latero-dorsal side, spine placed on a long basal tubercle, about as long as segment is thick, dark brown; segment II clothed more densely with simple hairs than I, intermixed with long hairs only at basal fourth where impressed with two longitudinal grooves, one along the inner latero-ventral side and the other along the outer latero-ventral side, thus forming three longitudinal ridges each armed with a row of small black teeth (the outer row is doubled); a long, apically curved spine located between the distal ends of the inner and middle ridges; spine slenderer but longer than that on segment I, dark brown; the portion ef segment beyond base of spine broadly and distinctly curved ,apical portion darkened; segments III and IV more slender, dark brown. The prominent spines on segments I and II are actually composed of several strengthened or spine-like hairs fused to form a single mass.

Pronotum transverse, declivent anteriorly, length 0.32 mm., width at base 0.92 mm., at apex 0.36 mm., lateral margins slightly sinuate behind middle, posterior margin strongly sinuate before scutellum, humeral angles rounded, calli distinct, confluent, with a distinct transverse impressed line separating them from posterior disk of pronotum, apical collar absent; apex of pronotum narrowly, posterior portion of calli, and posterior margin of humeral angles dark brown. Mesonotum broadly exposed, dark brown excepting lateral margins. Scutellum dark brown, distinctly convex, length 0.37 mm., width at base 0.42 mm. (both measurements not including mesonotum).

Hemelytra explanate, semitransluscent, reaching apex of abdomen at apex of commissure; embolium slightly broadened posteriorly, embolial margins distinctly convex, length 0.5 mm.; commissure narrowly dark brown, inner apical angle of corium tinged with brownish; cuneus declivent, length 0.46 mm., width at base 0.41 mm., fracture distinct; membrane transparent, finely rugulose, inner margin narrowly brown, major areole coriaceous as cuneus, minor areole obsolete.

Xyphus concave medially; ostiolar peritreme conspicuous, whitish. Right paramere of genitalia leaf-like, gradually narrowed toward apex and ending in a small hook; left paramere slender, broadly curved, thickened at base and pointed at apex.

Legs moderately long, posterior femora 1 mm. in length with several rows of distinct spinules along basal portion; posterior tibiae 1.37 mm. in length with three or four long spinules at basal portion, distinct from general pubescence. Arolia conspicuous, convergent at apex.

Female.—Similar to male in coloration, pubescence and general appearance, but strikingly different from it in the following features: Antennae normal, without armature; head and vertex much narrower; and posterior femora with only scattered long pubescence, posterior tibae devoid of basal spinules as described for male. Vertex excepting posterior margin pale, inner side of antennal segment I and base and apex of II brown.

Body, length 2.45 mm., width 1.23 mm.; head, width across eyes 0.58 mm., length seen from above 0.13 mm., height at base seen from side 0.26 mm., width of vertex 0.29 mm. Length of antennal segments, I : II : III : IV = 0.21 mm. : 0.71 mm. : 0.46 mm. : 0.45 mm. Pronotum, length 0.3 mm., width at base 0.92 mm., at apex 0.36 mm.

Types.—U. S. National Museum No. 57196; holotype, male; allotype, female; paratypes, 11 males and 7 females, Lima, Peru—on leaves of cotton and beans infested with *Empoasca.*—November, 1943 (Wille- Bezerra). Nine females, from Caffete, Peru—on cotton—February 11, 1941 (E. J. Hambleton). Three females, from Lima, Peru, March 28, 1940.

Closely related to *H. caviceps* Reuter (Fig. 2) but the female differs from that of *caviceps* by the longer second antennal segment, absence of spinules on posterior tibiae, different coloration, and in the more pronounced curvature of the costal margin of the hemelytra.

SAILERIA, new genus

Allied to *Diaphnidia* Uhler, 1895 (type: *D. debilis* Uhler, 1895), but differing in the following characters: Head vertical, with vertex wider and shallowly excavate, frons strongly convex and eyes farther removed from apex of pronotum; rostrum distinctly exceeding the middle coxae; pronotum with posterior margin strongly sinuate before scutellum, distinctly transversely impressed behind calli, anterior lobe subequal in length to posterior; membranal cells coriaceous; legs proportionally shorter. It is readily distinguished from *Hyalochoria* Reuter, 1907 (type: *H. caviceps* Reuter, 1907) by the characters as follows: Head with vertex only shallowly depressed and frons for most part distinctly convex (in *Hyalochloria* both vertex and frons, excepting the anterior margin of the latter, are distinctly and broadly excavate), posterior margin of vertex less defined; clypeus separated from frons with deep broad impression; collum shorter, measured from side less than half as long as eye (in *Hyalochloria* it is distinctly more than half as long as eye); eyes seen from above larger; male antennae normal; scutellum not convex; hemelytra less explanate, with costal margins nearly parallel and embolium incomplete.

Genotype: Hyalochloria bella Van Duzee, 1916 (Fig. 1).

This genus is named in honor of Dr. R. I. Sailer in appreciation of his kind help in this work.

MINUTES OF THE 548TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, OCT. 5, 1944

The 548th regular meeting of the Society was held Thursday, Oct. 5, 1944, at 8 P. M., in Room 43 of the National Museum. President Annand presided and 38 members and 25 guests were present. The minutes of the previous meeting were approved as read.

The following applicants were unanimously elected to membership:

Dr. Lauren D. Anderson, Div. of Control Investigations, U. S. Bur. of Ent. & Plant Quar.

Lt. Richard H. Daggy, Naval Medical School, Bethesda, Md.

Dr. A. L. Ayroza Galvão, Departamento de Parasitologia, Faculdade de Medicina, Universidade de São Paulo, São Paulo, Brazil.

Stanley W. Bromley, Entomologist, Bartlett Tree Research Laboratories, Stamford, Conn.

William F. Buren, Entomologist, Malaria Control in War Areas, U. S. Public Health Service.

William E. Hoffmann, Associate Curator of Insects, U. S. National Museum.

Howard B. Owens, Research Assistant, Dept. of Entomology, University of Maryland.

Earl E. Rogers, Div. of Control Investigations, U. S. Bur. of Ent. & Plant Quar.

Lt. Louis M. Roth, Fourth Service Command Medical Laboratory, Fort McPherson, Georgia.

Dr. Cory announced that it had been decided to hold a joint meeting of the Entomological Society of America and the American Association of Economic Entomologists on Dec. 13, 14, and 15 at the Hotel New Yorker, N. Y. City.

Dr. Roger C. Smith of the War Man Power Commission gave the first paper on the regular program: The National Roster with Special Reference to Entomologists.

The National Roster of Scientific and Specialized Personnel, which is a division of the Bureau of Placement, War Manpower Commission, was organized four years ago to compile an inventory of the nation's scientific and technical men and women from which to recruit specialists for all phases of the war effort. A complete file of information on all professionally qualified persons in the United States was sought by circularizing the memberships of the learned societies, staffs of industries, and other sources with a questionnaire and appropriate check list of specializations. A comparable file for physicians, dentists and veterinarians is maintained by the Procurement and Assignment division of the Bureau of Placement, War Manpower Commission. The Roster registration now totals approximately 472,000 but this number changes constantly through additions, deaths, and other causes. Registrations in seven, broad, general fields, one of which is the Agricultural and Biological Sciencies, are now accepted.

The Roster has a relatively small staff distributed among three sections, the largest of which has charge of coding, punch card machine operations, filing, and routine correspondence. Other sections deal with placement and evaluations. As a war agency, the Roster certified the names of over 140,000 individuals to the

Military and other war and peace-time agencies from which more than 50,000 received appointments. This organization is now giving increasing attention to postwar, peace-time, plans and activities. A series of vocational guidance booklets for the professions is being prepared.

The National Roster was organized as a central registry and war-time placement agency. Its files were not originally arranged to facilitate statistical studies but they are being currently converted for this purpose. The tables used in this talk are based on an analysis of a small sample in the new file which constitutes about one-seventh of the total Roster registration. There were 1,493 persons whose chief specialization was in the entomological field registered in the Roster on April 1, 1944 of which 30 were women. The group median age was 41.1 years. According to an analysis of the sample drawn from the file, entomologists constituted 0.58 percent of the total Roster registration. These and other percentages given herewith, may or may not be typical for the profession as a whole.

All states, territories and some foreign countries were represented in the sample. The order, beginning with the largest number of zoologists and entomologists, was California, New York, Pennsylvania, Illinois, Ohio, Texas, Massachusetts, New Jersey, Washington, D. C., etc.

An analysis of the industry in which the small sample of zoologists and entomologists studied were engaged showed that 43 percent were employed by institutions of higher education, 23 percent by the Federal Government and smaller percentages in many lines of industry. Some of the industrial employment probably indicated war-time displacement.

Approximately 25,000 Roster registrants are in the armed services, of which 327 indicated specialization in zoology or one of its branches, 283 in Bacteriology and 152 in Entomology.

In a sample of 1,169 persons in the Roster file whose specialization appeared to be in Entomology, 207 indicated the study and control of insect pests of man and domestic animals as their first field of specialization, 157 in some phase of insecticides, 137 in the study or control of pests of fruit, nut and shade trees; 136 indicated insect taxonomy as their main specialization, of which 23 considered themselves to be Dipterists, 35 Coleopterists and 20 Hymenopterists.

Approximately 25 percent of the Roster registrants classified as professional entomologists indicated that they had Doctor's degree, while 51 percent had a Master's degree or beyond but not the Doctor's degree. Eleven percent of the professionally qualified entomologists had no college degree.

The Federal Government, particularly the Bureau of Entomology and Plant Quarantine, was the largest employer of Entomologists in the United States, The Agricultural Experiment Stations ranked second, and the Agricultural Colleges were third. Only 39 entomologists were employed in industry and 38 were Extension Entomologists.

These are samples of the kinds of data which the National Roster can supply for the entire registration. The Roster is foremostly a national registry but its files lend themselves to interesting professional studies. The more nearly complete Roster registration is for any profession, the more complete such data will be for the profession as a whole. At the present time, it is estimated that not over 75 percent of the entomological profession is registered in the Roster. It is therefore important that all professionally qualified entomologists and all other scientists cooperate with the National Roster by registering and returning all recircularization blanks properly filled out, promptly. (Author's Abstract)

Dr. Cory commented on the fact that, although there are about 2300 entomologists in the Country, only 1,493 are listed on the National Roster, and he also stated that he believed the military file to be incomplete. Dr. Smith and Mr. Edward Knott explained that every effort was being made to complete the Roster, and pointed out that replies had so far been received from only about half the questionnaires mailed. Mr. Rohwer remarked on the large percentage of men over 40 listed, and also stated that there were 1,000 men serving with the Armed Forces as entomologists. There was further comment by Dr. Annand and Dr. Townes.

Mr. J. A. Morris gave an illustrated talk on the biology of the body louse.

The following visitors were introduced to the Society: Dr. Cyril Abbott, Mrs. Abbott, Edward Knott, H. E. Barnard, Ralph B. Swain, Dr. A. B. Hardcastle, Dr. M. McCown.

There being no further business, the meeting adjourned at 9:40 P. M.

INA L. HAWES,
Recording Secretary.

MINUTES OF THE 549TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, NOV. 2, 1944

The 549th regular meeting of the Society was held Thursday, Nov. 2, 1944, at 8.15 P. M., in Room 43 of the National Museum, with President Annand presiding. There were 145 persons present, of whom 70 were members. Because of the large attendance and the length of the program, it was voted to omit the reading of the minutes for the previous meeting.

Dr. Annand appointed the following nominating committee: R. W. Harned, Chairman; E. R. McGovran; W. H. Anderson.

The following new members were elected:

Edward L. Bunch, War Food Administration.

Dr. A. Bascom Hardcastle, Specialist, Medical Corps, U. S. Naval Reserve.

Sophy Parfinowich, Division of Insects, U. S. National Museum.

Dr. Annand read an announcement of a lecture by Dr. Alex Sprunt, Jr., of the National Audubon Society, N. Y., to be given on Nov. 10th, at 8 P. M., in the Universalist Auditorium.

In response to Dr. Annand's request for notes or specimens, Mr. Austin H. Clark said that on June 25, 1938, he found a colony of *Vespa crabro* at Limeton Warren Co., Virginia. It was reported from the vicinity in subsequent years, and on October 15, 1944, he saw a large number of individuals about a mile south of the original locality. It is now well known to the people of the region, who call it the "stranger-bee." On September 3, 1944, he captured one three miles west of Mt. Solon in Augusta Co., Virginia, where the natives recognized it as a new arrival in that vicinity.

Mr. Clark noted the capture of two specimens of *Nathalis iole* at Salem, Virginia, by Mr. Carl W. Gottschalk on September 26, 1944, this being the first record for the State; and also the capture of a specimen of *Calephelis laverna* (identified by Mr. William P. Comstock) at Guantanamo City, Cuba, by Mr. W. Herbert Wagner on September 13, 1943, the genus heretofore not having been reported from Cuba.

Dr. H. K. Townes exhibited a nest of *Vespa crabro* which had been collected from the wall of a house near Chatham, Va., and sent to the National Museum by Mr. L. A. Hetrick. The specimen arrived in exactly the condition in which exhibited. Its peculiar shape was probably caused by the wasps being forced to build in a space about 5 inches wide between the inner and outer walls of the house. The sheltered location probably accounts for the presence of only a part of the normal, outer, laminated paper covering. The cells of the comb in the upper, central, and older part are smaller than those in the newer, lower, outer part. Dr. Townes also exhibited the queen, worker, and male of the wasp. Mr. Hetrick had reported damage to fruit and sent an apple the meat of which had been eaten out, leaving only the heavy skin and core. Dr. Townes stated that he had collected this same species from Dupont; which constitutes a new locality record. The Bureau of Entomology and Plant Quarantine has also received a letter reporting *Vespa crabro* from South Dakota. If really established, this would be the first record for that State.

The first paper on the regular program was given by Dr. H. O. Calvery: Toxicity of DDT—By Oral, Parenteral, and Cutaneous Administration.

This presentation consists of a brief resume of our toxicological studies of DDT along the following lines:

I. Acute and subacute application to the skin of rabbits, rats, guinea pigs, and dogs.
II. Acute and subacute feeding to rats, mice, guinea pigs, chicks, rabbits, dog, sheep, horse, cow.
III. Chronic feeding to rats and dogs.
IV. Skin irritation and sensitization.
V. Pharmacological investigations as to the site and mode of action.
VI. Gross and microscopic pathology and blood studies of poisoned animals.

In solid form DDT applied topically to the skin is nonirritating, nonsensitizing and not appreciably absorbed. In solution, either in oil or in organic solvent, it does readily penetrate the skin, is very mildly irritating and a very mild sensitizing agent.

In single and multiple dose administration (acute and subacute) there are wide individual as well as wide species variations.

In the prolonged feeding experiments (chronic toxicity) rats have been fed for about 18 months diets containing 100, 200, 400 and 800 p. p. m. Guinea pigs, dogs and monkeys have been studied for shorter periods.

The pharmacological manifestations of effect from DDT are principally loss of appetite, mild to severe tremors of central nervous system origin, convulsions and death. Tremors can be prevented or abolished by general anesthetics and narcotics.

Histopathologic examination of tissues of animals which have received DDT shows tissue damage but it is neither striking nor characteristic for all species. (Author's Abstract.)

Dr. Paul A. Neal followed with a paper on: Toxicity of DDT—By Inhalation.

The toxicity and potential dangers of DDT when used as an aerosol, spray and dusting powder for insecticidal purposes are discussed. It is pointed out that in spite of the inherent toxicity of DDT such aerosols, sprays and dusting powders may be used safely if certain precautions are observed. (Author's Abstract).

For further details *see* Supplement No. 177 to the Public Health Reports. Washington, 1944.

Both papers were illustrated by lantern slides.

Dr. Mitchell asked if test animals returned to a normal state when removed from contact with DDT. Dr. Calvery replied that there was a great difference in the reaction of various animals; that it was possible for test animals to exhibit extreme tremors, recover, and continue to live for 2 or 3 months while still receiving the same daily dosage as before. It has not been demonstrated satisfactorily whether there is complete recovery when the material is withdrawn. Symptoms can be entirely allayed by narcotics, such as phenobarbitol, etc. Whether animals in a serious condition can be saved by such procedure has not definitely been proved. Dr. McIndoo inquired if there was a known antidote. Dr. Calvery and Dr. Neal agreed that studies have not yet been made on this factor. There was further discussion by Mr. Sameth and Dr. Neal.

Dr. Bishopp continued the regular program with: An Entomologist takes a Look at New Guinea. Colored lantern slides illustrated his paper.

Experiences of a special mission in visiting a number of army camps in New Guinea and some of the islands to the northwest were briefly recited and illustrated with Kodacrome slides. The mission, consisting of Dr. R. B. Watson, Malariologist of TVA and the speaker, went to the Southwest Pacific Area under the auspices of the OSRD and Army at the request of the theater commander. The trip occupied the months of July and August. All travel (about 25,000 miles) was by air and numerous points in eastern Australia and New Guinea were visited. Entomologists, sanitary engineers, and physicians were observed in action against malaria, scrub typhus and other arthropod-borne diseases. In the control of malaria these men are doing a fine job. They were much interested in learning of recent research results and their application to field problems. The knowledge of conditions at the front, and how they are being met should aid in planning research and indicating where emphasis should be placed. (Author's Abstract.)

The Society adjourned at 10:10 P. M.

Ina L. Hawes,
Recording Secretary.

Actual date of publication, February 6, 1945.

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THE

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PROCEEDINGS OF THE
ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 47 FEBRUARY, 1945 No. 2

MITES OF THE GENUS TENUIPALPUS (Acarina: Trichadenidae)

By EDWARD W. BAKER

Bureau of Entomology and Plant Quarantine, United States Department of Agriculture

The genus *Tenuipalpus* was proposed by Donnadieu in 1875, and the type has been designated as *T. palmatus* Donn. Since *T. palmatus* and the closely allied species are now considered generically distinct from the other members of the genus, such as *T. inornatus* Banks, the name should be restricted to the *palmatus* group; and the name *Brevipalpus* Donn., 1875, which has been synonymized with *Tenuipalpus*, should be reinstated as the generic name for the *inornatus* group of mites. The type of the genus *Brevipalpus* is *obovatus* Donn., 1875.

The mites composing the genus *Tenuipalpus* are members of the family Trichadenidae[1] and are plant feeders. So far as is known, none of the species herein considered cause much damage to their hosts, although some members of the closely related *Brevipalpus* are of economic importance.

The study was based on the collection at the United States National Museum, Washington, D. C. Except for *Tenuipalpus palmatus* the species treated are established in the United States or have been intercepted on imports.

The genus *Tenuipalpus* is characterized by the broad propodosoma and the narrowed hysterosoma; by the presence of a few striations on the skin instead of reticulations; by having the ventral hysterosomal plates not plain as in *Brevipalpus* and the marginal body hairs large, lanceolate; by the presence of 4 pairs of broadly lanceolate posterior marginal hairs and a single pair of long, whiplike posterior hairs; by a palpus consisting of 3 segments, the penultimate segment provided with a long semiplumose hair and the last with 1 or 2 simple hairs; by the presence of a pair of semi-plumose ventral rostral hairs;

[1] The family Trichadenidae Ouds., 1938, includes the following genera: *Trichadenus* Rondani, 1870 (not placed in a family until 1938); *Brevipalpus* Donn., 1875, *Tenuipalpus* Donn., 1875, *Raoiella* Hirst, 1924, and *Tegopalpus* Womersley, 1940, all of which were formerly in the family Tetranychidae; also *Phyllotetranychus* Sayed, 1938, which had been put in Pseudotetranychinae (*Tetranychidae*). These genera differ principally from those of the family Tetranychidae in having highly simplified palpi.

and by the flat body. The type of the genus is *Tenuipalpus palmatus* Donnadieu 1875. This genus will also include *T. palmatus* var. *simplex* Oud. and *T. orchidarum* Parfitt, which are otherwise not mentioned in this paper.

Tenuipalpus palmatus Donnadieu

(Fig. 1)

Tenuipalpus palmatus Donnadieu, 1875, Recherches pour servir a l'histoire des Tetranyques. Lyon, pp. 112–114, pl. 1, II, fig. 1–19.

In the U. S. National Museum Collection there is a single slide with a male and a female from the Berlese Collection. Owing to the thickness of the mount the characters of the male are difficult to see, but the female is in rather good condition for study. The male does not have large dorsal lanceolate setae on the hysterosoma but small, short, lanceolate-like setae, and the abdomen is narrower than in the female. Otherwise there is very little difference between the sexes. In both specimens the ventral side is indistinct.

Male.—Penultimate palpal segment with a semiplumose hair; 3rd segment, small, slender, and apparently with only one terminal hair, which is about one-half the length of the semiplumose hair, ventral rostral hairs semiplumose. Shield over mouth parts simple. Anterior and median dorsal propodosomal setae small, lanceolate. Anterior shoulder seta large, lanceolate, situated just behind a dorsal projecting lobe or plate. Paired eyes somewhat in from body margin, shoulder hairs of hysterosoma shorter, broader than on propodosoma, and placed anterior to a projecting lobe or plate. Dorsal hysterosomal setae like the dorsal propodosomal hairs. Along the posterior lateral margin 4 pairs of large lanceolate setae and a single pair of long whiplike hairs. Tarsal claws and hairs not clearly seen but there appear to be a pair of tenant hairs on each claw and a row on the pulvillus. Ventral tarsal setae strong, pilose; long, simple dorsal seta, with lanceolate seta on outside and thick spinelike pilose seta on inside margin of tarsus. Legs I, II, and III with lanceolate setae; lanceolate seta of trochanter III smaller than the hysterosomal shoulder seta. Legs wrinkled. Length 262 μ; width 181 μ.

Female.—Anterior ventral setae pilose; the long median pair simple; dorsal hysterosomal setae large and broadly lanceolate. Length, including rostrum, 313 μ, width 219 μ.

The listed host plants are *Viburnum tinus* and *Citrus* spp. It is South European in distribution and as yet has not been taken by foreign plant quarantine inspectors of the Bureau of Entomology and Plant Quarantine.

Tenuipalpus micheli Lawrence

(Figs. 2–4)

Tenuipalpus micheli Lawrence, 1940, Jour. Ent. Soc. South Africa, 3: 111–113, figs. 4, 5.

Lawrence's description of a single female from *Chaetaeme aristata* at Umhlote Beach, Natal, South Africa, is sufficiently detailed to permit determination of specimens from Florida as the same species. Several specimens were taken on magnolia, Jacksonville, Fla., April 24, 1924, by Robertson and Williams, and several on oak at Cocoa Beach, Fla., December 11, 1942, by O. D. Link. Specimens have also been taken on *Sobralia macrantha*, Guatemala, at San Francisco, Calif., October 12, 1943 (collector unknown).

This species differs from *Tenuipalpus palmatus* Donn. in having the hysterosomal shoulder setae smaller than the third trochanter setae, and the third palpal segment provided with a long and a short hair. There appear to be rows of tenant hairs arising from pulvillus and tarsal claw as figured.

The mites from oak are much broader than those from magnolia. Female (from oak) 306 μ long and 262 μ wide; male 262 μ long and 206 μ wide. As in the preceding species, the dorsal abdominal hairs of the female are large and broadly lanceolate, while those of the male are small and lanceolate.

Tenuipalpus carolinensis, new species

(Fig. 5)

Female.—Third palpal segment stout and with only one seta. Shield over rostrum long, simple. The 2 pairs of dorsal anterior setae on propodosoma small, the shoulder setae long, lanceolate. Eyes set slightly behind and in from shoulder setae. All hysterosomal setae small except those on posterior margin; these 4 pairs large, lanceolate; also a single pair of long simple hairs. Genital setae of female as usual. Only one pair of long hairs opposite posterior coxae; hairs of coxae III and IV longish. A pair of long and a pair of short hairs on posterior venter of propodosoma; anterior ventral hairs long, simple. Apparently no claws, only 3 pairs of tenant hairs arising from vestigal remains of claws and pulvilli. Leg hairs strong, those on basal segments lanceolate. Legs wrinkled. Tarsus I with the usual long dorsal terminal hair; an outer simple hair, and below this a rodlike seta of medium length; on opposite inner side a strong simple hair; ventral hairs simple. Length, including rostrum, 294 μ, width 156μ.

Type.—U. S. National Museum No. 1479.

Described from a single specimen taken from goldenrod at Batesburg, S. C., March 26, 1910, by "H. F. W." On the same slide is a specimen of *Brevipalpus inornatus* (Banks). It is quite possible that the mite was only a straggler and that goldenrod is not the true host.

Although very close to *Tenuipalpus orchidarum* Oud., *T. carolinensis* is considered distinct because of the difference in the ventral hairs, and in the presence of one instead of two setae on the third palpal segment, as well as in distribution and hosts (*T. orchidarum* is from orchids in Java).

Tenuipalpus guamensis, new species

(Figs. 6, 7, 8)

Female.—Third palpal segment apparently cylindrical, longish, and with only one long, straight, strong seta. Shield of normal size, simple. Dorsal propodosomal setae small, the anterior median ones slightly larger, both pairs lanceolate; shoulder setae large, lanceolate. The paired eyes behind shoulder setae and in from body margin. Hysterosomal shoulder setae of medium size, lanceolate; dorsal hairs minute; posterior marginal hairs large, lanceolate with the exception of the pair of long setae. Ventral hysterosomal hairs pilose except for posterior pair; ventral propodosomal hairs pilose except for the long median anterior pair and the short posterior pair. Tenant hairs hard to see, but they appear to be as in *T. micheli*. Leg hairs lanceolate; legs wrinkled. Length, including rostrum, 356 μ, width 256μ.

Male.—The same general description holds for the male. However, none of the genital hairs pilose; the 2 anterior pairs of ventral hysterosomal hairs pilose. Ventral propodosomal hairs as in female. Length, including rostrum, 275 μ; width 219 μ.

Type.—U. S. National Museum No. 1480.

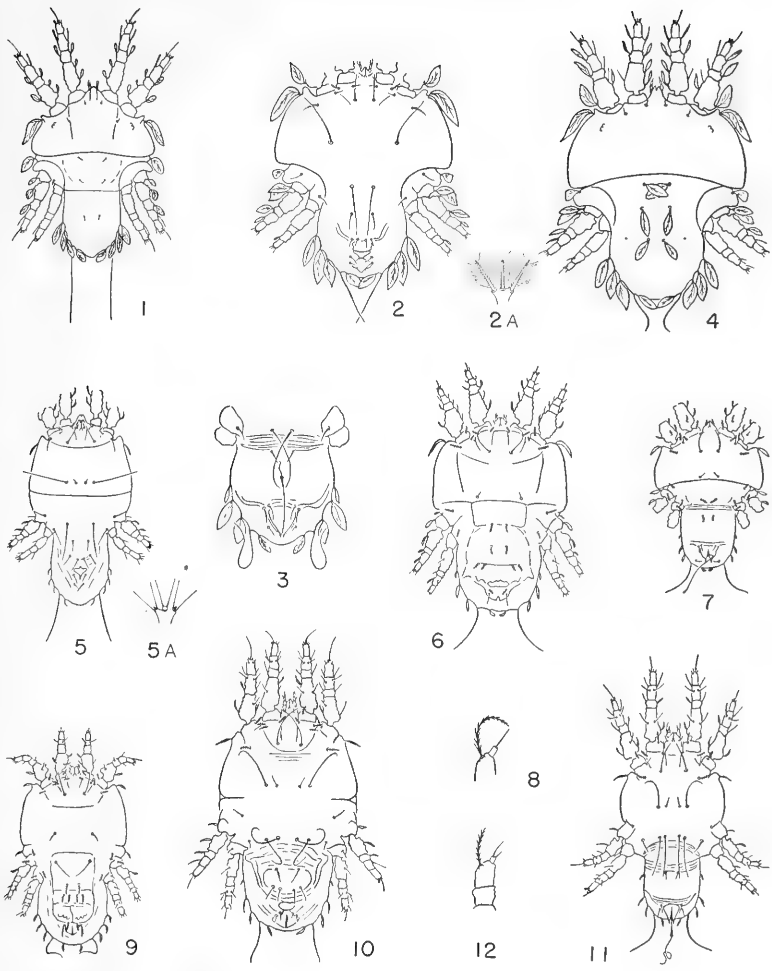
The type (female), allotype male, and two paratypes of each sex on a single slide; taken on *Neottopteris nidus*, Sumay, Guam, February 11, 1938, by R. G. Oakley.

The chaetotaxy is distinctive.

Tenuipalpus heveae, new species

(Fig. 9)

Female.—Penultimate palpal segment rather short and broad, with the curved, semi-pilose seta; 3rd segment small, with a single long spine which approaches the tip of the semiplumose seta. Shield small with only a rounded lateral "tooth," or protuberance. Dorsal propodosomal setae small, the center-median pair being the smaller; shoulder setae large, lanceolate. Eyes slightly behind and in from shoulder. Hysterosomal shoulder seta almost as large as posterior-marginal setae; dorsal setae minute; posterior-marginal setae large, lanceolate except for the pair of long whiplike setae. All ventral hysterosomal hairs, except the single pair of long anterior hairs, pilose. The posterior pair and the long anterior-median pair of ventral propodosomal hairs simple, the rest pilose. Legs typical of the genus but with fewer lanceolate hairs; tenant hairs as in *T. micheli*. Length, including rostrum, 256 μ; width 169 μ.



Tenuipalpus palmatus Donn. Fig. 1. Dorsal view of male.

Tenuipalpus micheli Lawrence. Fig. 2. Ventral view of female. Fig. 2A. Schematic drawing of tarsal tenant hairs. Fig. 3. Ventral view of hysterosoma of male. Fig. 4. Dorsal view of female.

Tenuipalpus carolinensis, new species. Fig. 5. Ventral view of female. Fig. 5A. Schematic drawing of tarsal tenant hairs.

Tenuipalpus guamensis, new species. Fig. 6. Ventral view of female. Fig. 7. Ventral view of male. Fig. 8. Tip of palpus.

Tenuipalpus heveae, new species. Fig. 9. Ventral view of female.

Tenuipalpus pacificus, new species. Fig. 10. Ventral view of female. Fig. 11. Ventral view of male. Fig. 12. Palpus.

Type.—U. S. National Museum No. 1481.

Type and paratype (on same slide) collected on the underside of rubber leaf, Belterra, Brazil, 1941. From J. A. Zilles.

The chaetotaxy is distinctive.

Tenuipalpus pacificus, new species

(Figs. 10–12)

Female.—Palpal segments short, broad, wrinkled; 3rd segment small, with a short, straight seta and a longer, slightly curved seta. Shield of normal size with a single simple lateral tooth. Dorsal propodosomal setae small, lanceolate; shoulder setae larger, about size of posterior-marginal setae but not so wide. Eyes slightly to rear and in from shoulder setae. Hysterosomal shoulder and dorsal setae small; anterior pair of posterior-marginal setae not much larger than dorsal setae; rest of marginal setae of normal size. All ventral hysterosomal hairs simple, the 2 pairs between the posterior coxae very long and fine. Posterior row of ventral propodosomal hairs simple, the inner pair short and the outer pair long; anterior median pair long and simple; the other hairs pilose. Tenant hairs hard to see but they appear to be as in *T. micheli*. Tarsi I and II at tips each with a rod-like, slightly curved seta. Ventral leg hairs pilose; lateral and dorsal hairs larger, lanceolate, serrate. Legs wrinkled. Length of female, including rostrum, 312 μ; width 190 μ.

Male.—Same general appearance as female except smaller and narrower. Length 269 μ; width 150 μ.

Type.—U. S. National Museum No. 1482.

The type (female) and a single male (allotype) on slide with paratype females and nymphs, taken on *Phalaenopsis stuartiana*, from Canal Zone, at Hoboken, N. J., U. S. A., by D. P. Limber, April 26, 1943. Also paratype slides of mites taken on *Saccolabium gigantum* var. *illustre*, from Australia, at Hawaii by T. F. Chong, April 11 and 12, 1936; on *Phalaenopsis lindeni*, from Philippine Islands, at Hawaii by T. F. Chong, April 11, 1938; on *Aerides falcatum*, from Bangkok, Siam, at Washington, D. C., by D. P. Limber, May 20, 1938; on *Phalaenopsis amabilis*, from Philippine Islands, at Hawaii, by T. F. Chong, April 11, 1938.

The chaetotaxy is distinctive.

A MOSQUITO SYNONYM (Diptera: Culicidae)

By Alan Stone, *Bureau of Entomology and Plant Quarantine, United States Department of Agriculture*

In describing the subgenus *Luzonus* in the genus *Aedes*, the writer and R. M. Bohart made an inexcusable synonym. We failed to compare the genitalia of *Aedes* (*Luzonus*) *clavirostris* with those of the genus *Ficalbia*, and we put too much reliance upon what appeared to be the bases of postspiracular setae. The generic and specific synonymy is as follows:

Ficalbia, subgenus **Etorleptiomyia** Theobald

Etorleptiomyia Theobald, 1904, First Rept. Wellcome Res. Lab., p. 71. (Type *mediolineata* Theobald.)

O'Reillia Ludlow, 1905, Canad. Ent. 37: 101. (Type, *luzonensis* Ludlow.)

Dasymyia Leicester, 1908, Fed. Malay States, Inst. Med. Res. Stud. 3 (3): 102 (Type, *fusca* Leicester.)

Dixomyia Taylor, 1914, Trans. Ent. Soc. London 1913: 703. (Type, *elegans* Taylor.)

Aedes, subgenus *Luzonus* Stone and Bohart, 1944, Ent. Soc. Wash. Proc. 46: 212. (Type, *Aedes clavirostris* Stone and Bohart.)

Ficalbia (**Etorleptiomyia**) **luzonensis** (Ludlow)

O'Reillia luzonensis Ludlow, 1905, Canad. Ent. 37: 101.

Etorleptiomyia completiva Leicester, 1908, Fed. Malay States, Inst. Med. Res. Stud. 3 (3): 178.

Aedes (*Luzonus*) *clavirostris* Stone and Bohart, 1944, Ent. Soc. Wash. Proc. 46: 213.

O'Reillia Ludlow and *Luzonus* Stone and Bohart are isogenotypic by synonymy.

NEW MEMBRACIDAE FROM CENTRAL AMERICA

By C. C. Plummer

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine

A few specimens of Membracidae were collected in the arid month of March 1942 during a short trip to Guatemala and El Salvador in company with Dr. George B. Saunders, Jr. of the Fish and Wildlife Service, United States Department of the Interior. One genus and three species proved to be new and are described in this paper.

HEMICARDIACUS, new genus

Pronotum very high, foliaceous, with evenly rounded crest; median carina prominent, the greater part of its length strongly compressed laterally; extremely long humeral angles, sometimes each with a node projecting down to cover part of the eye. Scutellum concealed; tibiae not dilated, posterior tarsi not reduced; tegmina membranous, partly concealed by pronotum, venation prominent, third apical cell stylate, 5 apical and 2 discoidal cells; underwing with terminal cell sessile, its base truncate.

Type, *Hemicardiacus saundersi*, n. sp.

Systematically, this genus follows *Archasia* Stål in the tribe Telamonini Goding. The high pronotum and long humeral angles of *Hemicardiacus*, together with certain other affinities with *Antianthe* Stål in the succeeding tribe Smiliini Goding, suggest that the systematic arrangement of the latter should be altered to place *Antianthe*, rather than *Smilia* Germar, in first position.

Hemicardiacus saundersi, new species

(Figures 1, 2, 3)

Easily distinguished by size, frontal overhang of pronotum, and small lobes projecting down from frontal margin of pronotum to cover part of outer lateral margin of each eye. Length of male 12 mm., width between tips of humeral angles 8 mm.

Head shiny, very finely sculptured, more than twice as long as broad; base nearly straight at middle, thence almost straight down to eyes; ocelli about equidistant to each other and to the eyes, situated on a line drawn through centers of eyes; distal portion of inferior margins of genae slightly rounded to apex of clypeus; lateral margins of clypeus obscure, median sulcus very faint.

Pronotum high, foliaceous; metopidium straight for a short distance, about 1 mm., above base of head, then overhanging in front and evenly rounded to high crest, the maximum height about 6.5 mm. on perpendicular from base of head, and continuing evenly arched to apex; posterior third of inferior margin gently rounded to apex; apex slightly less than right angle when viewed from side, not attaining tips of tegmina; long humeral angle with rounded tip extending 2 mm. outward from eye and very slightly forward, a small lobe projecting down to cover distal part of eye; median carina prominent, strongly compressed laterally except on metopidium below overhanging portion; finely punctate including sides of compressed median carina; central portion of sides very finely rugose.

Tegmina hyaline, distal half rufo-testaceous near costal margin; venation prominent, dark rufo-testaceous, a definite constriction with no connecting cross-vein at juncture of second and third longitudinal veins; 5 apical and 2 discoidal cells. Underwing with venation typical of the tribe Telamonini Goding; venation light brown to black.

Color light testaceous mottled with bright green; dark reddish brown on sides of midcarina, becoming gradually wider on metopidium below overhanging portion to form a distinct triangular area down to head, base of triangle extending to mid-point above each eye; edge of median carina black throughout; humeral angles entirely reddish brown except proximal part of frontal margin; head, body, and legs light to dark testaceous; tarsi of at least the first two pairs of legs gray-black.

Type, male, from near Totonicapan (altitude 9,500 ft.), Dept. Totonicapan, Guatemala, March 29, 1942, Cat. No. 56896, United States National Museum. This locality is approximately 136 kilometers north of Guatemala City on the road to the Mexican border.

Described from a single male taken on oak (*Quercus* sp.) by the author. Named in honor of Dr. George B. Saunders, Jr.

Hemicardiacus saundersi, n. sp., superficially appears to be a species of *Antianthe*, a compact genus consisting of six species. The venation of the underwing of this new species (fig. 3), however, is typical of the tribe Telamonini (fig. 4), not Smiliini (fig. 5), and the prominent venation of the tegmina is unquestionably more like that of *Archasia* than *Antianthe*. The tegmina of some specimens of *Archasia belfragei* Stål also show a similar constriction of the second and third longitudinal veins at the discal juncture. *Archasia* is also a compact genus with three species recorded only north of Mexico. All species of *Archasia* are characterized by short humeral angles on the pronotum, and this character alone is sufficient to exclude *Hemicardiacus saundersi*, n. sp.

Poppea vestigia, new species

(Figs. 6, 7, 8)

A shining-black or dark-reddish-brown species resembling *Poppea subrugosa* Fowler but readily distinguished by larger size, higher middorsal node with pair of vestigial processes just below crest, and trifurcate process with more swollen base. Length 8.5 mm., width between tips of suprahumeral horns 3.9 mm.

Head smooth, shining, about 1.3 times longer than broad; base subsinuate; ocelli large, light yellow, about equidistant to each other and to the eyes, situated below a line drawn through centers of eyes; eyes large, situated well within extremities of humeral angles of pronotum; inferior margins of genae evenly rounded; clypeus very long, almost two-thirds of its length extending below inferior margins of genae, very few yellow hairs on distal portion; median sulcus appearing as wide straight line extending from above clypeus and between the raised, mesally arcuate areas that partly surround the ocelli.

Pronotum with metopidium rounded to dorsum; dorsum slightly rounded between swollen bases of suprahumeral horns; suprahumeral horns short, about 0.75 mm. long, almost straight when viewed from front, curved backward when seen from above; median depression behind suprahumerals on frontal base of large, subpyramidal middorsal node; middorsal node the highest point on dorsum, crest rounded, a small rudimentary process on each side of obscure median carina just below and in back of crest; a small round node on lateral margin of pronotum below distal half of mid-dorsal node and the deep sulcus separating the middorsal node and the much enlarged subsemicircular basal portion of the trifurcate process; middle spine of trifurcate process 1.8 mm. long, slightly decurved, not attaining distal angle of fifth apical cell of tegmen, each lateral spine about 0.8 mm. long, almost straight, pointing outward; median carina percurrent except for dorsal depression and anterior part of middorsal node in front of vestigial processes; coarse punctures on metopidium and dorsum between suprahumeral horns, finer punctures on rest of pronotum; not pubescent, few yellow hairs near lateral sclerite on pronotum above eyes.

Color of pronotum light testaceous marked with dark testaceous and black to all black marked with a small amount of dark reddish testaceous above the humeral angles; even in the black specimen the spines of the trifurcate process are testaceous, the tips black; head light testaceous to black; thorax, abdomen, and legs down to tibiae mostly dark reddish brown to black; tibiae and tarsi light testaceous; tegmina hyaline with dark-reddish-brown area at basal union of radial and ulnar veins and a similar but smaller area at distal union of the same two veins; venation mostly light testaceous, 5 apical and 3 discoidal cells.

Type, female (black), from near Santa Tecla, El Salvador (altitude not over 2,000 feet) June 30, 1942, Cat. No. 56997, United States National Museum.

Described from two females collected on "calague" (*Heliocarpus glanduliferus* Robinson) by Dr. Anton Kovar. Paratype in collection of author. One female specimen of *Parantonae dipteroides* Fowler was taken on the same host plant by Dr. Kovar.

Poppea kovari, new species

(Figs. 9, 10)

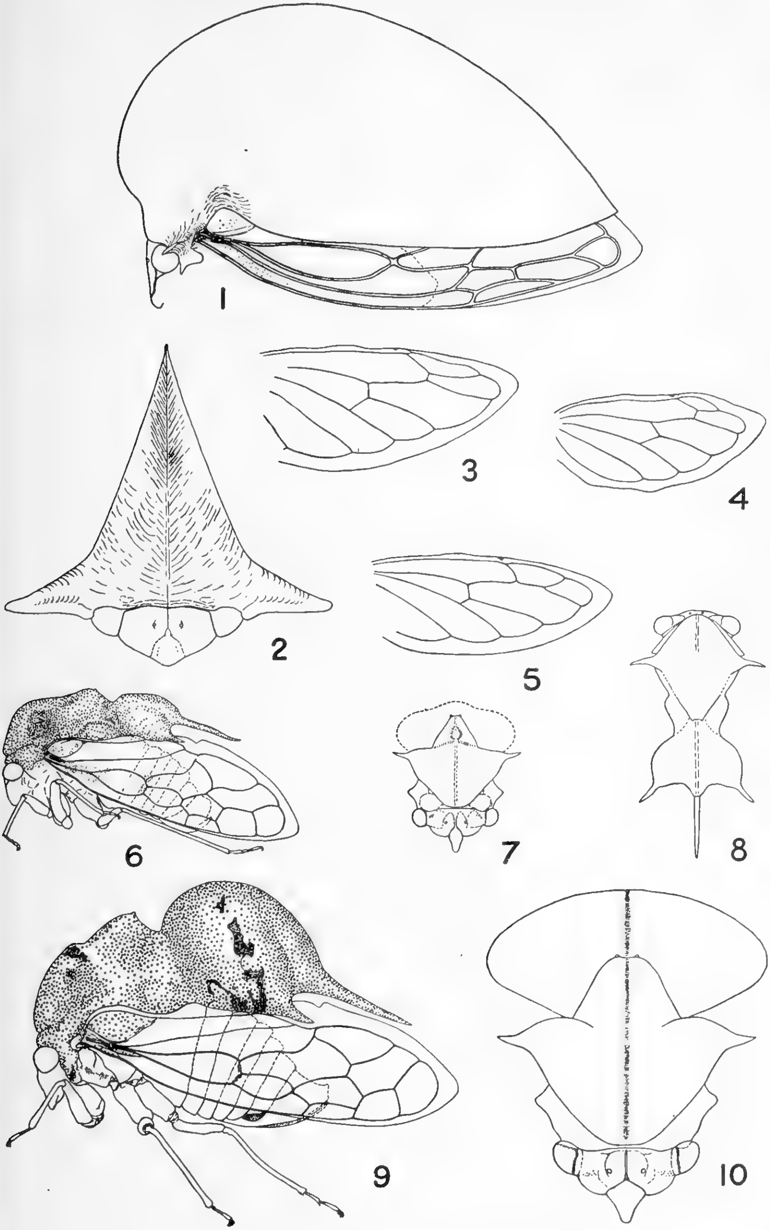
A large, light-testaceous species with few dark-reddish-brown markings. Very readily separated from all described species by the enormous size of the hump of the trifurcate process. Length 10 mm., width between tips of suprahumeral horns 5.5 mm.

Head smooth, about 1.8 times longer than broad; base slightly sinuate; ocelli transparent, slightly nearer to each other than to the eyes, below a line drawn through centers of eyes; eyes large, prominent, well within extremities of humeral angles of pronotum; inferior margins of genae nearly straight; clypeus very long, about two-thirds of its length extending below inferior margins of genae; few yellow and black hairs between ocelli and also on clypeus and inferior margins of genae.

Pronotum with metopidium slightly rounded, dorsum narrow (about 0.8 mm.) and flat between bases of suprahumeral horns; suprahumeral horns slightly curved backward, basal two-thirds greatly enlarged, abruptly tapering to a point at distal third, merging posteriorly with large subpyramidal middorsal node with vestiges of a pair of processes on crest; a deep sulcus between middorsal node and large hump of trifurcate process; a small round node on lateral margin posterior to base of suprahumeral horn and delimited dorsally and posteriorly by sulcus in front of enlargement of trifurcate process; enormously enlarged posteriorly as rounded hump of trifurcate process, hump measuring approximately 4 mm. from middorsal sulcus to base of middle spine of trifurcate process and about 2.5 mm. in maximum height; trifurcate process with short (about 0.75 mm.), straight lateral spine on each side directed outward and

EXPLANATION OF PLATE

Hemicardiacus saundersi, n. sp. Fig. 1. Side view; 2, front view; 3, underwing. 4. Underwing *Archasi belfragei* Stål. 5. Underwing *Antianthe expansa* Germar. *Poppea vestigia*, n. sp. Fig. 6. Side view; 7, front view; 8, top view. *Poppae kovari*, n. sp. Figure 9. Side view; 10, front view.



New Membracidae from Central America

straight, acuminate middle spine, about 2 mm. long, directed slightly downward, not reaching proximal margin of terminal apical cell of tegmen; unevenly punctate, large shallow punctations on sides of subpyramidal middorsal node and in sulcus separating middorsal node, lateral node, and enlargement of trifurcate process; sparsely covered with long yellow and black hairs; median carina percurrent.

Color uniformly light testaceous with small, dark-reddish-brown spot on dorsum of each suprahumeral horn at base, a narrow line of similar color extending from dorsal disc of posterior hump to base of lateral spine and then along lower lateral margin of hump almost to middorsal sulcus; eyes, tarsi, extreme tips of suprahumeral horns, and spines of trifurcate process dark reddish brown; ovipositor black; tegmina and wings hyaline throughout, venation light testaceous, 5 apical and 3 discoidal cells.

Type, female, La Ceiba, on road between San Salvador and Santa Tecla, El Salvador (altitude not over 2,000 feet), December 1938, Cat. No. 56898, United States National Museum.

Described from a single specimen captured on "calague" (*Heliocarpus glanduliferus* Robinson) by Dr. Anton Kovar.

It is a pleasure to name this species in honor of Dr. Anton Kovar, Jefe de la Sección Entomología of the laboratores of the Associatión Cafetalera de El Salvador, who has graciously given me permission to describe this species and to deposit the type specimen in the United States National Museum. It is believed that these are the first original descriptions of membracids from the Republic of El Salvador.

This short paper includes two new species of *Poppea* both of which possess a pair of very small vestigial processes on the middorsal hump. Furthermore, similar processes have been detected on 3 out of 35 specimens of *Xolonia variegata* Plummer in my collection. So far as the writer knows, these processes have not been described for these genera or any others in the subfamily Smiliinae. There can be little doubt but what these are vestiges of the two spines that readily distinguish *Cyphonia* Laporte from *Poppea* Stål and related genera. In *Xolonia* these vestiges are not constant and a longer series of specimens of the two new species of *Poppea* may show that they are not constant in that genus.

NEW SPECIES AND SUBSPECIES OF RYGCHIUM FROM NORTH AMERICA (Hymenoptera: Vespidae)

By Richard M. Bohart
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A study of the *Rygchium* material in the U. S. National Museum has resulted in the discovery of two species and two subspecies which are apparently undescribed. One of the new species has probably escaped attention because of its rarity, the other three because they have been confused with previously described forms.

The holotype specimens and most of the paratypes are in the U. S. National Museum. Paratypes have been deposited also in the collections of J. Bequaert and the author.

Rygchium planitarsis, new species

(Figs. 1, 3, 5, 6)

Male.—Black, marked with whitish yellow on mandible, clypeus, scape, antennal hook, interantennal spot, front margin of pronotum, pleural spot, tegula, post-scutellum, legs, apical margins of first 6 tergites and sternites II to V, lateral spots on sternite VI. Tibiae and tarsi partly reddish, last tarsal segment black. Clypeus evenly punctured, narrow and hardly produced apically; last antennal segment stout, obliquely truncate, reaching base of eighth segment; humeral and propodeal angles not prominent; basal four segments of mid tarsus extremely constricted in dorsal view, last segment broadly expanded; first 2 abdominal tergites moderately punctured, covered with thick short hair which is longest at summit of first, second not upturned apically, remaining tergites and sternites moderately punctured.

Female.—About as in male except as follows: Clypeus black except for basolateral spots, vertex with a very broad foveate depression; mid tarsus normal, dark reddish; venter with apical bands only on sternites I and sometimes II, other sternites with lateral spots.

Holotype male, (U. S. National Museum No. 57181), Cranmoor, Wisconsin, August 16, 1909 (C. W. Hooker). Paratypes, 22 ♂♂ and 9 ♀♀, collected from June to September at the following localities: Wisconsin (C. F. Baker); Michigan: Marquette (R. R. Dreisbach), Michigamme (C. Sabrosky), Pine River (H. C. Severin); New Hampshire: White Mts. (A. S. Packard), Jefferson; Maine: Carrs (F. A. Eddy), S. W. Harbor, Saddleback Lake (C. L. Metcalf), Ironbound Valley (D. Blaney), Waldoboro (J. H. Lovell); Nova Scotia: Portaupique (C. A. Frost), Cape Breton Island; New Brunswick: Nerepis and Douglas Harbor (A. G. Leavitt); Quebec: Joliette (C. J. Oellett), Montreal (W. Couper); Ontario: Timagami (A. Brown); Manitoba: Cedar Lake (C. T. Brues); Alberta: Clymon (E. H. Strickland); British Columbia: Nanaimo.

This species occurs with *leucomelas* (Saussure) in Canada and northeastern United States and has been confused with it in collections. The male of *planitarsis* is readily distinguished by its stouter last antennal segment and constricted mid tarsus (figs. 1 to 4). The female is usually more robust, more heavily punctured, the abdomen somewhat more dull, and the second sternite has a complete apical band instead of lateral spots only.

Rygchium barberi, new species

(Figs. 7, 8)

Female.—Black, marked with deep yellow as follows: a latero-basal clypeal spot, interantennal spot, scape in front, ocular spot, postocular spot, front margin of pronotum, comma-shaped lateral spot on scutum, tegula, pleural spot, triangular spots on scutellum, lateral propodeal spots, femora slightly, tibiae partly, apical margins of first 5 abdominal tergites and sternites II to IV. Legs partly and wings reddish brown. Pubescence short, not prominent, silvery. Puncturation moderate to coarse, punctures well separated on second sternite; vertical surface of first abdominal tergite smooth, horizontal surface well punctured. Clypeus sub-triangular, narrowly bidentate at apex, one and one-third times as broad as long; a weak interantennal carina; interocellar area strongly tuberculate, a smooth tubercle below median ocellus, vertex pit twice as broad as an ocellus. Front margin of pronotum sharp, front face practically impunctate, humeral angle rounded; scutellum flattened, postscutellum strongly punctured but not serrate, no postscutellar shelf; propodeal concavity impunctured, weakly striate, margined above by a sharp carina, lateral angle of propodeum blunt. First abdominal tergite almost rectangular, vertical and horizontal faces at right angles, slightly depressed at middle above; second tergite somewhat thickened and upturned apically, depressed subapically; second sternite with a sharp medio-basal crease (fig. 8).

Holotype female (U. S. National Museum No. 57182), Brownsville, Texas, June 4, 1904 (H. S. Barber). Paratypes: 3 ♀ ♀, same data as holotype; 2 ♀ ♀, Esperanza Ranch, Brownsville, Texas, July 25–27.

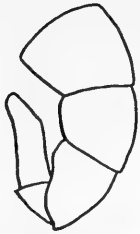
This species is characterized by its slender form, interocellar tubercles, spotted scutellum but unspotted postscutellum, sharp margins to the propodeal concavity, and the deformed second abdominal tergite. These same characters occur in *cluniculus* (Saussure) which differs from *barberi* in having a distinctly bituberculate scutellum and a much more strongly contorted and apically upturned second tergite.

Rygchium rugosum fedoris, new subspecies

Male.—As in typical *rugosum* (Saussure) with well punctured first abdominal tergite covered with abundant short hair, blunt propodeal angles, reddish brown wings, and pale tarsi with black terminal segment. Differing from typical *rugosum* in markings and sculpture as follows: Mandible, pronotum and legs

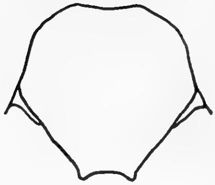
1. planitarsis

2. leucomelas

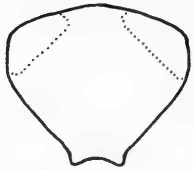


3. planitarsis

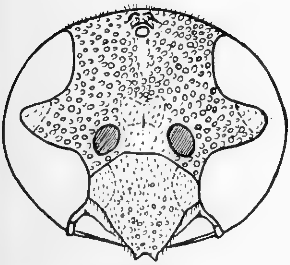
4. leucomelas



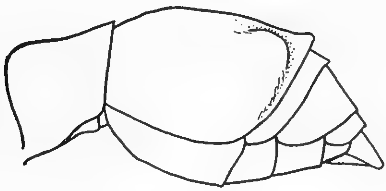
5. planitarsis



6. planitarsis



7. barberi



8. barberi

Fig. 1, male mid tarsus of *R. planitarsis* n. sp. Fig. 2, male mid tarsus of *R. leucomelas* (Saussure). Fig. 3, lateral view of male antennal segments 9 to 13 of *planitarsis*. Fig. 4, lateral view of male antennal segments 9 to 13 of *leucomelas*. Fig. 5, male clypeus of *planitarsis*. Fig. 6, female clypeus of *planitarsis*. Fig. 7, front view of head of female *R. barberi* n. sp. Fig. 8, lateral view of abdomen of *barberi*. (No puncturation or pubescence shown in figures 3 to 6, and figure 8.)

more extensively yellow; scutellum and propodeum usually, second abdominal tergite sometimes with lateral yellow spots; first tergite with prominent inwardly directed attached lateral spots; abdomen with broad apical yellow bands at least on tergites I to V and sternites II to V. Clypeus moderately punctured, not quite evenly convex, somewhat produced apically; frons somewhat less strongly punctured than in *rugosum*, second abdominal tergite without an apical upturned membrane and only moderately punctured subapically, third and following tergites moderately punctured.

Female.—Vertex with broad foveate depression as in typical *rugosum*. Differentiating characters as in male except that clypeus has a central black spot and is reddish apically, first abdominal tergite is often almost wholly yellow above with only a diamond-shaped black mark.

Holotype male, (U. S. National Museum No. 57183), Fedor, Lee Co., Texas, April 2, 1909. Paratypes: 2 ♂ ♂, 11 ♀ ♀, Fedor, Texas; 1 ♂, 2 ♀ ♀, Lee Co., Texas; 5 ♂ ♂, 7 ♀ ♀, "Texas"; 2 ♀ ♀, Kerrville, Texas (F. C. Pratt); 1 ♂, Goliad Co., Texas, March 25, 1907 (J. D. Mitchell).

Rygchium sulphureum imperialis, new subspecies

Male.—As in typical *sulphureum* (Saussure) with sparsely punctured clypeus and vertex, flattened and apically expanded antennal hook, smooth interantennal area, basally depressed middle femur, and practically impunctured first abdominal tergite. Differing from typical *sulphureum* in markings as follows: Yellow, marked with reddish on vertex, upper frons, scape, scutum, pleuron, propodeum, legs, and bases of abdominal segments. Area around ocelli, spot at front of scutum, black. Flagellum and wings reddish brown.

Female.—Marked about as in male but more extensively yellow. Black markings much reduced or absent, abdomen and pleuron almost wholly yellow.

Holotype male (U. S. National Museum No. 57184), Imperial County, California, June, 1912 (J. C. Bridwell). Paratypes: 7 ♂ ♂, 2 ♀ ♀, same data as holotype; 1 ♂, 11 ♀ ♀, San Diego Co., Calif., (D. W. Coquillett); 3 ♂ ♂, 19 ♀ ♀, California (C. F. Baker); 1 ♀, southern California; 1 ♀, Bard, Calif., July 13, 1920 (H. R. Reed).

This subspecies represents the extreme xerophytic color type. The replacement of black with orange-yellow distinguishes it at once from typical *sulphureum*.

It is much more similar in markings to *annulatum evectum* (Cresson) which occurs in the same area. The male of *imperialis* has the clypeus about one and one-third times as broad as long, whereas *evectum* has the clypeus one and one-half times as broad as long. The female of *imperialis* can be distinguished by its more extensive yellow markings, the yellow instead of orange frons below the upper level of the eye emarginations, and the narrower, yellower clypeus.

Rygchium digiticornis, new name

Odynerus canaliculatus Viereck, 1908, Trans. Am. Ent. Soc. 33:392 (preocc. by *O. canaliculatus* Saussure, 1855.)

The holotype male of this species at the University of Kansas was examined in 1937. It differs from all other North American *Rygchium* in having a v-shaped notch at the apex of the clypeus. In size and coloration it resembles a yellow specimen of *dorsale* (Fabricius). In addition to the clypeal difference, however, *digiticornis* has a longer, more finger-like last antennal segment and a much more sharply upturned second abdominal tergite than in *dorsale*.

REPORT OF THE CORRESPONDING SECRETARY NOV. 1, 1943 TO OCT. 31, 1944

Letters written, 107; many matters attended to informally.

Proceedings acquired, 525 (net gain in nine numbers for year) plus 352 (gifts of back numbers), total 877.

Back numbers sold, 1295, including 3 complete sets; net reduction, 418.

Old reprints sold, 9

Memoirs sold; No. 1, 6; No. 2, 50; several advance inquiries for next memoir are on file.

Literature sales: Proceedings and reprints, \$531.59; Memoir 2, \$140.85; Memoir 1, \$18.00; total \$690.44.

Membership changes of record: Elected 23, resigned 5, died 3, dropped 17, (Proceedings suspended to 5); net loss 2.

(Some of the members dropped were long-delinquent ones not on the present Corresponding Secretary's list; we had really a net gain.) Present list, 264 members, including 11 not receiving Proceedings.

Subscribers: 2 lost, 5 added; present list 135. American Library Association carries 10 subscriptions for suspended European subscribers.

Respectfully submitted,
F. M. Wadley,
Corresponding Secretary.

REPORT OF THE TREASURER FOR THE YEAR 1944

GENERAL FUND

RECEIPTS

Cash on hand January 1, 1944 (stamps)	$ 2.50
Cash on hand January 1, 1944, in general fund deposited in Hamilton National Bank	545.83
From members, dues for 1944	531.61
dues in advance	32.00
back dues	184.00
initiation fees	29.00
credited to account as advance deposit	130.86

From subscribers, for subscription to Proceedings:	
1944 and back payments	308.00
1945 subscriptions in advance	246.75
American Library Association, for 10 sets 1944 Proceedings	42.50
From authors, separates and author's copies	59.50
for illustrations	14.49
From institutions, for author's separates	98.25
for cost of printing articles	35.35
From sale of back numbers of Proceedings	216.49
From sale of copies of Constitution and By-Laws	.30
Miscellaneous	33.90
Total receipts	$2,511.33

EXPENDITURES

To H. L. & J. B. McQueen, Inc., for printing Proceedings (No. 9 of Vol. 45, and 1-8 of Vol. 46) and separates	$1,478.54
To H. L. & J. B. McQueen, Inc., for printing programs of 9 meetings (542–550th, inclusive)	32.00
To H. L. & J. B. McQueen, Inc., for 500 remittance notices	4.50
3500 envelopes	38.75
500 invoices	9.50
To Southern and Standard Engravers, for engravings for the Proceedings (Nos. 1-8 of Vol. 46)	147.00
To AAA Letter Service, for 100 membership application blanks (mimeographed)	1.75
To Kirby Lithograph Co., for 300 copies of Constitution and By-Laws	16.29
For stationery	.50
For stamps	50.96
For notary public fees	1.25
Shipping charges	18.95
For clerical help (January to December 1944, inclusive)	120.00
For rental and tax on safe deposit box at City Bank	4.20
Miscellaneous expenses	24.70
Refunds for orders cancelled	4.00
Total expenditures	$1,952.89
Stamps on hand received in lieu of cash during 1944	1.00
Cash on hand in Hamilton National Bank	557.44
	$2,511.33
Outstanding obligations	310.28

PUBLICATION FUND

Schwarz donation (principal $1,000.00), invested with American Building Association (reported 1943)	$1,379.26
Dividends earned 1943, credited 1944	57.98
Total in Schwarz donation fund	$1,437.24

Knab bequest, invested with Columbia Federal Savings and Loan Association, reported 1943	$985.57
Dividends received 1943, credited 1944	12.31
Dividends received 1944	13.71
Deposited 1944, covering payment in full of non-interest bearing note	500.00
Total in Knab bequest	$1,511.59
General publication fund, in savings account with Hamilton National Bank January 1, 1944	$722.22
From sales of Memoir No. 1 (6 copies)	18.00
From sales of Memoir No. 2 (46 copies)	128.50
From sales of 3 complete sets of Proceedings	350.85
From interest on savings account	7.04
Total in General Publication Fund	$1,226.61
Total amount of publication fund	$4,175.44

Respectfully submitted,

G. J. Haeussler, *Treasurer*

The auditing committee has examined the report of the treasurer of the Entomological Society of Washington for the calendar year ending December 31, 1944, and find it correct.

Respectfully submitted, January 4, 1945

W. A. Baker

U. C. Loftin

Auditing Committee

MINUTES OF THE 550th REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON DECEMBER 7, 1944

The 550th regular meeting of the Society was held at 8 P. M., Thursday, December 7, 1944, in Room 43 of the National Museum with President Annand presiding. The minutes of the meeting for October 5, 1944, were approved as read; those for November 2, 1944, were read, corrected, and approved.

The following men were elected to membership:

Dr. John S. Caldwell, U. S. National Museum.

Lt. (j. g.) D. S. Farner, H(S) U. S. Naval Reserve.

The report of the Treasurer, G. J. Haeussler, was read. Dr. Annand appointed U. C. Loftin and W. A. Baker as auditors.

The report of F. M. Wadley, Corresponding Secretary, was read and accepted.

The report of the Chairman of the Membership Committee, M. P. Jones, was read by C. M. Packard and approved.

In the absence of R. W. Harned, Dr. E. R. McGovran read the report of the Nominating Committee on officers for the coming year. There were no further nominations from the floor and the Secretary was instructed to cast a unanimous ballot. The officers for 1945 are as follows:

Honorary President	L. O. Howard
President	F. W. Poos
First Vice-President	C. A. Weigel
Second Vice-President	Austin Clark
Recording Secretary	Ina L. Hawes
Corresponding Secretary	F. M. Wadley
Treasurer	L. B. Reed
Editor	Alan Stone
Member of Executive Committee	P. N. Annand
Representative to the Washington Academy of Sciences	S. A. Rohwer

The new President, F. W. Poos, was escorted to the chair and presided over the rest of the meeting.

The first paper on the regular program was given by Dr. W. H. Anderson: Some Remarks on Weevil Larvae.

The principal reason for studying weevil larvae is to be able to distinguish between the different ones received for identification. In addition to this, conclusions drawn from a systematic study of the larvae are applicable to the problem of the natural classification of the group. In most cases the classification of the larvae agrees with that of the adults, but in other cases there is little or no agreement. In the latter, it will be necessary to examine the evidence presented by the study of both adults and larvae in order to arrive at the more correct conclusions. No attempt was made to outline a classification of weevil larvae. Drawings were shown which pointed out some of the more striking ways in which larvae of the various groups differ. The homologies of the various areas of the abdomen based upon studies of the musculature, were pointed out. With the homologies of the areas established it is possible to compare the setae on them with confidence. (Author's Abstract).

Dr. James inquired if the larval characters mentioned applied to the earlier instars as well as to mature forms. Dr. Anderson replied that they were different for the first-stage larva, but remained constant for all instars after the second. Dr. Siegler asked if the body forms were curved in all species. Dr. Anderson said that some of the externally feeding larvae (such as *Ceutorhynchus* larvae) are flat ventrally, but that the majority are curved. Mr. Snodgrass referred to recent work on so-called sensory pores which indicates that they respond to strains and stresses in the integument. There was further comment by Dr. Roger Smith and President Poos.

Dr. F. C. Bishopp presented the second paper on the regular program: A Visit with Australian Entomologists.

Introduction of visitors was omitted, and the meeting adjourned at 9.45 P. M.

INA L. HAWES.
Recording Secretary.

Actual date of publication, March 2, 1945.

VOL. 47 **March, 1945** **No. 3**

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

PUBLISHED MONTHLY EXCEPT JULY, AUGUST AND SEPTEMBER

BY THE

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U. S. NATIONAL MUSEUM

WASHINGTON 25, D. C.

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THE

ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884.

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

Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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Honorary President . . . . L. O. HOWARD
President . . . . F. W. POOS
First Vice-President . . . . C. A. WEIGEL
Second Vice-President . . . . AUSTIN H. CLARK
Recording Secretary . . . . INA L. HAWES
Corresponding Secretary . . . . F. M. WADLEY
Treasurer . . . . L. B. REED
Editor . . . . ALAN STONE
Executive Committee . . . . . E. N. CORY, R. W. HARNED, P. N. ANNAND
Nominated to represent the Society as Vice-President
of the Washington Academy of Sciences . . . . . . C. F. W. MUESEBECK

PROCEEDINGS
ENTOMOLOGICAL SOCIETY OF WASHINGTON.

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The Corresponding Secretary and Treasurer should be addressed similarly.

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 47 MARCH, 1945 No. 3

THE GENUS GALERUCA IN NORTH AMERICA
(Coleoptera: Galerucinae)

By Doris H. Blake

The genus *Galeruca* consists of species found mostly in the temperate and even subarctic regions of Europe, Asia and North America. Such localities as the Himalayas, Finland, Siberia and the Swiss Alps indicate its tendency to occur in cold or mountainous areas. In North America two species have been described, one, *G. externa* Say from specimens collected on Long's expedition to the Rocky Mountains, and the other, *G. rudis* LeConte from Puget Sound, Washington. *Rudis* has been wrongly synonymized by Horn with *externa*. A third name, *G. pomonae* Scop., has been erroneously applied to a species collected about 1878 in Ohio, which was supposed to have been introduced into this country from Europe.

Of late years the common name of "peppergrass beetle" has been adopted for a species misidentified as *G. externa* Say that occurs in the prairie provinces of Canada and northern United States and which has transferred its feeding habits from peppergrass (*Lepidium* sp.) to the cultivated crops of cabbage and other cruciferous garden plants. Such statements as the following: "The peppergrass beetle (*Galeruca externa* Say) * * * feeds on lupine in the Great Basin area. In 1934 it destroyed the lupines over hundreds of acres in Eastern Oregon and also fed on the grasses" [1], a statement that is contradictory in itself in regard to the insect's natural foodplant, have led me to examine critically the specimens of *Galeruca* in the National Museum and other collections. It was not surprising, therefore, to find that there are several hitherto unrecognized species of the genus occurring in North America.

Unlike the European species, the North American ones are closely related to each other and rather difficult to separate. They are all deep brown or piceous with paler elytral margins, all are coarsely and densely punctate, all have strong elytral costae, and some have lesser intercostal ridges running parallel to the main costae. Moreover, the aedeagi are all very much alike. The main differences lie in the sculpture of the elytra,

[1] Keen, U. S. D. A., Mis. Pub., 273, p. 166, 1938.

In addition, the distribution of each species seems clear cut. There is (1) a Rocky Mountain species which extends from the Pacific Northwest down through the Sierras and Rocky Mountains; (2) a northern great plains species found in the prairie provinces of Canada and Minnesota and the Dakotas; (3) a central or Mississippi Valley species; (4) a species found in the arid Southwest, in southwestern Colorado, Utah, Arizona and New Mexico; and lastly (5) a species found in the mountains of Texas and New Mexico. What little is known of the food habits indicates that these too are distinctive.

I have examined many specimens and wish to thank the following for sending me their material for study: Nathan Banks, Museum of Comparative Zoology; Warwick Benedict, University of Kansas; W. J. Brown, Dept. of Agriculture, Canada; J. J. Davis, Blatchley collection; T. H. Frison, Illinois State Natural History Survey; C. A. Frost; L. G. Gentner, Oregon State College; G. F. Knowlton, Utah State College; S. Maulik, British Museum; A. T. McClay; Clarence E. Mickel, Univ. of Minnesota; H. B. Mills, Montana State College; Miriam A. Palmer, Colorado State College; W. D. Pierce, Los Angeles Museum; H. C. Severin, South Dakota State College; E. C. Van Dyke, California Academy.

Key to the Species

1. Deep reddish or even blackish brown with an indistinct pale elytral margin, elytral punctation very coarse and deep and with many irregular, short, sharp ridges between the costae (Upper Mississippi Valley from about the Great Lakes southwards along the Mississippi River and its tributaries. Breeding on *Phlox divaricata*)............. *G. externa* Say

   Very dark brown or piceous with distinct pale elytral margin, elytral punctation not so coarse and the intercostal areas not broken up conspicuously by many sharply cut ridges............................2

2. Between the usual 3 or 4 costae on each elytron narrower and less elevated intermediate costae, making 7 or 8 costae on each elytron, the main costae very prominent (Utah, S. W. Colorado, Arizona and New Mexico).................................. *G. costatissima* n. sp.

   Usually only 3 or 4 distinct costae on each elytron, although ridges or remnants of intercostae present in many specimens....................3

3. Costae not very elevated, punctation coarse, shallow, regular, and contiguous, and usually with little ridging between (Extreme northwestern Texas and New Mexico)......................... *G. popenoei* n. sp.

   Costae more or less sharply prominent, punctation more irregular, sometimes less dense, sometimes finer, often with small intercostal ridgings....4

4. Punctation on elytra not so dense, aedeagus with a somewhat attenuated tip (Pacific Northwest, Sierras, Rocky Mts., feeding on lupine)....... *G. rudis* Lec.

   Punctation on elytra dense, contiguous, aedeagus with a slightly less attenuated tip (Western plains of Canada and northern U. S., feeding on *Lepidium* and other crucifers)..................... *G. browni* n. sp.

Galeruca externa Say

(Fig. 2)

Galleruca externa Say, 1824, Journ. Acad. Nat. Sci. Phil., 3:4~~8~~58.
Galeruca pomonae "Scop.", Knab, 1905 Ent. News, 16:230–32. (Not *G. pomonae* Scop. 1763.)

In 1903 Charles Dury [2] wrote that 25 years before he had found rather commonly in the vicinity of Cincinnati, Ohio, a *Galeruca* that Horn identified as *externa*. He reported that Schwarz rather doubted its occurrence there and on receiving a specimen had identified it as *G. tanaceti* L., a European species, and the first record of its being in the United States. Dury queried whether his specimens from Ohio, Michigan, Colorado, New Mexico and California although "varying in minor details so that no two are alike" might not "any of them fit the description of either *tanaceti* or *externa*" and asked if the two species might not be identical. Two years later Frederick Knab took up the problem and identified Dury's specimens and also a series reared by C. A. Hart from Champaign Co., Illinois, now in the collection of the Illinois State Natural History Survey, not as *G. tanaceti* L. but as *G. pomonae* Scop. because of its ferruginous coloration and some differences in marginal grooving of the elytra. He stated that *G. externa* is confined to the Rocky Mountain region and "although costate like *G. pomonae* is amply distinct." Two years later J. J. Davis[3] wrote in detail of his breeding of the species which C. A. Hart had found feeding as larvae on both *Phlox divaricata* and *Dentaria laciniata*. Davis wrote "in all our observations of the past two years they have been found only on *Phlox divaricata*." He quoted Kaltenbach as authority for the statement that the food plants of *G. pomonae* in Europe were *Centaurea jacea*, *Cirsium palustre*, and *Scabiosa succisa*. These incongruities in food plants will be cleared up in the following paragraphs.

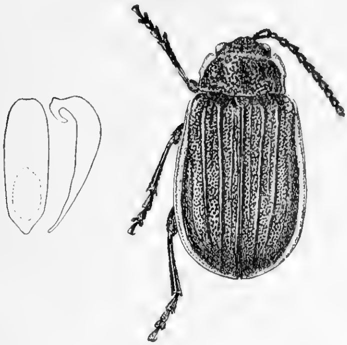
Galeruca externa was described by Say from "Arkansa", meaning thereby along the Arkansas River. Contrary to Knab's statement, this species was not collected in the Rocky Mountains. Those insects that Say described from the Rocky Mountains, he specifically stated were collected "near the Rocky Mts.", "at the base of the Rocky Mts.", or even "the upper Arkansa". The Long expedition, after following the Platte River out to Colorado, climbed only Long's Peak, and some of them possibly Pike's Peak, and then returned by following the Arkansas River back. It must have been on this return trip that Say collected the species which he named *Galleruca*

[2] Dury, 1903, Ent. News, 14:146.
[3] Davis, 1907, Ent. News, 18:269–275.

externa. Specimens in the National Museum which have been labelled by Knab as *G. pomonae*, the European species, are of of the same species as those in the LeConte collection from Nebraska (as indicated by the green color disc) labelled by LeConte as *G. externa.* Furthermore, in the F. H. Snow collection in the University of Kansas, there are specimens of this species from Douglas Co., Kansas, which is not far from the type locality, the Arkansas River. It was also collected by Blatchley in Indiana, and by E. P. Van Duzee as far east as Lancaster, N. Y. One old specimen in the Wickham collection is from Pittsburg, Pa. Old specimens labelled simply Canada, or "C.W." (Canada West) are in the F. A. Eddy collection in the Museum of Comparative Zoology. These scattered records indicate that the species is found in the central area of the United States from the Great Lakes down the Mississippi and its tributaries, and that it is not a dry plains or a mountain or a far northern species. In the east *Phlox divaricata* grows in rich river woods, a soil not dissimilar to that found in the Mississippi Basin.

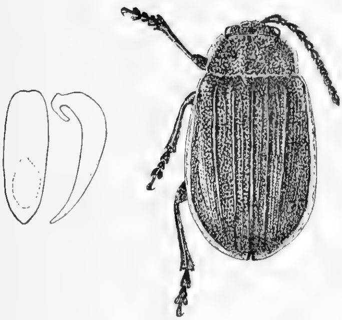
Knab's identification of this species as the European *pomonae* is incorrect. Both the North American species and *pomonae* are costate and coarsely punctate, but they differ in coloration, *pomonae* being bright reddish brown and the North American species being dull brown, often blackish brown. The aedeagi are quite unlike. The elytral sculpture of the Mississippi Valley species is irregular with numerous sharp intercostal ridges giving the appearance of confluent punctures, and the punctures are coarser and more sharply cut and deeper than in *pomonae* or other North American species. Two points in Say's short description apply strictly to this species,—the blackish brown coloration and the confluent elytral punctation. Two other species, one found on the great plains of Canada and northern United States, and the other in the high mountains of the Rockies, are both clearly black and with dense but not confluent punctation. In short, all indications point to this Mississippi Valley species being the one that Say described in 1824 as *externa.*

Distribution: CANADA: "Canada West" (F. A. Eddy collection): NEW YORK: Lancaster (E. P. Van Duzee). PENNSYLVANIA: Pittsburg (G. A. Ehrmann). OHIO: Near Cincinnati (Charles Dury). INDIANA: Kosciusko Co. (Blatchley). ILLINOIS: Champaign Co. (C. A. Hart); Urbana (J. J. Davis). KANSAS: Douglas Co. (F. H. Snow). NEBRASKA: LeConte collection.



1. Galeruca rudis Lec.

2. Galeruca externa Say



3. Galeruca browni

4. Galeruca pomonae Scop.

5. Galeruca popenoei

6. Galeruca costatissima

Galeruca rudis Lec.

(Fig. 1)

Galleruca rudis LeConte, 1857, Ent. Rept. upon Insects collected on the Survey on Route near 47th Parallel, Rept. of Expl. and Surv. Miss. to Pac., vol. XII, pt. 3, p. 69.

LeConte drew up his description of *G. rudis* from a specimen or specimens found by Mr. Gibbs at Steilacoom, Washington, which is on Puget Sound below Tacoma. In his collection there are 3 specimens, each bearing a small blue disc indicating the locality Oregon or Washington, the type, a female, bearing LeConte's label, and two others, a smaller male and a large female. A fourth specimen without locality label is also this species. The fifth specimen from Veta Pass, Colorado is of Schwarz's collecting, and the sixth labelled W. T. (Washington Territory) completes the series.

LeConte's description of *rudis*, translated, reads thus: "piceous, ovate, above glabrous, with the head and thorax coarsely punctate, the latter widely canaliculate, bifoveate, unequal, anteriorly narrowed, with sides subangulate; elytra with the suture elevated and four smoothish (*sublaevis*) costae, the interstices and marginal sulcus deeply and coarsely punctate. Length .4."

Compared with *G. externa*, this species differs in being piceous black throughout with the margin and epipleura yellow brown. In *externa* the pale margin, while discernible in most specimens, offers no great contrast to the rest of the body, not being much paler. The difference in the sculpture of the two is most striking; in *externa* the elytral punctures are nearly twice as large and considerably deeper than in *rudis*, and moreover the punctures are contiguous, often confluent, whereas in *rudis* the punctures, although dense, are for the most part clearly defined and not confluent.

This species is found feeding on lupine. E. C. Van Dyke, O. H. Swezey, Arthur McClay, L. G. Gentner, and others have recorded it on that host plant in Washington, Oregon, and California. There is one record of its occurrence on lupine at Big Horn, National Forest, Wyoming. Undoubtedly it is the same as the species referred to in the quotation at the beginning of this paper as destroying hundreds of acres of lupine in eastern Oregon. In the Rocky Mountains it appears to inhabit high elevations. One collector (J. F. G. Clarke) writes, "I have seen this species by the thousands on glaciers and rocks" (Table Mountain, Wyoming). No hint of its food plant at these elevations is given, but lupine occurs abundantly in the high mountain meadows. Throughout its long range from British Columbia along the coast of Washington and Oregon, down through the Cascades and Sierras, the specimens are not very variable.

But specimens from the Rocky Mountains are slightly different in appearance. In general they are smaller, and correspondingly the punctation does not appear so coarse. I am unable to find any stable differences, however. Possibly these high mountain specimens are a small depauperate race. It will be seen that all the localities listed from Colorado are at a considerable elevation and none of them are located in the eastern part of the state. *G. rudis* and *externa* do not overlap in their range.

Distribution: BRITISH COLUMBIA: Alasak Mt., 7,500 ft., Lytton (F. Perry) on *Dryas drummondi;* Glenora (Wickham); Hope Summit (A. N. Gartrell); Mt. Apex (A. N. Gartrell); Mts. between Hope and Okanagan, Lillooet Dist.; Vancouver. ALBERTA: Crow's Nest Pass (F. Johansen). WASHINGTON: Friday Harbor; Gulf of Georgia (A. Agassiz); Hurricane Hill, Clallam Co. (M. H. Hatch); Mt. Ranier, 5,000, ft. (M. Malcolm); Paradise Valley (Wickham); Vancouver (Blaisdell); Washington Territory (Morrison). OREGON: Crater Lake, 7,2–7,400 ft. (L. G. Gentner); Gardiner (Fender); Gearhart (M. C. Lane); Hanson's Resort, Jefferson Co. (Van Dyke); Hauser (L. G. Gentner, A. T. McClay) on lupine; Malheur, Jefferson Co. (Van Dyke) on lupine; Mt. Hood (Van Dyke); Prospect, Jackson Co., (Van Dyke); Seaside; Warrenton, on *Franseria.* CALIFORNIA: Big Pine, Inyo Co. (I. McCracken); Bishop (E. E. Kenaga, D. E. Hardy); Crescent City, Del Norte Co. (Van Dyke); Eldorado Co.; Echo (R. H. Beamer); Fallen Leaf, Eldorado Co. (O. H. Swezey) on lupine; Lake Tahoe (Van Dyke); Mt. Whitney Portal, Inyo Co. (L. J. Muchmore); Placer Co., Pyramid Range station (F. H. Herbert) on wild parsley; Sisson; Tallac (A. Fenyes); Tuolumne Co. (R. L. Usinger). NEVADA: Mt. Wheeler (F. W. Morand). IDAHO: Bonanza. UTAH: Mt. Nebo (Peabody Collection); Pine Mts. Stoddard Ranch, Wasatch (Otto Lugger, Schwarz). MONTANA: Bear Paw Mt. (E. A. Schwarz); Broadwater Co. (A. A. Nichol), Gallatin Mts.; Gallatin Co.; W. Gallatin Canyon; Mystic Lake, 7,000 ft.; West Fork Bitterroot River (S. Beller). WYOMING: Big Horn, National Forest (Hettinger) on lupine; Crandall Creek (R. Currie); Freedom (Knowlton); Jackson's Hole (R. Currie); Table Mt., Whatcomb Co. (J. F. G. Clarke); Yellowstone Park (Schwarz). COLORADO: Argentum, 12–13,000 ft. (Wickham); Bailey; Breckenridge, 9, 6–10,000 ft. (Wickham); Buford; Copeland Park, Boulder Co. (Alexander); Dutch George, near Estes Park; Ft. Collins (S. Beller); Glenwood Spgs. (Wickham); Gothic, 9,500 ft.; Leadville (Wickham); Timberline above Leadville, 11–12,000 ft.; Little Willow Creek, Gun. Co., 8,000 ft.; Long's Peak, 12,000 ft. (S. A. Rohwer); Muchanawago (A. Fenyes); Palmer Lake; Pagosa Springs (R. H. Beamer); Pingree Park, 9,300 ft. (Warwick Benedict, R. H. Beamer, Lawson); Ouray, 9,000 ft. (Wickham); above

Ouray, 13,000 ft.; Torrey Park, Boulder Co., 10,000 ft.; Veta Pass (E. A. Schwarz); Ward, 9,000 ft. (L. J. Muchmore); Westlake. NEW MEXICO: Chama (R. H. Beamer.)

Galeruca browni, new species

(Fig. 3)

8–10.5 mm. long, ovate, piceous with pale yellow brown elytral margin, somewhat shining, densely and rather coarsely punctate, the head and sometimes the prothorax very inconspicuously pubescent; elytra with the suture raised and on each elytron three costae and sometimes remnants of a fourth below the humerus.

Head coarsely and densely punctate, sparsely pubescent, a median depressed line running from occiput to lower end of front, front short, ending a little below antennal sockets; frontal tubercles prominently raised with a little depression on the vertex above them; eyes rather small, elliptical, widely separated. Antennae extending a little below the humeri, rather stout, first six joints less hairy than last five, third joint longer than fourth, the fourth longer than fifth, remainder about equal. Prothorax over twice as broad as long, narrowed anteriorly, sides angulate in many specimens, often with a slight constriction at middle or a little below, the margin more widely explanate in anterior half and turned upwards on the edge. Surface moderately shiny, very densely and coarsely punctate and irregular, more or less canaliculate in the middle and with depressions on either side, a very short and sparse pubescence in some specimens. Elytra each with three costae besides the raised sutural edges, and frequently remnants of another below the humerus, occasionally two others more faintly marked between the suture and first and second costae. Punctation very dense, contiguous, and rather regular becoming finer and shallower at apex. Body beneath piceous, shining, lightly covered with pale pubescence. Anterior coxal cavities closed, middle tibiae with short spur at tip, claws with a short tooth at base. Length 8–10.5 mm.; width 5.5–6.2 mm.

Type male and 7 paratypes in Canadian National Collection, Ottawa; 4 paratypes in U. S. National Museum (Cat. No. 57193).

Type locality.—Aweme, Manitoba, collected by Norman Criddle, Sept. 3, 1906.

Distribution: MANITOBA: Aweme (George Greene); Brandon (Wickham); Treesbank (Criddle); Wawansea (Mrs. E. Ellis). SASKATCHEWAN: Estevan (P. C. Brown); Rutland (A. R. Brooks). ALBERTA: Blairmore (J. H. Pepper); Dead Horse Lake (P. J. Darlington); Medicine Hat (L. J. Muchmore); Nanton (E. H. Strickland); Nordegg. MINNESOTA: Becker Co.; Bemidji (M. Taylor); Cass Co. (R. H. Daggy); Detroit Lakes (M. H. Ostrem); Fertile (H. L. Parten) feeding on clover and alfalfa; Itasca Park; Lancaster (D. G. Denning) feeding on Russian thistle; Norman Co.; Plummer (D. G. Denning and O. Pearson); Red Lake Co. (D. G. Denning). IOWA: Sioux City. SOUTH DAKOTA: Aberdeen; Eureka (H. C. Severin)

Remarks: Norman Criddle [4] appears to have been the first to record this beetle in economic literature. He wrote that it "appeared in enormous numbers but as it confined itself chiefly to *Lepidium* and a species or two of *Arabis* it could hardly be objected to." Since then it has been mentioned from time to time, especially in Canadian reports. In 1932 Dunstan [5] gave a brief account of its life histroy, stating that it winters over as an egg, which hatches early in the spring, the adults appearing about the middle of June. There is only one generation. According to him it feeds on cabbage, turnip, perennial alyssum, and *Arabis*. Gibson [6] reports it as occurring in the prairie provinces of Canada on peppergrass and tumbling mustard, and also damaging plants of the same family, such as alyssum and rock cress, in gardens. Although there are specimens from Minnesota (in University of Minnesota collection) labelled as having been taken on Russian thistle (*Salsola kali* var. *tenuifolia*), alfalfa, and clover, it may easily be that the insects are so numerous at times as to be found on everything. Certainly the bulk of evidence indicates that it breeds on wild crucifers.

This species is very similar to *G. rudis* found in the Rockies and westward on lupine. The elytral punctation is denser and the punctures are contiguous. In *rudis* the punctures as a rule are finer and quite distinctly separated. The tip of the aedeagus is a little less pointed than in *rudis*. It is difficult to separate the two species except by their range and food plant.

Galeruca popenoei, new species

(Fig. 5)

6.5 to 10 mm. long, broadly ovate, deep brown to piceous with pale elytral margin, not very shining, elytral costae not much elevated and few traces of intercostal ridges, punctation rather coarse and contiguous.

Head densely and coarsely punctate with a short pubescence more conspicuous in lower part; a median line from occiput down front dividing the prominent frontal tubercles. Antennae not extending much below humeri, third joint longer than fourth, four apical joints more pubescent than basal ones. Prothorax more than twice as wide as long, narrowed anteriorly, sides usually somewhat angulate with an explanate margin turned up at the edges; disc very uneven with median and lateral depressions, surface coarsely and densely punctate, the punctures for the most part contiguous, and with very short inconspicuous pale pubescence. Elytra broad, not so convex as in *G. browni*, and not so shiny; costae broad and distinct but not very elevated and the usual ridges between not marked, usually absent; punctation coarse, rather shallow and contiguous. Body beneath piceous black, shiny, with a fine pale pubescence. Middle tibiae with a tiny spur at apex. Length 6.5–10 mm.; width 3.7–6.2 mm.

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[4] Criddle, 1913, 43rd Ann. Rept. Ent. Soc. Ont. (1912), p. 99.

[5] Dunstan, 1932, Can. Dept. Agr. Ent. B. 32:48.

[6] Gibson, 1934, Can. Dept. Agr. Ent. B. (n. s.) 99: 34.

Type male and 4 paratypes (females), U. S. National Museum (Cat. No. 57194.)

Type locality.—Van Horn Mts., Texas, collected in September 1922 by C. H. Popenoe.

Distribution. NEW MEXICO: Cloudcroft, Sacramento Mts., 8,000 ft. (Wheeler, Wickham); Glorieta (Fall collection); top of range between Sapello and Pecos Rivers, elevation 11,000 ft. (T. D. A. and W. P. Cockerell); "N. M." (F. A. Eddy collection, M. C. Z.).

Remarks.—In a study of the comparatively few specimens examined, this species appears quite distinct from the Rocky Mountain *G. rudis*, which also occurs at high altitudes. It is usually rather dull and deep brown. The punctation is very dense, even contiguous, and coarser than in *rudis*. The elytra appear less convex and therefore broader. So far it has been collected only in the mountains of New Mexico and the northwestern tip of Texas, and it may very well extend down into Mexico.

Galeruca costatissima, new species

(Fig. 6)

9–12 mm. long, broadly ovate, moderately shiny, deep brown to piceous with pale elytral margin, coarsely and deeply punctate, elytra with four main costae well developed and usually with intermediate ridges or costae running parallel to the main ones.

Head densely and coarsely and often confluently punctate, with a median line from the occiput down the front, dividing the prominent frontal tubercles; inconspicuously pubescent. Antennae extending below the humeri, stout, third joint nearly as long as first, and longer than fourth, the remainder shorter than fourth, the four or five distal densely pubescent. Prothorax a little over twice as wide as long, sides usually angulate, often constricted at or below the middle, surface uneven with median and lateral depressions, densely, often confluently punctate, sometimes with a little very inconspicuous pubescence. Elytra broad, each with four strong costae and usually between these main costae well developed but not so wide ridges running parallel to the main ones, making seven or eight costae on each elytron; punctation rather coarse and tending to be confluent. Body beneath shining piceous, lightly pubescent. Middle tibiae with tiny spur. Length 9–12 mm.; width 5–7 mm.

Type male and 7 paratypes U. S. National Museum (Cat. No. 57195.)

Type locality.—Williams, Arizona, collected by Barber and Schwarz May 25 (1901).

Distribution: ARIZONA: Dewey (V. W. Owen). NEW MEXICO: near Hot Springs, Las Vegas, 7,000 ft. (F. H. Snow); San Juan Valley, Taos Co., 4,500 ft. UTAH: Farmington (E. W. Anthon); Logan (F. C. Harmston, R. J. Costley); Ogden (D. R. Maddock); Salt Lake City (G. F. Knowlton, Schwarz, Wickham);

St. George (A. Call); Vernon (H. F. Thornley). COLORADO: Ackmen; Cortez, vicinity of Durango, La Plata Co.

Remarks.—*G. costatissima* and *G. externa* are the largest North American species of the genus. Like *externa*, *G. costatissima* is readily distinguishable by its elytral sculpture which in its case consists of 7 or 8 more or less well-marked costae on each elytron. Other species frequently have small intermediate ridges but in no species are they as well developed and sharply elevated and constant as in this one.

TWO NEW TROMBICULID MITE LARVAE (CHIGGERS) FROM BURMA

By H. E. EWING

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

Recently a rather large collection of trombiculid mite larvae (chiggers), taken in Burma, were received for identification. They were collected by H. S. Fuller, who is now a member of the United States of America Typhus Commission. Among these larvae two new species of *Trombicula*, *s. s.*, were found which are here described. Most of the type material has been deposited with the U. S. National Museum, but some of it has been returned to the collector.

Trombicula burmensis, new species

Larva.—Fang of chelicera very sharp-pointed; upper margin almost straight, lower strongly outcurved. Palpus rounded along outer margin; palpal claw moderately curved, lower prong almost straight, reaching to tip of main prong, upper prong small, slightly curved, about one-half as long as lower and extending apically to about middle of latter. First palpal seta semiplumose, second with several short, lateral branches. Dorsal plate about twice as broad as long, slightly incurved along anterior margin and outcurved along posterior margin; median seta situated back from the front margin of dorsal plate, when depressed extending slightly beyond posterior margin of plate; anterolateral seta similar to median and of about same length; posterolateral seta situated considerably in front of posterolateral angle, longer than anterolateral; pseudostigmata situated on a line connecting the posterolaterals; pseudostigmatic organ flagelliform, sparsely barbed for entire length and when depressed extending over one-half its length beyond posterior margin of dorsal plate. Eyes well-developed; anterior and posterior corneas subequal. Abdomen rather short; dorsal setae subplumose, in slightly engorged larvae 32 are situated above lateral line and arranged as follows: 2–8–6–8–6–2 or 2–8–6–4–4–6–2. Legs rather short; paired claws equal.

Length of larva when well engorged, 0.83 mm.; width, 0.44 mm.

Type host.—"Rats."
Type locality.—Ting Kawk, Burma.
Type slides.—U. S. N. M. Cat. No. 1484.

Description based on the following material collected by H. S. Fuller in Burma, 1944: Ting Kawk, 4 specimens, June 14, 4 specimens, June 18, 1 specimen, June 29; Shaduzup, 1 specimen, July 14. This species is near *deliensis* Walch, but differs from *deliensis* in that the posterolateral setae are situated in front of the posterolateral angles, and the first and second palpal setae are not simple but branched.

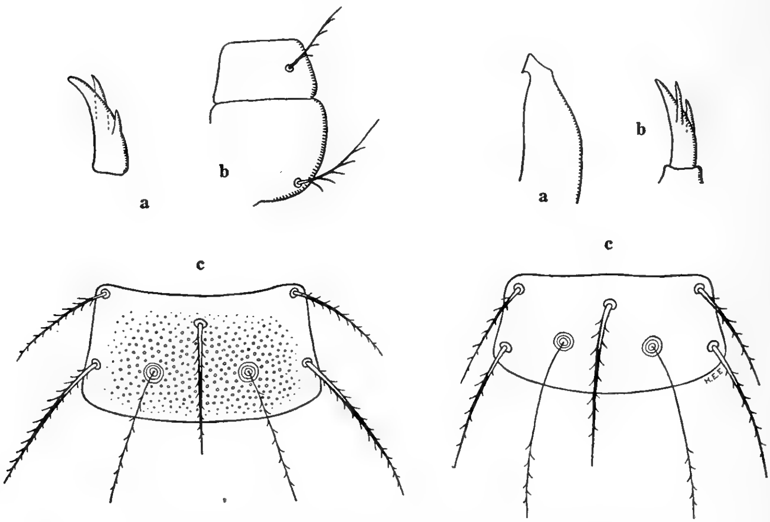


Fig. 1. To left: Detail drawings of *Trombicula burmensis*, new species: *a*, palpal claw, from above; *b*, palpal femur and patella, from above; *c*, dorsal plate. To right: Detail drawings of *T. fulleri*, new species; *a*, fang of chelicera, side view; *b*, palpal claw; *c*. dorsal plate. All greatly but not equally enlarged.

Trombicula fulleri, new species

Larva.—Chelicera with tip of fang obliquely truncate; lower tooth poorly developed; upper tooth absent, but margin of truncate end forming a functional tooth by the angle it makes with upper margin of fang. Palpus somewhat angulate laterally on the margin of femur; first, second, and third palpal setae simple; palpal claw moderately curved, accessory prongs almost equal, both projecting beyond outer margin of claw proper. Eyes absent. Dorsal plate more than twice as broad as long, incurved in front on each side of median line and broadly outcurved behind; median seta almost straight, situated somewhat behind anterior margin of dorsal plate and when depressed extending beyond posterior margin by over one-third its length; anterolateral seta similar to median but only about two-thirds as long; posterolateral seta similar to anterolateral but slightly longer; pseudostigmata situated almost between posterolateral setae; pseudostigmatic organ flagelliform, slightly longer than median seta and with a few short branches on distal one-third. Abdomen short and broad; dorsal seta as follows in engorged specimens: 2–8–6–6–4–2, counting a pair of posterolaterals and posteromarginals. Legs rather short; paired tarsal claws equal.

Length of larva when engorged, 0.52 mm.; width, 0.42 mm.

Type host.—"Shrews."
Type locality.—Shaduzup, Burma.
Type slides.—U. S. N. M. Cat. No. 1485.

Description based on four specimens taken from type hosts at type locality, July 7, 1944, by H. S. Fuller, for whom the species is named. This trombiculid is nearest *walchi* Womersley and Heaslip, but has no eyes, and the median seta is situated considerably behind the anterior margin of the dorsal plate and when depressed backward it extends for more than one-third its length beyond the posterior margin of the dorsal plate.

A NEW SPECIES OF AEDES FROM SAIPAN AND THE LARVA OF AEDES PANDANI (Diptera: Culicidae)

By Alan Stone

Bureau of Entomology and Plant Quarantine, United States Department of Agriculture

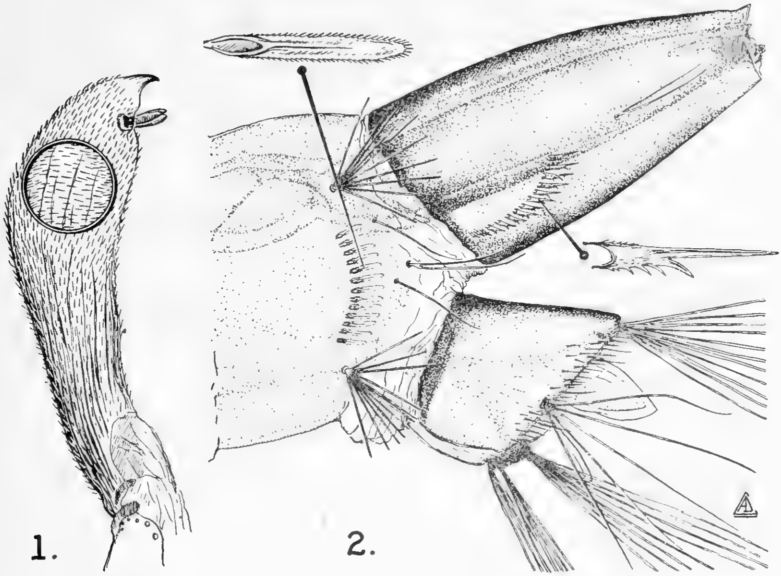
As the result of recent collecting by Army and Navy entomologists on the island of Saipan, Marianas Islands, a series of specimens has been received of what appears to be an undescribed species of mosquito. This was tentatively determined in the field as *Aedes pandani* Stone, a species known only from Guam, but the coloration of both sexes and the structure of the male genitalia show the two species to be quite distinct although related. I am indebted to Lt. (jg) Joseph Greenberg, USNR, and to Capt. David G. Hall, AUS, for these specimens.

Before the male of the new species was discovered, it was thought possible that the material from Saipan was no more than a race of *Aedes pandani* from Guam. The need for larvae of the latter species was expressed, and the National Naval Medical School requested these from the Naval Epidemiological Unit on Guam. I am indebted to these organizations, and particularly to the collector, Lt. (jg) Engel L. R. Gilbert, for so promptly supplying the desired specimens, which confirm the close relationship but specific distinctness of the two species.

Aedes (Stegomyia) saipanensis, new species

Female.—Length 3.6 mm., wing 2.5 mm. Scales of vertex flat, creamy white medially, flanked on each side by a dark-brown patch of about the same width, and a broad lateral patch of creamy-white scales usually broken by a narrow line of dark ones; a narrow line of pale scales and overhanging yellow setae between the eyes, and flat yellowish scales on the yellow tori; clypeus dark brown; palpus about one-fourth length of proboscis, nearly black, with a small apicodorsal white area; proboscis dark brown, the labella and a narrow midventral line slightly paler. Anterior pronotum with long yellow setae above and flattened yellowish-white scales below; posterior pronotum with a patch of flat white scales; scales of mesoscutum narrow, deep reddish brown except for a pattern of yellow scales as follows: A narrow median line slightly narrowed to the prescutellar bare area and divided to border this area to the scutellum; a pair of narrow sublateral stripes from level of anterior spiracle to the scutellum; a marginal band on each side from front of scutum to above wing base; the sublateral stripe, which borders the supra-alar area, does not join the marginal stripe anteriorly; scales of scutellum broad, those on median lobe pale yellow, on lateral lobes dark brown; paratergites with broad yellow scales; pleuron with flat white scales on propleuron, a patch on upper portion of sternopleuron widening posteriorly and bordering hind margin below, and a patch on mesepimeron above and medially; postspiracular setae few; no lower mesepimeral setae. Wing scales all dark; halter pale yellow with only a few dark scales dorsally near base of knob, the rest of scales yellow. Coxae yellow with patches of broad white scales; fore femur anteriorly mainly dark-scaled with a narrow row of pale scales not reaching apex and a very small apical yellow spot; posteriorly all but ventral margin with pale-yellow scales; fore tibia dark brown with scattered pale scales posteriorly; fore tarsus dark, the first segment with a small patch and the second with several white scales dorsally; mid femur dark anteriorly except for a very small yellow spot at apex, mostly pale posteriorly; mid tibia dark except for a pale posterior stripe; mid tarsus dark except for complete, narrow white bands on first two segments; hind femur pale except for a narrow dorsal stripe widening apically; apex narrowly yellow; hind tibia almost entirely dark; first hind tarsal segment with a white band about one-fourth length of segment, broken by a dark stripe on inner surface; second and third segments with complete white rings about one-fourth and one-third of the segments, respectively; usually a few white scales or narrow bands at bases of segments 4 and 5. Abdomen dark brown with complete basal bands of whitish scales on tergites 2–7; these bands widen laterally except on tergite 7, where the band is widest medially; sternites white, with a broad apical dark band on sternite 6 and traces of dark bands on the more anterior sternites.

Male.—Color essentially as in female, but tori somewhat darker. Palpus nearly as long as proboscis, with white bands, sometimes incomplete, at bases of segments 3–5. Dorsal abdominal pale bands often broken medially. Genitalia: Rather similar to those in *pandani* but the dististyle (fig. 1) broader subapically and more densely covered with fine pile, which points medially on the dorsal surface, distally on the ventral surface, and the subapical spine stouter and double; the basal lobe forms a concave shelf, broad dorsally, narrowed ven-



Aedes (*Stegomyia*) *saipanensis*, n. sp. Fig. 1.—Diststyle, ventral view (portion in circle shows direction of setae on dorsal surface). Fig. 2.—Larva, eighth and ninth segments; comb scale and pecten tooth, enlarged. (Drawn by Arthur D. Cushman.)

trally, densely clothed with hairs which are longer and straighter on dorsal portion, shorter and with an inward bend on ventral portion; ninth tergite concave medially, with a few hairs on the broad lateral lobes.

Holotype female and 19 paratypes, U. S. National Museum No. 57197 and British Museum.

Type locality.—Saipan, Marianas Islands.

Collection data.—Holotype and 6 female paratypes, June–July 1944 (Joseph Greenberg); 6 male paratypes, October 1, 1944 (Joseph Greenberg); 3 female, 4 male paratypes, Hashigaro and Laulau, Saipan, August 22 to September 6, 1944 (David G. Hall).

The color characters which most readily separate this species from the closely related *pandani* are the narrow line of paler scales on the under surface of the proboscis, the abundant pale scales on the knob of the halter (these are all dark in *pandani*), the somewhat darker integument most noticeable on the pleuron and the postnotum, and the complete abdominal bands of the female.

The larva of this species was also collected by Lt. (jg) Joseph Greenberg in considerable numbers and is herein described.

Larva (fig. 2).—Length 5.25 to 6.25 mm. Head slightly broader than long; antenna about 6 times as long as greatest width, scarcely tapering, its length about one-fourth width of head; no spicules; a single antennal hair at about five-eighths distance from base; clypeal spines single, slender, pale, curved downward; anteantennal hair (A) double; lower head hair (B) single or double, placed close to front of clypeus; upper head hair (C) long, single, placed well anterior to hair A; postclypeal hair (d) a small tuft of about 8 hairs slightly anterior to and mesad of hair B; sutural hair (e) and transutural hair (f) both very fine, single. Thorax: Prothoracic submedian hairs 3, the inner posterior one a tuft of about 5 long, slender hairs, the outer anterior one a tuft of about 10 straight, rather short, stouter setae, and the third, between these tufts, a single long, slender hair; 3 more pairs of dorsal stellate tufts and 4 ventral pairs on thorax; a very short basal spine on metathoracic pleural hair tuft. Abdomen: Segments 1–7 each with an anterior submedian, a posterior submedian, and a posterior sublateral pair of stellate hairs dorsally, and a posterior submedian pair of stellate hairs ventrally; lateral tuft of first segment with 5–6 hairs, of second with 4–5 hairs, and of the remaining segments with 2–3 hairs; comb of 16–18 long, finely fringed scales, closely set in a curved row; eighth segment with 2 siphonal tufts, 1 stellate, 1 a single hair, 2 subsiphonal hairs, 1 double, 1 single, and 1 stellate anal hair; siphon very sparsely pilose, the index about 2.0; no acus; pecten of about 15 teeth set in a row which curves dorsoapically and reaches only about two-thirds length of siphon, each tooth with several lateral teeth subbasally on the ventral side; siphonal hair double, somewhat beyond middle; anal ring rather widely separated ventrally, the hind margin strongly curved so that the dorsal length of the saddle is decidedly greater than its ventral length; saddle very sparsely spicular pilose except near the hind margin, where the pile is longer and merges into the irregular fringe of longer hairs; saddle hair tuft of 4–6 rather short, stout hairs; gills stout, pointed apically, the dorsal pair slightly longer than the ventral pair and both usually shorter than dorsal length of saddle.

The larvae were found in water held in holes in breadfruit and banyan trees, and less frequently in the axils of *Pandanus* leaves.

Aedes (Stegomyia) pandani Stone

Aedes (*Stegomyia*) *pandani* Stone, 1939, Ent. Soc. Wash., Proc. 41: 162.

Larva.—Length 6 to 7 mm. Head slightly broader than long; antenna about 4.5 times as long as greatest width, scarcely tapering, its length about one-fourth width of head; no spicules; a single antennal hair about at middle; clypeal spine pale, stout at base and split into 2–4 downward curving filaments; anteantennal hair (A) double; lower head hair (B) single or double, placed close to front of clypeus; upper head hair (C) long, simple, placed about on level with hair A; postclypeal hair (d) a small tuft of about 8 hairs slightly anterior and mesad of hair B; sutural hair (e) double, transutural hair (f) single, both very fine. Thorax: Prothoracic submedian hairs, 3 a long single one between 2 multiple ones, the hairs of posterior tuft decidedly longer than those of anterior tuft; stellate tufts arranged, both on thorax and abdomen as in *saipanensis*, but the elements all longer, thinner and paler, and with sparse lateral fraying and an acute apex;

abdominal lateral tufts of 5–6 hairs on first 2 segments, of 2–3 hairs on remainder; comb of about 15–19 long, slender, acutely pointed teeth that are very finely fringed laterally, closely set in a curved row; eighth segment finely spicular-pilose; 2 siphonal hairs, 1 stellate, 1 single, 2 subsiphonal hairs, 1 triple, 1 single, and 1 stellate anal hair. Siphon finely but rather densely pilose, the index about 2.5, its greatest width near middle; no acus; pecten of 22–28 teeth starting a short distance from base and curving abruptly dorsally near middle of pecten, so that the apical half runs nearly at right angles before the middle of the siphon; each pecten tooth almost exactly like a tooth of the comb, although slightly smaller; basal teeth smaller than the long ones of the outer two-thirds; siphonal tuft of 4 hairs, a little beyond middle of siphon, the apex of the nearest pecten tooth almost reaching it; anal ring complete, longest dorsally, the surface rather densely spicular-pilose and this pile gradually lengthening towards hind margin; saddle hair tuft of 8–9 hairs; gills slender, the dorsal pair distinctly longer than dorsal length of anal ring, the ventral pair about equal to this length.

These larvae were collected in the axils of *Pandanus*. Adults from the same source were reared, although they were not submitted. The most obvious differences between the larva of *pandani* and that of *saipanensis* are found in the clypeal spines, the character of the stellate hairs, and the shape of the pecten teeth.

MINUTES OF THE 551st REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JANUARY 4, 1945

The 551st regular meeting of the Society was held at 8 P. M., Thursday, January 4, 1944, in Room 43 of the National Museum. President Poos presided and there were 35 members and 14 visitors present. The minutes of the previous meeting were approved as read.

The following committees were appointed by President Poos:

Program: Henry K. Townes, Chairman, F. L. Campbell, Randall Latta.
Membership: C. M. Packard, Chairman, Floyd Andre, H. W. Capps, L. S. Henderson.

Mr. Loftin announced that the Auditing Committee had checked the report of the Treasurer and found it correct. He spoke of the clear, excellent, manner in which Mr. Haeussler's records had been kept and moved that the Society extend a vote of thanks to him. The motion was seconded by Dr. Annand, put to a vote, and carried unanimously.

The following new members were elected:

Howard Baker, U. S. Bureau of Entomology and Plant Quarantine, Washington, D. C.
H. B. Derr, Fairfax, Virginia.
Dr. C. P. Haskins, Haskins Laboratories, 305 E. 43d St., N. Y.
J. Anthony Morris, U. S. Bureau of Entomology and Plant Quarantine, Beltsville, Md.

The Society next listened to reports on the December meetings in New York. Mr. Van Dine, the New President of the American Association of Economic Entomologists, stated that the papers and discussions centered around the new insecticide, DDT. A special committee was appointed by Dr. Essig to prepare a statement on the procedure necessary to obtain supplies for experimental work. DDT will be increasingly available for tests on an extended scale. Mr. Van Dine then gave the highlights of Dr. Essig's speech as Retiring President of the American Association of Economic Entomologists. Dr. Essig dealt with Entomology as a science essential to the winning of the war and also with the problems ahead. In the latter section, the training of Entomologists was stressed. Mr. Van Dine mentioned an interesting paper by L. A. Stearns of Delaware on the Control of Malaria on the Supply Route through Iran to the Russian Front. It was voted to hold an annual meeting in 1945, the Executive Committee to determine the dates, time, and place. The next speaker, Dr. F. C. Bishopp, also spoke of the tremendous interest shown by both the entomologists and the public in the part of the program dealing with DDT. On the first day 18 out of 19 papers dealt with this insecticide; on the following day a round table discussion, under the competent leadership of Mr. Rohwer, dealt with the different aspects relative to present-day entomological problems. The field was well covered, but time for discussion was lacking. Following the sessions, the DDT Committee appointed by Dr. Essig held a special session which, after a lengthy discussion, prepared a one-page report in popular style for the use of the press. This report was accepted without criticism. It is expected that the Committee will be continued and charged to prepare a more detailed and scientific report.

Mr. W. E. Hoffmann, of the Division of Insects, U. S. National Museum, was asked to discuss the meetings of the Entomological Society of America. He said that, since he had attended the meetings primarily to make contacts, he had not been present at the reading of all the papers. Consequently his report would have to be limited to those he had heard and he would confine his brief remarks largely to papers that had been accompanied by movies.

Dr. N. A. Weber of the University of North Dakota had some very interesting pictures and notes on "Tropical coccid-tending ants"; Capt. R. L. Usinger of the U. S. Public Health Service ably discussed "Post-war training in Medical Entomology" which paper was followed by a technical training film entitled "Malaria Control." This excellent film (about 25 minutes) is one of a series prepared by the U. S. Public Health Service and may be obtained on loan by responsible institutions. Reference was made to literature along the same line which may be obtained free from the Service.

"Burying beetles (Silphini), a movie of their behavior and life history" by Dr. and Mrs. L. J. Milne, of the University of Pennsylvania was a very intriguing film showing various events in the life and love affairs, so to speak, of these beetles. The pictures, taken in Canada, revealed much detailed information, several of which disproved some of the commonly held beliefs concerning this group. The beetles were very active in cloudy weather and frequently resumed their labors so rapidly after a rain that it was difficult to get the motion picture machine in action quickly enough to avoid missing important details. The legends for the "shots" were well chosen and the film altogether entertaining and informative.

The annual public lecture, entitled "Tarantulae and Tarantula Killers", given by Dr. A. Petrunkevitch of Yale University, was also built up around a film of the arthropods concerned. Considerable ingenuity had entered into getting pictures of these forms in action, and night work was necessary since some of the activities took place around midnight. The author had a vast amount of detailed information and obviously was saturated with his subject matter.

The symposium on "How can the 'American Commission on Scientific Nomenclature in Entomology' best serve and stimulate taxonomy in this country" was, unfortunately, not given.

The meetings were well attended and the interest was keen. (Speaker's Abstract.)

Mr. Jones reported on the session held by the Extension Entomologists, which was attended by from 35 to 40 representatives primarily from the north-east section of the Country. The topics discussed were: 1) annual plans of work and annual reports required by law, 2) the assistance which can be given to people who sell insecticides, and through them to the public which buys the products; 3) various surveys now being made to permit forecasting of insect outbreaks, 4) the need for adequate courses in Extension Entomology. Cornell has requested funds to be available for employing students for summer field work which will apply toward credit in extension entomology. This should help to satisfy the requests of employers for experienced people.

Mr. Rohwer commented that the 1945 meetings had three features which distinguished them from those of previous sessions. One of these was the failure to follow the prepared program. Some papers and notes by speakers on the round-table discussion were not presented and one whole session of the published program for the Entomological Society of America was canceled and replaced by other subjects. Another feature was the absence of the average number of Federal entomologists. They were in the minority. The third was the great emphasis placed on a single insecticidal chemical. He stated that interest in DDT was evidenced by the size of the group in attendance and character of the attention they gave to the papers, notes, and discussion at these meetings. He called attention to selection of the new President to the Entomological Society of America who is the well-known Philadelphia orthopterist, James Rehn. He mentioned that special greetings from the American Association of Economic Entomologists were sent to Dr. L. O. Howard and that in addition these were emphasized by the personal visit by the President, Professor E. O. Essig, and Professor Harry Smith. Mr. Rohwer stated that following the meetings he had also visited Dr. Howard, whom he found in good health and who desired that his warm greetings be given to the Entomological Society of Washington. Mr. Rohwer referred to Mr. E. R. Root and B. J. Pratt as being among those who attended the meetings. (Speaker's Abstract.)

The first paper on the regular program was given by Capt. F. S. Blanton: Louse-Borne Diseases.

In many of our past wars lice, through transmission of louse-borne diseases, such as Typhus Fever, Relapsing Fever and Trench Fever, have cost more lives than all battle casualties.

Those two sound movies shown demonstrated delousing of the individual soldier by means of insect powder, also unit disinfestation by both steam and methyl bromide fumigation.

The speaker stated that in contrast to the past world war, where numerous casualties occurred among our troops, not one casualty has occurred from louse-borne diseases up to this time in this war. (Author's Abstract.)

Mr. E. J. Hambleton gave the second paper: Notes on Insect Problems of Latin America.

The work of the Office of Foreign Agricultural Relations of the U. S. Department of Agriculture in Latin America was briefly reviewed. Cooperative work on the propagation of rubber, cinchona, derris, barbasco, pyrethrum and fibre crops constitutes an important part of the program being developed by this Office in Central and part of the countries in South America.

Although present-day insect problems in Latin America may not be as numerous and as varied as those of the more temperate regions, the factors contributing to the relative abundance and importance of any one destructive species are of especial interest. Many of the agricultural practices developed over a long period of years are still in use. This is particularly true in the more populated areas where farm lands are divided into small holdings. The kind of agriculture conducted under these conditions often seems to be effective in maintaining certain destructive insect species in check. With the introduction of more modern farm methods and the tendency towards mechanization, we have already witnessed striking examples of insect outbreaks under tropical conditions where heretofore nothing of the kind was ever experienced. Mention was made of the bollworm, *Heliothis virescens* on cotton in the Canete Valley of Peru and the spittlebug, *Tomaspis postica* on lemon and citronella grass in Guatemala. The *Atta* leaf-cutting ants, if not held in check after new forest areas are cleared may constitute a more important problem than they are today. Livestock, particularly cattle, in some countries suffer serious injury from the warblefly, *Dermatobia hominis*. Other insects common in the tropics were mentioned.

The use of insecticides is more or less restricted to cotton and citrus and for controlling leaf-cutting ants and locusts. Considerable interest in rotenone production and its possible use for tick and warble fly control is now evident. Preliminary experiments with DDT on leaf-cutting ants indicated that it had no more than a repellant effect when applied as a dust in the underground runways or broadcast on the soil above the nests. No satisfactory method has been devised whereby insecticidal dusts can be forced to all parts of an *Atta* colony. (Author's Abstract.)

President Poos reminded the members that 1945 dues are now payable.

The Society adjourned at 10:20 P. M.

INA. HAWES,
Recording Secretary.

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THE ANATOMY OF THE INTERNAL GENITALIA OF SOME COLEOPTERA

By JOSEPH L. WILLIAMS
Lincoln University, Pennsylvania

INTRODUCTION

The internal genitalia compose that part of the reproductive system which is concerned with the generation, nutrition, protection and fertilization of germ cells in reproduction. The morphology, for the most part, is constant for a given species or varies according to the species. Female organs composing the internal genitalia are the ovaries, lateral and medial oviducts, spermatheca, bursa copulatrix, accessory and colleterial glands and the vagina. The organs of the male composing this system are the testes, seminal vesicles, accessory glands, vasa deferentia and the ejaculatory duct.

Studies on the internal genitalia of insects are by no means new. This phase of insect morphology probably began, in earnest, with the work of Swammerdam in 1737. Malpighi (1669), Hunter (1792), and Herold (1815), all of which are referred to in the classical work of Bordas (1900), likewise made studies on the internal genitalia. Detailed studies on the internal genitalia of Coleoptera probably began with the work of Dufour (1825). Escherich (1894) made a detailed study of three species of Coleoptera representing three families. The most extensive study on the internal genitalia of Coleoptera is that of Bordas.

The studies of Sharp and Muir (1912) and Wilson (1926–27) concern only the ejaculatory duct and external genital structures related with it. These structures combined are referred to as the male genital tube. The work of Tanner (1927) is concerned only with those structures, mainly external, of females which can resist the action of hot caustic potash. The internal structures presented in this study are possible only because the specimens were dissected while fresh. This method eliminates the need for alkali and therefore preserves those structures which would otherwise be destroyed by the method Tanner used. Dissection of fresh material also makes it possible to study such structures as the ovaries, testes, various glands and ducts which deteriorate with age. Perhaps Sharp and Muir and Wilson were faced with the problems of age which limited their studies to the genital tube. The method pursued in this study is, without question, the most satisfactory for studying the internal genitalia in their entirety. However, it offers many difficulties which make it objectionable. The foremost among these is that one is limited to the investigation of species within his radius.

However, in spite of these difficulties some work of this nature has been done in this country. The studies of Hopkins (1909–11), Schedl (1931), Kaston (1936), Bissell (1937) and Tissot (1938), although concerned with a general discussion of certain beetles belonging to Rhynchophora, include detailed discussions on the internal genitalia. The fact that these workers include elaborate discussions on the internal genitalia of the species they studied is an indication of the importance of this system as an aid in classification. In view of the limitations in this direction, the author feels justified in releasing this work, though incomplete, as a contribution to a vast and still largely untouched field.

The illustrations have not all been drawn to scale because of sizes ranging from that of the very small potato flea beetle (*Epitrix* sp. ?) to the comparatively huge *Dynastes tityus* (L.) As this study is concerned primarily with the internal genitalia, the external genitalia are either not illustrated at all, or at most are represented by profile drawings. The arrangement of species is that of Leng (1920) "Catalogue of the Coleoptera of America, North of Mexico."

The author is indebted to Mr. C. A. Thomas of Kennett Square, Pennsylvania for identifications and to Dr. L. L. Buchanan of the United States National Museum for criticisms and helpful suggestions.

MATERIALS AND METHODS

The material consisted of freshly killed specimens, which were dissected according to the method described by Williams (1943). All of the males treated are placed together in the first part of this paper, and all of the females in the second part.

THE ANATOMY OF THE MALE INTERNAL GENITALIA

The following are common to all males unless otherwise indicated: Two testes (Fig. 14, C) attached to the vasa deferentia (Fig. 14, F) by means of small ducts (Vasa efferentia, Fig. 14, D). Each vas deferens expands just below the testis to form the seminal vesicle (Fig. 14, E). The vasa deferentia join the ejaculatory duct at the junction with two pairs of accessory glands (Fig. 14, A and B). The ejaculatory duct extends posteriorly to join the aedeagus (Fig. 14, H).

Carabidae: *Scarites subterraneus* (Fab.)

Dufour, Escherich and Bordas described three different species which belong to the genus *Carabus* and the characteristics, in general, are similar to those of this species. The testes are tubular with their basal portions loosely coiled. The extreme anterior portions are slightly greater in diameter than the coiled portions of the testes. Each vas deferens coils posteriorly to form what might be termed an epididymus. This is the coiled part of the vas deferens, below the testis, before it enters the seminal vesicle. The epididymus is not present in all beetles. The vas deferens extends below the epididymus to the ejaculatory duct. Only one pair of accessory glands is present. There is a pair of glands connected to reservoirs by means of slender ducts. The reservoirs are connected to the tissue surrounding the aedeagus by means of other slender ducts. No suggestion as to the function of these glands, except perhaps scent, can be given. Not one of the workers cited described these glands in connection with the species of this family which they investigated. (Fig. 1.)

Cantharidae: *Chauliognathus marginatus* (Fab.)

The testes are fused and are enclosed in a single testicular sac. The vas deferens expands slightly at the point where it joins the epididymus. This expansion is probably the seminal vesicle. The medial accessory glands are coiled into structures resembling a watch spring, and when uncoiled each is about 40 mm. long. The lateral accessory glands are comparatively short being about 2 mm. long. The diameter of the latter glands is about twice that of the former. The ejaculatory duct is of the same diameter throughout its length. (Fig. 2.)

Elateridae: *Conoderus lividus* (DeG.)

The testes are small and circular and each is about .5 mm. in diameter. Each vas deferens is about 7 mm. long. The seminal vesicles are about the same diameter as the testes and are situated on the vasa deferentia near their junction with the ejaculatory duct. The ejaculatory duct is about 2 mm. long and its diameter is the same throughout its length. There are three pairs of accessory glands. The lateral accessory glands appear to branch into two pairs. Each division of the long lateral glands is about 1.4 cm. in length and each division of the short laterals is about 2 mm. The medial accessory glands are about 1.75 mm. long. About 1 mm. of the distal ends of the latter glands are coiled The lateral glands are semi-transparent and membraneous, but the medial glands are opaque and thick. (Fig. 3.)

Melanotus communis (Gyll.)

Each testis is composed of many compact short tubes and is about 5 mm. in diameter. The vas deferens is very narrow and is approximately 20 mm. long. No obvious seminal vesicles are present. The vasa deferentia, however, expand slightly near their junction with the ejaculatory duct. These expanded areas might be the seminal vesicles. There are three pairs of accessory glands and they are comparatively broad, being about .4 mm. in diameter. The ejaculatory duct is about 1.2 mm. long. (Fig. 5.)

Ostomidae: *Tenebroides* sp.

The testes are circular and consist of small tubes. The vas deferens is about 3 mm. long and its distal portion is coiled to form the epididymus. The epididymus and testis form a single body as is illustrated on the left in the figure. The vas deferens appears to expand slightly at its proximal end to form the seminal vesicle. There is only one pair of accessory glands each division of which is flask-shaped. The proximal end of the ejaculatory duct bifurcates. The single part of the ejaculatory duct is about 1 mm. long. Its distal end is narrower than the proximal end. (Fig. 6.)

Coccinellidae: *Epilachna varivestis* Muls.

The testes are somewhat circular, about 1.5 mm. in diameter, and each is composed of many small tubes. The seminal vesicle is a slight expansion on the vas deferens below the testis. There are three pairs of accessory glands. Each branch of the medial pair is about 7 mm. long. The long lateral glands are about the same length as the medials and the short laterals about half as long. The diameter of the long laterals is greater than that of the others. The ejaculatory duct is about 3 mm. long. Its diameter is nearly the same throughout its length. The aedeagus is surrounded by a number of muscle bundles. (Fig. 4.)

Tenebrionidae: *Meracantha contracta* (Beauv.)

The testes are somewhat circular and each is enclosed in a testicular sac. A portion of the vas deferens expands into the flask-shaped seminal vesicle. There are two pairs of accessory glands. The branches of the short medial pair are about 1 mm. long. The length of the broader lateral pair is about the same as that of the medials. The ejaculatory duct is comparatively long measuring about 5 mm. A number of powerful muscles surround the aedeagus. (Fig. 8.)

Scarabaeidae: *Pinotus carolinus* (L.)

Misfortune was encountered with the four specimens dissected. No permanent slide, therefore, was made of this species. However, each testis appeared to consist of four disc-shaped bodies. Each disc was connected to the vas deferens by means of a small tube. These tubes collectively form the vasa efferentia. The ejaculatory duct expands into two cavities. These probably serve in moulding spermatophores. Further details were not observed.

Bolbocerosoma farctum (Fab.)

Each testis consists of six oval divisions and each division is 1 mm. long and .5 mm. across its greatest diameter. These six divisions are joined to the vas deferens by the vasa efferentia. The vas deferens expands near its junction with the ejaculatory duct to form the seminal vesicle. Each vas deferens is about 12 mm. long. There is only one pair of accessory glands and each branch is about 26 mm. long. The accessory glands are of a greater diameter near their junction with the ejaculatory duct. The ejaculatory duct is comparatively short, being only 1 mm. in length. (Fig. 7.)

Phyllophaga sp.

Each testis consists of six disc-like divisions, which are connected to the vas deferens by means of the vasa efferentia. Each vas deferens is about 17 mm. long and a portion of it expands into the seminal vesicle. The accessory glands expand into vesicles a few mm. above their junction with the ejaculatory duct. Each division of the accessory glands is about three times the length of the vas deferens. The ejaculatory duct is comparatively short, being only 2 mm. long. The reproductive organs are, in general, similar to those of *Bolbocerosoma farctum.* The external genitalia of this species are quite different from those of *B. farctum.* (Fig. 9.)

Popillia japonica Newn.

The internal genitalia are similar to those of *Bolbocerosoma farctum* and *Phyllophaga* sp. One obvious difference is in the aedeagus, although belonging to the external genitalia, this structure differs in these three species. The vesicles of the accessory glands are situated near the junction of these glands and the ejaculatory duct, much as in *B. farctum.* Each division of the accessory glands is about four times longer than the vas deferens. This characteristic is nearer to that of *Phyllophaga* sp. The testicular divisions are disc-shaped similar to that of *Phyllophaga* sp. The ejaculatory duct is short as in the other species, being .5 mm. long. (Fig. 10.)

Cotinis nitida (L.)

Each testis is composed of twelve disc-shaped bodies and these are connected to the vas deferens by means of the vasa efferentia. In this testicular character *C. nitida* differs from the other species treated. The vasa efferentia are comparatively longer and larger than those of the other species. The vas deferens expands slightly near its junction with the ejaculatory duct. This expansion is the seminal vesicle. There are three pairs of accessory glands. In this character *C. nitida* differs from the other species treated of this family. There are two pairs of short lateral glands. The branches of one pair of these are longer than those of the other lateral glands and the distal end of each branch is coiled. The medial accessory glands are comparatively longer than either of the lateral glands. The ejaculatory duct, as in the other species treated, is comparatively short being only 2 mm. long. (Fig. 12.)

Lucanidae: *Pseudolucanus capreolus* (L.)

The testes, as in *Cotinis nitida*, consist of twelve disc-shaped bodies and are connected to the vasa deferentia by means of the vasa efferentia. The vas deferens forms an epididymus below the testis. This character differs from the condition in the Scarabaeidae. The seminal vesicle is situated just below the epididymus. There is only one pair of accessory glands. In this character *P. capreolus* differs from *C. nitida*, but is similar to the other Scarabaeidae treated. The ejaculatory duct is comparatively long and part of it expands into a tubular cavity. This cavity is about 5 mm. long and the total length of the ejaculatory duct is about 16 mm. *P. capreolus* has a longer ejaculatory duct than any of the species of Scarabaeidae treated. (Fig. 16.)

Passalidae: *Popilius disjunctus* (Ill.)

Each testis consists of two somewhat oval bodies knobbed at their distal ends. In this respect *P. disjunctus* differs from the species of the superfamily Scarabaeoidea treated. The divisions of each testis join the vas deferens by means of the vasa efferentia. The vasa deferentia continue from the seminal vesicles to the ejaculatory duct. The proximity of the seminal vesicles to the testes is characteristic. In this respect *P. disjunctus* differs from the other species of the superfamily Scarabaeoidea treated. There are two pairs of accessory glands and the medial glands are thicker than the laterals. The divisions of the accessory glands are of about the same length. This species differs from all other species of this superfamily here treated, in having two pairs of accessory glands. The ejaculatory duct is comparatively long its length being about 5 mm. This character is similar to that of *Pseudolucanus capreolus*. (Fig. 14.)

Cerambycidae: *Tetraopes tetrophthalmus* (Forst.)

Each testis consists of two compact circular bodies apparently connected to each other by means of a duct. The vas deferens joins the proximal body. There is only one pair of short accessory glands. In this particular specimen both divisions of the accessory glands are joined to one division of the bifurcated ejaculatory duct. The non-divided part of the ejaculatory duct is comparatively long and slender, being 2 mm. in length. Each division of the accessory glands is about 6 mm. long. A circular, apparently chitinous tube is situated at the base of the aedeagus. Within this circular structure are attached fibers of striated muscle. (Fig. 13.)

Chrysomelidae: *Leptinotarsa decemlineata* (Say)

The testes are similar to those of *Tetraopes tetrophthalmus*. The duct between the compact bodies of the testes is larger and comparatively shorter than that in *T. tetrophthalmus*. The seminal vesicles are pronounced in this species, but this is not the case in *T. tetrophthalmus*. The accessory glands are larger and comparatively longer than those of *T. tetrophthalmus*. The ejaculatory duct bifurcates proximally as in *T. tetrophthalmus*. The ejaculatory duct expands into a long tubular cavity, which is not the case in *T. tetrophthalmus*. The length of the ejaculatory duct is about 4 mm. The expanded part takes up about half of this length. The aedeagus, although a part of the external genitalia, is similar to that of *T. tetrophthalmus*. (Fig. 15.)

Epitrix sp.

The testes are fused and are enclosed in a single testicular sac. The seminal vesicles are situated just below the fused testes. The vasa deferentia extend from the seminal vesicles to join the ejaculatory duct. The entire length of this specimen was only 2 mm. The diameter of the fused testes is about .3 mm. and each division of the accessory glands about 4 mm. long. The ejaculatory duct is about .75 mm. long and is the same diameter throughout its length. (Fig. 11.)

THE ANATOMY OF THE FEMALE INTERNAL GENITALIA

Females have the following in common unless otherwise indicated: Two ovaries (Fig. 17, I) the tubes of which join to form the lateral oviducts (Fig. 17, J). The lateral oviducts fuse posteriorly to form the median oviduct (Fig. 17, K) which extends posteriorly to the vagina (Fig. 17, P). A pair of colleterial glands (Fig. 17, L) arise from the median oviduct as in this figure or from the vagina as in figures 19 and 21. A spermatheca (Fig. 17, M) joins the vagina by means of its duct as in this figure or associated with the bursa copulatrix as in figure 19. The bursa copulatrix (Fig. 17, N) is connected to the vagina by means of its duct as in this figure or as an expansion of the vagina as in Figures 23 and 24. The outlet from the vagina is the egg-exit duct. (Fig. 19, R.)

Carabidae: *Scarites subterraneus* (Fab.)

Dufour investigated *Carabus auratus* and illustrated unusual glands, similar to those of *Hippodamia convergens* (Guer.) (Fig. 20), at the posterior end of the egg-exit duct. No such glands were observed in *Scarites subterraneus*, in which each ovary consists of at least six and possibly more ovarian tubes. Eggs of various sizes appear in a single tube. This character was also brought out by Dufour in the species he treated. The muscles, not illustrated, surrounding the vagina are massive. The egg-exit duct is comparatively short. The saccular part of the spermatheca appears to be glandular while the saccular part of the bursa copulatrix appears membranous. (Fig. 17.)

Cantharidae: *Chauliognathus marginatus* (Fab.)

There are two ovaries, each composed of a multitude of small tubes. Each tube appears to contain two or at most not more than three eggs. The ovarian tubes surround the centrally situated lateral oviducts which fuse posteriorly to form the median oviduct. The bursa copulatrix joins the vagina by a rather short duct. A crescent-shaped sac appears to arise from the bursa copulatrix. This sac may be a part of the bursa or it may function as a spermatheca. Another somewhat oval sac is attached to the vagina by means of a duct. This may also be the spermatheca or it may function as a colleterial gland. The two large glands which are situated at the posterior end of the egg-exit duct are probably accessory glands. Their connection with the egg-exit duct is obscured by a chitinous band (Z). These glands contain a white glue-like secretion, which is probably used to attach eggs to objects. (Fig. 18.)

Elateridae: *Alaus oculatus* (L.)

Each ovary appears to consist of four ovarian tubes. The tubes are branched and this condition makes the number appear greater than four. The lateral oviducts are long and each branch is about twelve times the length of the median oviduct. The colleterial glands arise from the vagina. There are two curved chitinous structures with teeth, not illustrated, situated on each side of the vagina. A well developed lamina dentata is situated within the walls of the bursa copulatrix. These chitinous structures and the lamina dentata most likely rupture spermatophores. The spermatheca consists of several tube-like structures and many of them are branched. All of these tubes empty into the centrally situated spermathecal reservoir. This entire structure is joined to the bursa copulatrix by means of the spermathecal duct. The egg-exit duct is comparatively long being about eight times the length of the medial oviduct. The latter duct is about 5 mm. long. (Fig. 19.)

Conoderus lividus (DeG.)

Each ovary appears to consist of two tubes, but the correct number is four. The median oviduct is about .5 mm. long. Each lateral oviduct is about three times longer than the median oviduct. The colleterial glands arise from the vagina and are more bulky and shorter than those of *Alaus oculatus*. No chitinous structures are present within the vaginal tissue and no lamina dentata is present within the walls of the bursa copulatrix. Several branched spermathecal tubes empty into the spermathecal reservoir. This reservoir is connected to the vagina by means of the spermathecal duct. The egg-exit duct is about three times longer than the median oviduct. The distal end of the egg-exit duct is in close proximity with the rectum, but it does not appear to fuse with this part of the alimentary canal to form a cloacal duct. (Fig. 21.)

Melanotus communis (Gyll.)

The ovaries are comparatively small and each consists of several ovarian tubes. The lateral and median oviducts are very slender. Each of the former ducts is about 2 mm. long and the latter about .5 mm. No colleterial glands are connected to the vagina. A pair of comparatively long glands, however, which may be the colleterial glands are connected to the bursa copulatrix. A rather complex lamina dentata is situated within the walls of the bursal sac. The spermatheca has rather short tubes extending from its reservoir, and is connected by means of its duct to the bursal sac. The egg-exit duct is about 3 mm. long (Fig. 20.)

Buprestidae: *Melanophila acuminata* (DeG.)

Each ovary consists of ten ovarian tubes. The lateral oviducts are comparatively large in diameter and each is about .75 mm. long, about twice the length of the median oviduct. No colleterial glands are present. The bursa copulatrix is a comparatively large sac connected to the vagina by its rather short duct. The spermathecal glands are probably situated within the walls of the spermathecal sac. The egg-exit duct is comparatively long being about 2.5 times longer than the lateral oviduct. (Fig. 22.)

Coccinellidae: *Hippodamia convergens* (Guer.)

Each ovary consists of at least twelve ovarian tubes. The greatest length of an ovary is about 1.5 mm. The lateral oviducts are about the same length as the ovaries. The diameter of the lateral oviducts is about one-half that of the median oviduct. The latter duct is about .7 mm. long. The bursa copulatrix is an expanded part of the vagina. The bursa narrows distally into a tube. A chitinous tube is inserted within the tubular part of the bursa. At the distal end of the chitinous tube is a chitinous U-shaped structure. A saccular gland-like body extends, apparently over the extreme end of the lower arm of the U-shaped structure to continue as part of the distal tube of the bursa. Striated muscle fibers appear to be attached on the inner borders of both arms of the U. This chitinous structure and gland is probably the spermatheca. A pair of unusual glands appear at the posterior end of the egg-exit duct. The function of these glands is not known, though they have been previously noticed in Coleoptera. Dufour recognized similar glands in *Melolontha vulgaris* and *Carabus auratus*. He called them in the former species "sortes de glandes prostatiques." The author has observed what may be homologous glands in *Synchlora aerata* (Fab.) and *Utetheisa bella* (L.) of Lepidoptera. No colleterial glands are present. (Fig. 23.)

Coccinella novemnotata (Hbst.)

The internal genitalia are similar in many respects to those of *Hippodamia convergens*; the unusual glands being present, and colleterial glands being absent. Obvious differences are as follows: The chitinous rod which is situated within the bursal tube is expanded proximally; the U is thicker and the space between its arms smaller; the gland extending over the lower arm of the U and continuing as part of the distal bursal tube is bifurcated. (Fig. 24.)

Epilachna varivestis Muls.

The ovaries are comparatively small, each being about 3 mm. long. Each lateral oviduct is about .5 mm. long and the median oviduct about .75 mm. A pair of colleterial glands extend from the median oviduct. The bursa copulatrix is probably the expanded area in the vicinity of the vagina. No further details could be determined. (Fig. 25.)

Tenebrionidae: *Tarpela micans* (Fab.)

The long axis of each ovary is about 5 mm. in length and consist of many ovarian tubes which contain oat-shaped eggs. The lateral oviducts are comparatively short, each being about .2 mm. long. The median oviduct is about 1 mm. long. No colleterial glands are present. The bursa copulatrix is a pronounced expansion arising from the vagina. The duct extending from the bursa is spermathecal. Several small tubes which vary in length, and a gland like tube, join at their proximal ends to form a common duct. This common duct continues as the spermathecal duct. This entire tubular structure is probably the spermatheca. The egg-exit duct is comparatively long, its length being about 6.5 mm. The gut is closely associated with the egg-exit duct, but the two do not appear to form a cloacal duct. (Fig. 26.)

Scarabaeidae: *Pinotus carolinus* (L.)

There is only one ovary and this consists of but one ovarian tube. Seven eggs were recognized within this tube. The ovary, oviduct, vagina and egg-exit duct form a continuous tube about 13.5 mm. long. An expanded cavity in the vaginal region is probably the bursa copulatrix. A U-shaped chitinous structure and gland, probably the spermatheca, are connected to the vagina by means of a duct. This resembles the spermathecae of *Hippodamia convergens* and *Coccinella novemnotata*. No colleterial glands are present. (Fig. 27.)

Bolbocerosoma farctum (Fab.)

Each ovary appears to consist of a saccular ovarian tube. A careful examination of this tube reveals its contents to be fully developed eggs and what might be degenerate eggs. The lateral oviducts are relatively short, each being about .3 mm. long. The median oviduct is about 2 mm. long. A bilobed structure is attached to the vagina by means of a duct. The larger lobe may be bursal and the smaller spermathecal. The latter arises from the former by means of a duct. No colleterial glands are present. (Fig. 28.)

Eucanthus lazarus (Fab.)

The genitalia of this species are similar to those of *Bolbocerosoma farctum*. However, the germarium and terminal filaments of the ovaries are well developed in this species. A bilobed structure is also attached to the vagina by a short duct. The shape of the vagina is quite different from that of *B. farctum*. Two eggs, without question, can be seen in one ovary, as illustrated, but it is a question as to whether they are in one or two tubes. Nevertheless, the smaller egg appears to be in a degenerate state. The lateral oviducts are broader and comparatively shorter than those of *B. farctum*. The median oviduct is broader than that of *B. farctum* and is .5 mm. long. The external genitalia of this species differ considerably from those of *B. farctum*. (Fig. 29.)

Phyllophaga sp.

Each ovary consists of six ovarian tubes. In some of these tubes both larg and small eggs were present. The former probably develops at the expense of the latter. Two oval gland-like bodies (Fig. 30, Q) are situated in the tissue surrounding the distal end of the egg-exit duct. Similar bodies are present in *Popillia japonica*, *Ligyrus gibbosus*, *Dynastes tityus* and *Cotinis nitida*. In *Dynastes tityus* there are two pairs of these bodies and they appear to be associated with other chitinous-like bodies. These bodies may function in the same manner as the glands at the hinder end of the egg-exit duct in *Hippodamia convergens* and *Coccinella novemnotata*. The spermatheca is independent of the bursa copulatrix and consists of a reservoir and gland. The internal genitalia are quite different from those of *Bolbocerosoma farctum* and *Eucanthus lazarus*. (Fig. 30.)

Popillia japonica (Newn.)

The internal genitalia are similar to those of *Phyllophaga* sp. A comparison follows: The median oviduct in *P. japonica* is about as long as the ovary rather than about one-third the length; the vagina is comparatively longer and narrower; the spermathecal duct enters the vagina more distad of the bursa copulatrix; the spermathecal duct is obviously shorter; the spermathecal gland, bursal sac and bursal duct are comparatively longer. (Fig. 31.)

Ligyrus gibbosus (DeG.)

The characteristics of the internal genitalia resemble those of *Popillia japonica*. A comparison follows: The spermathecal sac is comparatively longer and the spermathecal duct definitely longer in *Ligyrus gibbosus*. The external genitalia are quite different from those of *P. japonica*. (Fig. 32.)

Dynastes tityus (L.)

The characteristics of this species resemble those of *Phyllophaga* and *Ligyrus gibbosus*. A comparison follows: The bursa copulatrix and its connection with the vagina resemble the condition in *Phyllophaga*. The spermatheca resembles that of *L. gibbosus*. The spermathecal reservoir, however, is comparatively shorter than that of *L. gibbosus* and the spermathecal duct is also shorter. The eggs develop more equally in the tubes than they do in the other species of this family treated. (Fig. 33.)

Cotinis nitida (L.)

The ovaries are similar to those of *Dynastes tityus* and the eggs also develop equally in the tubes. However, the shape and size of the bursa copulatrix differ from the condition found in other species of the Scarabaeidae treated. The spermatheca resemble that of *Ligyrus gibbosus*, but the spermathecal gland is comparatively shorter. A spermatophore was observed within the bursal sac. (Fig. 34.)

Passalidae: *Popilius disjunctus* (Ill.)

Each ovary consists of two ovarian tubes. The species of this superfamily treated may, therefore, have one, two or six ovarian tubes composing the ovary. The median oviduct is comparatively longer than in the other members of this superfamly treated, except possibly *Pinotus carolinus*. This statement concerning *P. carolinus* is true if the non-ovarian part of the single tube above the vagina be considered the median oviduct. The bursa copulatrix is a short sac extending from the vagina. The spermathecal duct expands into a small cavity near its distal end. This cavity may have a glandular function. A large sac, which may be the spermathecal sac, is situated at the extreme end of the spermathecal duct. (Fig. 35.)

Cerambycidae: *Prionus laticollis* (Drury)

The ovaries are large and each consists of many tubes. The ovarian tubes are filled with peanut-shaped eggs, all of about the same size. The spermathecal duct appears to arise from the bursal duct. A tubular sac, curved as shown in the figure, is attached to the distal end of the spermathecal duct. Fiber-like tissue, apparently muscle, extends from the distal end of this sac back across its middle and continues for a short distance down the spermathecal duct. A slender gland, undoubtedly the spermathecal gland, arises from the proximal end of this sac. The slender bursal duct expands distally into the bursal sac. Massive bundles of muscle fibers surround the vaginal area. The egg-exit duct is comparatively long. (Fig. 36.)

Romaleum rufulum (Hald.)

The ovaries are similar to those of *Prionus laticollis*, but the eggs are oat-shaped. The oviducts are comparatively shorter and the median oviduct actually longer than these structures in *P. laticollis*. The spermatheca and bursa copulatrix, as in *P. laticollis*, communicate with the vagina by means of a common duct. The spermathecal reservoir is pea-shaped. The spermathecal gland is comparatively shorter than that of *P. laticollis*. Massive muscle bundles, not illustrated, surround the vaginal area. (Fig. 37.)

Chrysomelidae: *Leptinotarsa decemlineata* (Say)

Each ovary consists of twenty or more tubes. The lateral oviducts are comparatively short being only .5 mm. long. The median oviduct is about 1 mm. long. The structure, which is connected to the vagina by means of a comparatively long duct, may be the bursa copulatrix and spermatheca combined. A twisted body, probably a spermatophore, appears within the saccular part of this structure. (Fig. 38.)

Epitrix sp.

Each ovary appears to consist of six ovarian tubes. The length of the entire reproductive system is about 1.5 mm. A chitinous body is attached to the vagina by means of a very slender duct. This duct is about .5 mm. long. The glandular tissue projecting from the chitinous body is probably spermathecal. This entire structure may function as the bursa copulatrix and spermatheca. (Fig. 39.)

DISCUSSION

Satisfactory dissections can only be made with fresh material. This is an unfortunate draw-back since the species belonging to a genus may exist in areas far distant from each other. If a method could be worked out for studying dried material, satisfactory studies of the internal genitalia could be made. Some portions of the internal genitalia, as the ejaculatory duct and bursa copulatrix, can be studied from dried material. A complete study of the internal genitalia from such material is most likely impossible. This is probably the reason why most studies on the genitalia are limited to the ejaculatory duct, bursa copulatrix and in particular to the external genital structures. If specimens are killed and properly preserved, satisfactory dissections, of course with some difficulty, can be made if the specimens are not allowed to become too old.

In most Lepidoptera the proximal end of the ejaculatory duct is bifurcated. One known exception is the evergreen bagworm (*Thyridopteryx ephemeraeformis* Haw.). Serial sections of the proximal end of the ejaculatory duct of this species reveal it to be divided internally. The condition in the bagworm appears in most of the beetles treated. Exceptions among the beetles are *Leptinotarsa decemlineata*, *Tetraopes tetrophthalmus* and *Scarites subterraneus*. These species have the proximal end of the ejaculatory duct bifurcated. The glands which are situated in the vicinity of the aedeagus of *Scarites subterraneus* were not observed in the other Coleoptera treated or Lepidoptera. However, the glands which are situated at the end of the egg-exit duct in the females of the Coleopterans *Hippodamia convergens* and *Coccinella novemnotata* have been observed in the lepidopterous *Synclora aerata* (Fab.) and *Utetheisa bella* (L.).

SUMMARY

The internal genitalia of 27 species representing 7 superfamilies and 12 families of Coleoptera are discussed and figured. A few remarks concerning the history of the internal genitalia of insects, including Coleoptera, are given. Insects must be dissected while fresh or killed and properly preserved and dissected before the specimens become too old. A complete study of the internal genitalia from dried material can not be made satisfactorily. Generally the ejaculatory duct in Lepidoptera is duplex, bifurcating proximally. This was observed in only three species of Coleoptera treated. The non-bifurcated ejaculatory duct appears to be common for Coleoptera. The non-bifurcated ejaculatory duct has been observed in only one species of many Lepidoptera studied.

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Explanation of Plates

ABBREVIATIONS

A, medial accessory gland (male); B, lateral accessory gland (male); C, testis; D, vasa efferentia; E, seminal vesicle; F, vas deferens; G, ejaculatory duct (non-bifurcated); H, aedeagus; I, ovary; J, lateral oviducts; K, median oviduct; L, colleterial gland (female); M, spermatheca and duct; N, bursal sac; O, bursal duct; P, vagina; Q, unusual glands of female; R, egg-exit duct; S, bifurcated part of the ejaculatory duct; T, lateral accessory glands of male (second division); U, unusual glands (male); V, gut; W, chitinous rod and U-shaped structure of the spermatheca; X, unusual glands (female); Y, epididymus; Z, band of chitin; AA, muscle.

Plate 6—Male Internal Genitalia

Fig. 1. *Scarites subterraneus* (Fab.). Note the unusual glands (U).

Fig. 2. *Chauliognathus marginatus* (Fab.). Epididymus to the left partly dissected.

Fig. 3. *Conoderus lividus* (DeG.).

Fig. 4. *Epilachna varivestis* (Muls.). One half illustrated.

Fig. 5. *Melanotus communis* (Gyll.). One testis and part of one division of the medial and lateral accessory glands illustrated.

Fig. 6. *Tenebroides* sp. Body to left represents a testis and epididymus. Epididymus and testis on right dissected.
Fig. 7. *Bolbocerosoma farctum* (Fab.).
Fig. 8. *Meracantha contracta* (Beauv.).
Fig. 9. Male internal genitalia of *Phyllophaga* sp. (May beetle).

PLATE 7—MALE INTERNAL GENITALIA

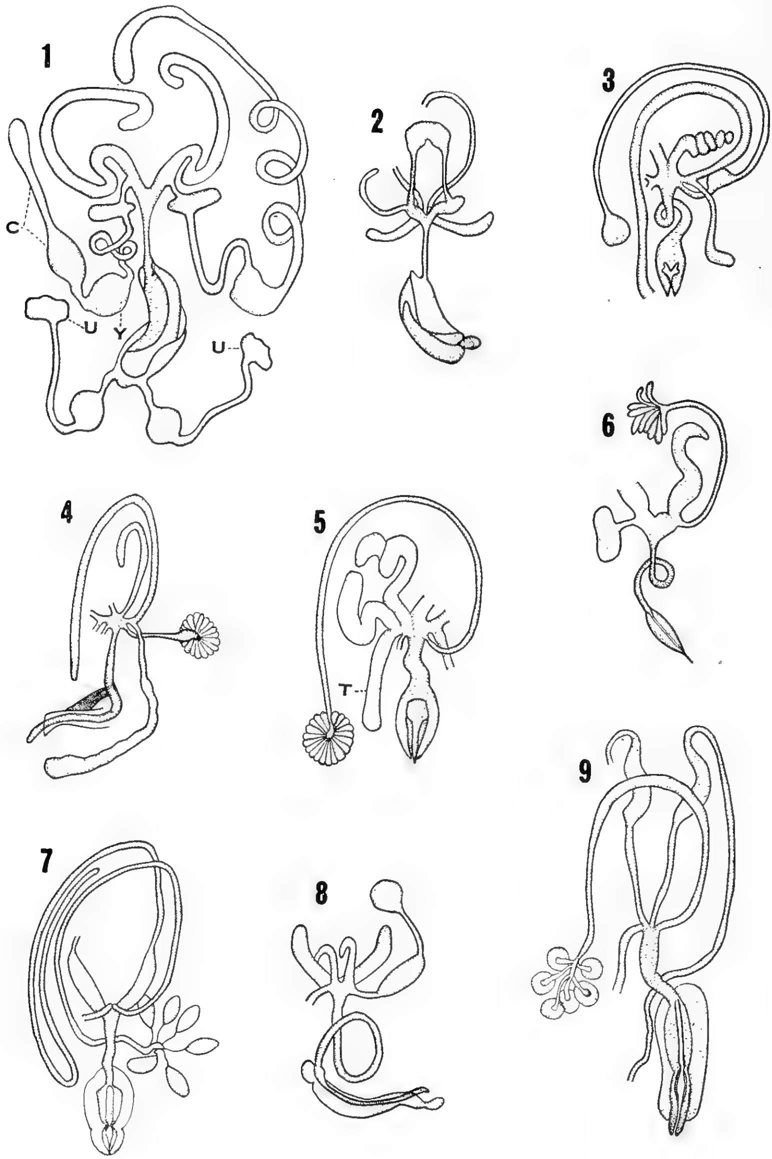
Fig. 10. *Popillia japonica* (Newn.)
Fig. 11. *Epitrix* sp. (Potato flea beetle).
Fig. 12. *Cotinis nitida* (L.). One half illustrated.
Fig. 13. *Tetraopes tetrophthalmus* (Forst.).
Fig. 14. *Popilius disjunctus* (Ill.).
Fig. 15. *Leptinotarsa decemlineata* (Say). Note bifurcated ejaculatory duct (S).
Fig. 16. *Pseudolucanus capreolus* (L.). One epididymus dissected.

PLATE 8.—FEMALE INTERNAL GENITALIA

Fig. 17. *Scarites subterraneus* (Fab.). Note unequal size of eggs.
Fig. 18. *Chauliognathus marginatus* (Fab.). Only a few of the egg-tubes illustrated.
Fig. 19. *Alaus oculatus* (L.). Lateral oviducts and part of one ovary illustrated. Note peculiar spermatheca.
Fig. 20. *Melanotus communis* (Gyll.). Note spermatheca.
Fig. 21. *Conoderus lividus* (DeG.).
Fig. 22. *Melanophila acuminata* (DeG.).
Fig. 23. *Hippodamia convergens* (Guer.). Note striated muscle (AA) inside of U structure.
Fig. 24. *Coccinella novemnotata* (Hbst.). Note unusual glands (X) and U-shaped structure (W).
Fig. 25. *Epilachna varivestis* (Muls.).

PLATE 9.—FEMALE INTERNAL GENITALIA.

Fig. 26. *Tarpela micans* (Fab.). Long bent rod on left is chitinous and not connected with the genitalia. Structure extending from the bursa is the spermatheca.
Fig. 27. *Pinotus carolinus* (L.). Structure extending from the vagina is the spermatheca or spermatheca and bursa.
Fig. 28. *Bolbocerosoma farctum* (Fab.). Ovaries appear as sacs.
Fig. 29. Eucanthus lazarus (Fab.). Ovaries contain (probably) degenerating eggs which may or may not be in the same tube.
Fig. 30. *Phyllophaga* sp. Structure (Q) may function as some type of gland.
Fig. 31. *Popillia japonica* (Newn.).
Fig. 32. *Ligyrus gibbosus* (DeG.).
Fig. 33. *Dynastes tityus* (L.).
Fig. 34. *Cotinis nitida* (L.).
Fig. 35. *Popilius disjunctus* (Ill.).
Fig. 36. *Prionus laticollis* (Drury).
Fig. 37. *Romaleum rufulum* (Hald.). One ovary illustrated.
Fig. 38. *Leptinotarsa decemlineata* (Say). All ovarian tubes not illustrated.
Fig. 39. *Epitrix* sp.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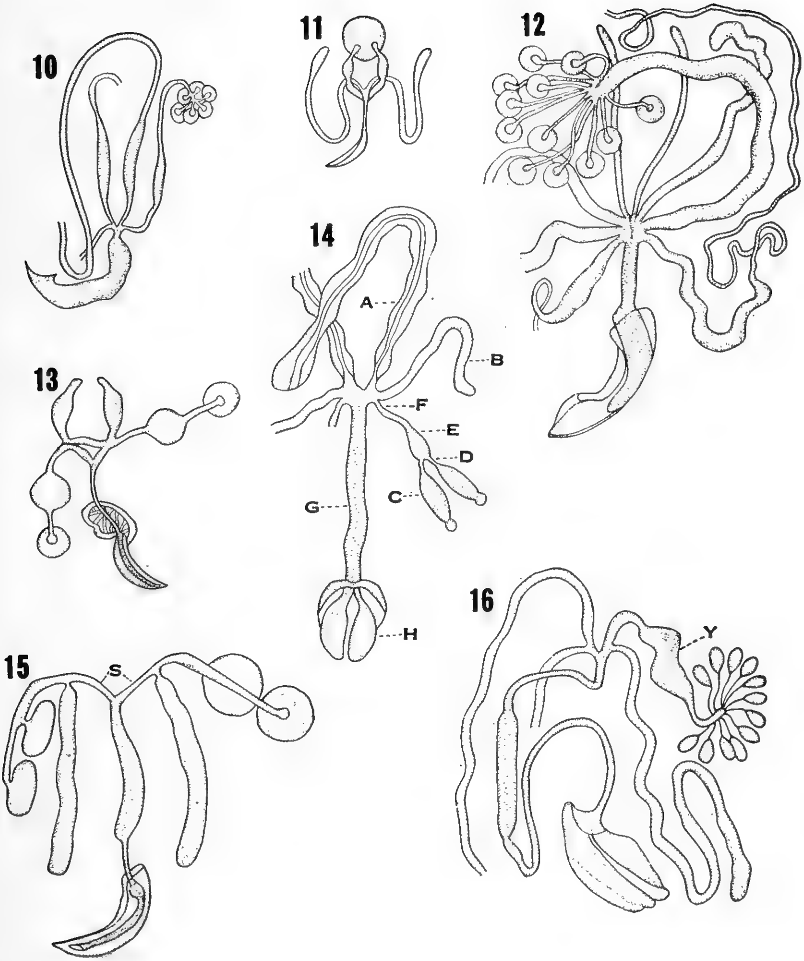
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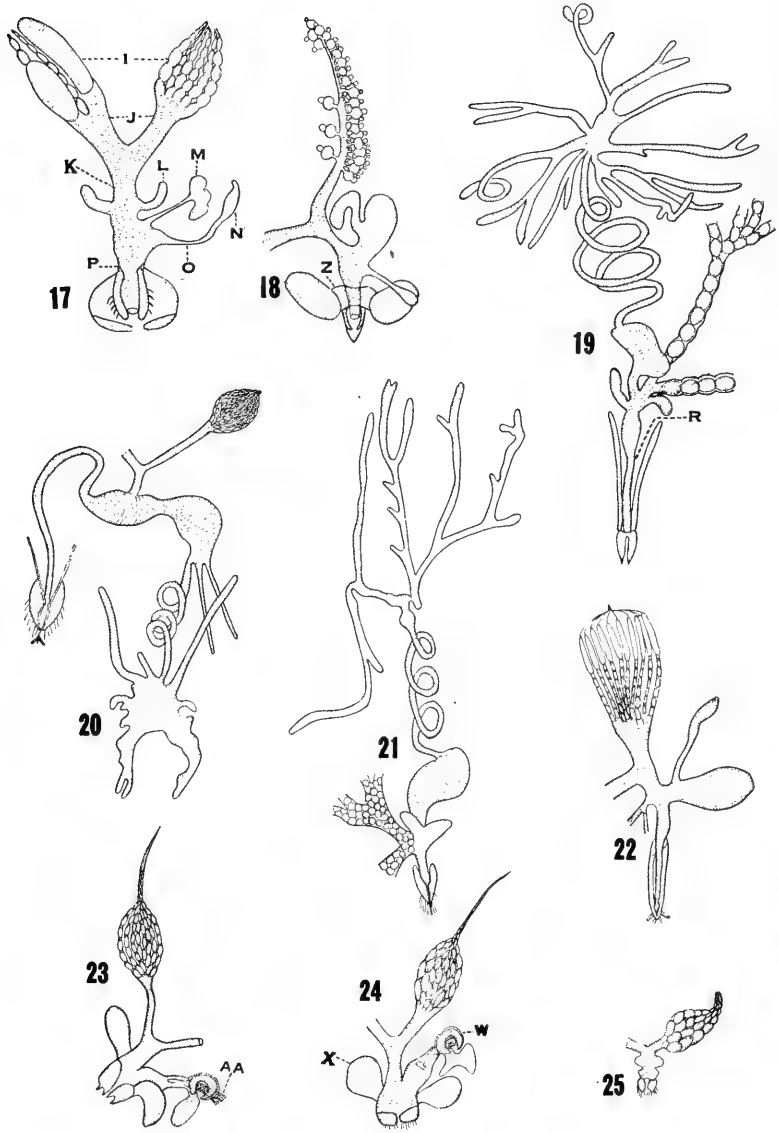
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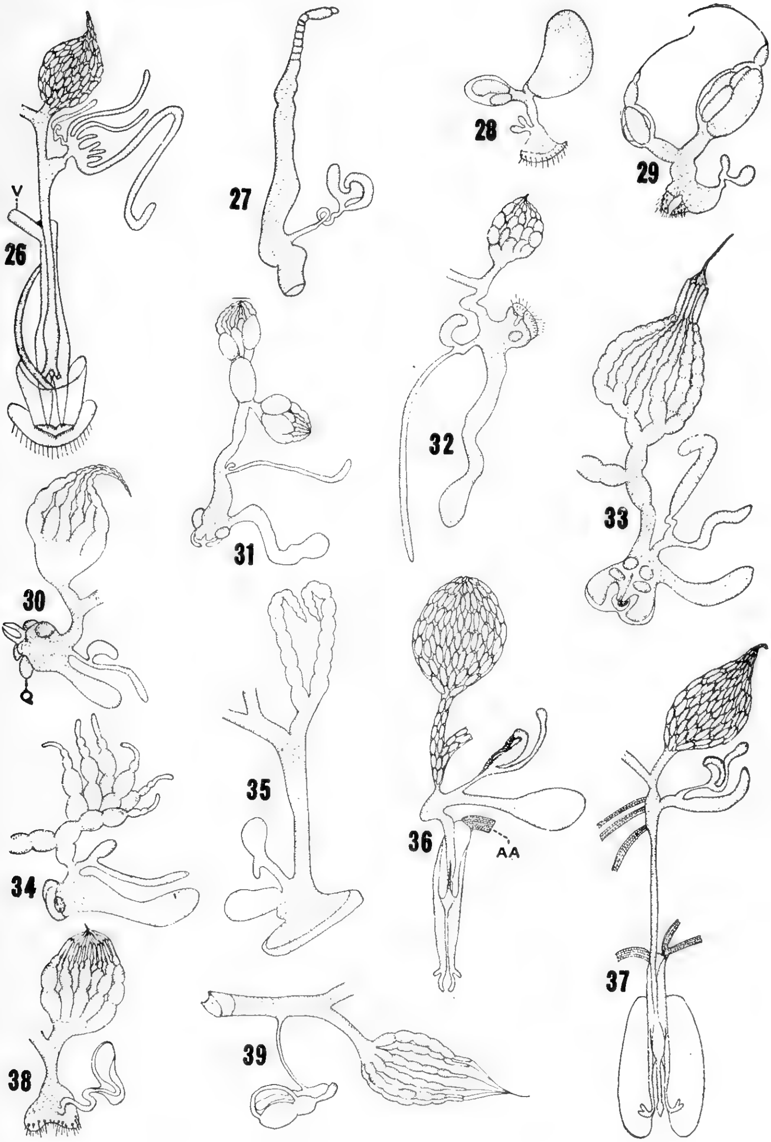
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A NEW GENUS AND SPECIES OF THRIPINAE FROM BULBS (Thysanoptera: Thripidae)

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For the following new genus of Thripinae I have chosen a name indicating that the species upon which it is based lives on bulbs. Its affinities are with certain genera discussed below, several of which are known to live in turf.

Bolbothrips, new genus

(Βολδος, a bulb)

Head, viewed dorsally, rounded in front, medially extending cephalad of eyes and overhanging bases of antennae; face below this distinctly, though briefly, produced in front of eyes; median ocellus well back of a line tangent to the front margins of eyes; antenna 7-segmented, with V distinctly narrowed to apex and VI to base, thus not forming a compact mass; segment III longer than IV; trichomes on III and IV U-shaped; antennae of the two sexes similar; maxillary palpi with 3 segments; prothoracic anterior angular, marginal, and midlateral setae not well developed; fore and hind veins of anterior wing setose their entire length; setae on anterior margin of forewing distinctly stronger than the hairs; ovipositor normally developed.

Type, *Bolbothrips aztecus*, new species.

The following genera are all stated to have the head produced in front of the eyes and to have 7-segmented antennae. Of those with only a few setae distad on the fore vein of the anterior wing, *Stenothrips* has the maxillary palpi 2-segmented; *Fulmekiola* has each abdominal tergum margined with a comb of coarse sawlike teeth; *Euchaetothrips* has long prothoracic midlateral setae; *Baliothrips* has antennal segment V not narrowed apically and forming with VI and VII a compact mass, and maxillary palpi with 2 segments; *Bolacothrips* has the trichomes on antennae III and IV simple; and *Sphaeropothrips* has antenna V not narrowed at apex, eyes strongly protruding, and the maxillary palpi apparently 2-segmented. Of those genera in which the anterior vein is completely (or almost) setose, *Bolacidothrips* has the trichomes on III and IV simple and the maxillary palpi with 2 segments; *Plesiothrips* has the ovipositor rudimentary, the vertex not overhanging, the anterior ocellus anterior to a line tangent to the anterior margins of the eyes, antennal segment III distinctly shorter than IV, and a great antigeny in the antennae of the sexes.

The genus *Stenchaetothrips*, described from specimens lacking the antennae, has well-developed anterior marginal and angular prothoracic setae and the setae on the fore vein of the anterior wing distally are said to be "sparing," indicating that the vein is not completely setose.

Bolbothrips aztecus, new species

Female holotype (macropterous).—Length 1.3 mm. Dark brown, including antennae, legs, and body setae, with antenna II light at apex, especially mesally, pedicel of III, except a narrow brown apical band and extreme base of segment, almost white, pedicel of IV light brown, of V only slightly lighter than rest of segment; forewing dark brown with the base only very slightly brownish, somewhat darker along anterior margin, especially at base, anal lobe distinctly darker, fading in color to apex; hind wing almost hyaline, with a dark median longitudinal stripe; fore tibia distinctly lighter apically, its tarsus light brown; all femora slightly lighter at apices; mid- and hind tarsi brown, lighter in color than the tibiae (in the single paratype, which is lighter in color and somewhat teneral, as is shown by the extreme amount of internal red pigment in the head and thorax, the lighter-colored parts of the legs are still lighter than described above).

Head wider than long, with cheeks straight, almost parallel, eyes hardly protruding, behind eyes with rather widely separated transverse anastomosing lines; frontal costa widely, shallowly emarginate; ocellar crescents dark red, almost obscured by dark color of head; posterior ocelli 15 μ in diameter, 40 μ apart; median ocellus 11 μ in diameter, 28 μ from lateral ocelli; interocellar setae about on lines connecting the centers of median ocellus and the lateral ones, much nearer the latter, 32 μ apart, 39 μ long; basal part of pedicel of antenna III swollen and subangulate near apex, separated from apical portion by an apparently nonsclerotized band, the apical portion indistinctly separated from main portion of the segment; trichomes of segments III and IV moderately long; segment VI not pedicellate, sense cone on its inner side about attaining apex of segment; mouth cone moderate in length, rounded at apex.

Thorax dorsally showing no sculpture except at rear of pronotum, where there are a few transverse lines of which the anterior one is more distinct; anterior angular setae about 18 μ long, the anterior marginals minute; posterior margin of pronotum with about 4–5 pairs of small setae between the posterior angulars; median pair of setae on metascutum remote from base (in one specimen 25 and 23 μ, in the other 18 and 30 μ); legs short, rather stout, hind tibia 176 μ long; fore vein in forewing with 3 (plus 1 minute) hyaline setae in the subhyaline band at base of wing, followed by a continuous row of 14–15 setae, the outer one more separated than the others, the basal one of the series just within the subhyaline area and only slightly brownish; hind vein with 14–15 setae.

Abdomen normal, with a few transverse anastomosing lines just behind the slightly better defined antecostal line; comb on tergum VIII complete, of sparse, fine setae with broad bases; tergum X above split open almost to base; venter with no accessory setae.

Measurements (in microns): Head, median length 152, width across eyes 176, width at base 172; pronotum, median length 164, greatest width 236; pterothorax, median length 260, width 312; ovipositor 260; setae, on tergum of IX, inner 128, lateral 176, ventrolateral 180, on X, inner 180, outer 160.

Antennae.....	1	2	3	4	5	6	7
Length.....	22	38	60	51	38	49	26
Width......	32	30	24	24	20	20	8

Male allotype (brachypterous).—Length (partly distended) 1.27 mm. Very similar to the female, but production of face in front of eyes (from eye to base of antenna outwardly 8 μ) slightly longer, the prothoracic anterior angular setae 28 μ, the posterior angulars, inner 48, outer 44 μ; sternal sensory areas on sterna III–VII transverse, that on IV, 17 μ long and 50 μ in transverse diameter.

Antennae (in microns)........	1	2	3	4	5	6	7
Length..................	20	36	48	38	28	44	22

Type locality.—Banderilla, V. C., Mexico.

Host.—On bulbs of *Tigridia pavonia.*

Type Catalog No. 57232, United States National Museum.

Described from two females and one male, taken May 5, 1944, by plant quarantine inspectors at Laredo, Tex.

A NEW NORTH AMERICAN SPECIES OF LITHOCHARIS (Coleoptera: Staphylinidae)

By Milton W. Sanderson,

Illinois Natural History Survey, Urbana, Illinois

At least two species of *Lithocharis* Boisd. and Lac. in collections are going under the name of *ochraceus* (Grav.). Both are very similar in size and appearance, they have about the same range in distribution in the eastern United States, and they are commonly taken in piles of dead grass and at light.

Lithocharis ardenus, new species

In Casey's revision of the American Paederini (Trans. Ac. Sci. St. Louis, XV, p. 17–248, 1905), males of this species key out to *ochraceus* (Grav.) by the presence of a comb of black spines on the posterior margin of the seventh[1] abdominal sternite. It differs in lacking the dense brush of hairs (Fig. 6) on each side of the emargination in the eighth sternite, and by other details especially in the genitalia.

Male.—Length 3 to 4 mm. Color and general features apparently identical to *ochraceus.* Seventh sternite (Fig. 4A) with a comb of 20 to 24 black spines occupying approximately the median one-third of hind margin; each spine three to four times longer than wide, and of nearly equal length and width. Eighth sternite (Fig. 3), with a wide and deep emargination equal to about one-third its length, and with posterior angles subacute; bottom of emargination with about four long setae. Genitalia as in Figs. 2A and 2B. Basal swelling large and bulbous and with the median lobe and a pair of short lateral

[1] Used in its true morphological sense. This is the "fifth ventral" of Casey's revision.

lobes attached to its ventral side near the apex. Lateral lobes curved dorsally, about four times longer than wide, and extending about one-third the length of the median lobe on the dorsal side. Median lobe about two and one-half times as long as wide, widest near the middle and slightly constricted before the nearly truncate apex.

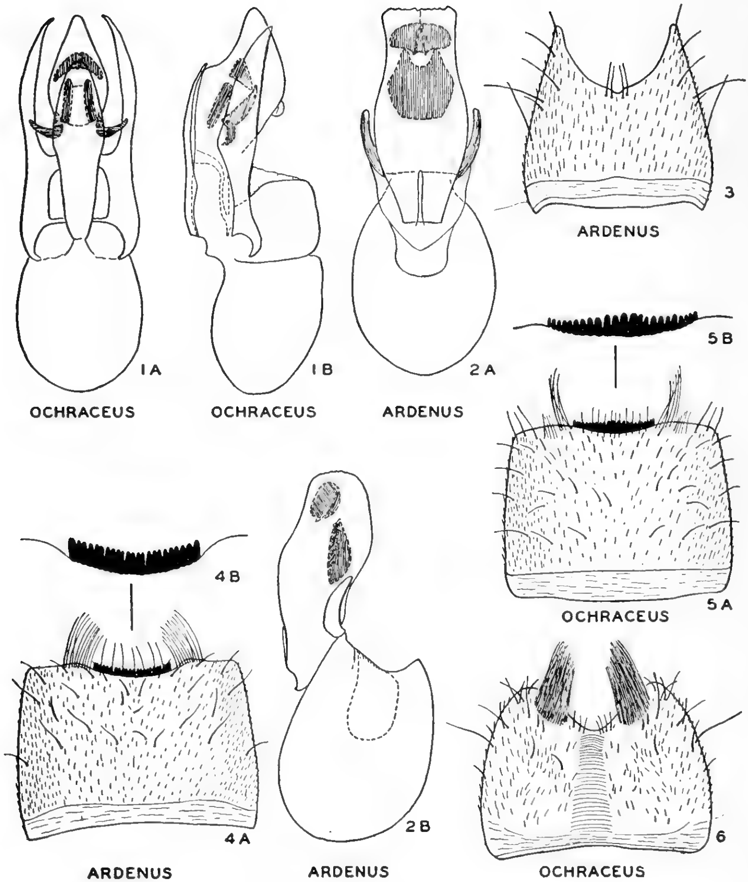
Base of median lobe with a very slender ventral process, about 12 times as long as wide, lying close to the surface of the lobe and extending to a line through the bases of the lateral lobes. Median lobe with an eversible copulatory sac provided with two conspicuous internal structures.

Female.—Similar to male in all general features except for a prolonged and subangulate eighth sternite and no comb of spines on the posterior margin of the seventh sternite. Satisfactory characters have not yet been found that will distinguish the females of this species and *ochraceus*.

Holotype, *male.*—Urbana, Illinois: June 28, 1944, at light in Brownfield Woods, M. W. Sanderson. In the collection of the Illinois Natural History Survey.

Allotype, *female.*—Same data as for holotype.

Paratypes.—ARKANSAS.—FAYETTEVILLE: August 24, 1940, at light, M. W. Sanderson, 1 ♂; February 2, 1941, in grass pile, M. W. Sanderson, 9 ♂♂, 22 ♀♀; March 1, 1941, in grass pile, M. W. Sanderson, 10 ♂♂, 14 ♀♀; October 22, 1941, at light, M. W. Sanderson, 2 ♂♂. GEORGIA.—FORT MCPHERSON: July 5, 1943, at light, H. Hoogstraal, 1 ♂. ILLINOIS.—APPLE RIVER CANYON STATE PARK: August 11, 1944, in dead grass pile, Sanderson and Leighton, 1 ♂, 1 ♀. CHAMPAIGN: November 13, 1933, O. Park, 1 ♂, 4 ♀♀. CHICAGO: August 29, 1942, H. S. Dybas, 1 ♀; September 8, 1942, H. S. Dybas, 1 ♂, 1 ♀. ELSAH: June 24, 1943, at light, C. L. Remington, 1 ♂. GIANT CITY STATE PARK: July 5, 1944, at light, Sanderson and Leighton, 2 ♂♂, 2 ♀♀. HAVANA: July 17, 1943, at light, T. H. Frison, 1 ♂; July 1, 1944, at light, T. H. Frison, 1 ♀. URBANA: June 18, 1890, flying at twilight (Acc. No. 15765), C. A. Hart, 1 ♀; June 19, 1890, flying at twilight, (Acc. No. 15771), C. A. Hart, 1 ♀; Same data as for holotype, 2 ♀♀. VOLO: October 27, 1943, in sphagnum moss, Ross and Sanderson, 1 ♂, 1 ♀. KANSAS.—LAWRENCE: September 29, 1933, 1 ♂, November 5, 1935, in damp debris, 1 ♂. TOPEKA: September 3, 1942, C. H. Seevers, 1 ♀; September 8, 1942, C. H. Seevers, 1 ♂. NEW JERSEY.—COLONIAL: Siepman, 1 ♂. NEW YORK.—BROOKLYN: November 10, 1940, William Spector, 1 ♂, 3 ♀. OHIO.—BARBERTON: June 26, 1936, L. J. Lipovsky, 7 ♂♂, 11 ♀♀; July 6, 1936, L. J. Lipovsky, 14 ♂♂, 16 ♀♀; July 25, 1936, L. J. Lipovsky, 2 ♀♀; August 21, 1936, L. J. Lipovsky, 1 ♂, 1 ♀. MT. HEALTHY: May, 1942, light trap, 2 ♀♀. PIKE FOREST: June, 1942, light trap, 2 ♀♀. SOUTH CAROLINA.—CLEMSON COLLEGE: March 7, 1938, J. G. Watts, 1 ♂.



Figs. 1A and 1B. *Lithocharis ochraceus* (Grav.), ventral and lateral aspects of male genitalia. Figs. 2A and 2B. *L. ardenus*, n. sp., ventral and lateral aspects of male genitalia. Fig. 3. *L. ardenus*, n. sp., eighth sternite. Fig. 4A. Fig. 4A. *L. ardenus*, n. sp., seventh sternite. Fig. 5A. *L. ochraceus*, seventh sternite. Fig. 6. *L. ochraceus*, eighth sternite.

Paratypes deposited in the collections of the Illinois Natural History Survey, U. S. N. M., University of Kansas, Clemson College, C. H. Seevers, C. A. Frost, Orlando Park, and Borys Malkin.

The present species is most closely related to *ochraceus* (Grav.) in the Nearctic fauna. In addition to having a brush of yellow hairs on each side of the emargination on the eighth sternite (Fig. 6), the spines in the comb of the seventh sternite (Fig. 5A) of *ochraceus* are not all of one size but are shorter at the ends. The lateral lobes of the genitalia of *ochraceus* (Figs. 1A and 1B), are highly developed and extend nearer the end of the pointed median lobe. The process arising from the base of the median lobe is very large compared with that of *ardenus*. In addition to these features, *ochraceus* has an additional pair of curved structures arising from the sides of the median lobe, and the internal structures on the copulatory sac are different, as shown in the figures. *L. ardenus* appears even more closely related to the West Indian *sororculus* Kraatz but differs in not having the spines in the comb on the seventh sternite shorter in the middle and at the ends as illustrated for that species by Blackwelder (Bull. 182, U. S. N. M., p. 240, 1943).

Specimens of *L. ochraceus* have been examined from Illinois. Arkansas, Oregon, Ohio, and Massachusetts. Unassociated females of either *ochraceus* or *ardenus* have also been examined from South Dakota and Florida.

NOTES ON PHYLLOPHAGA BARDA (HORN) WITH A DESCRIPTION OF THE LARVA (Coleoptera: Scarabaeidae).[1]

By P. O. Ritcher,

Kentucky Agricultural Experiment Station, Lexington

Phyllophaga barda (Horn) is a rather uncommon, widely distributed May beetle known to occur in New York, Illinois, Iowa, Kentucky, Arkansas, North Carolina, Georgia, and Mississippi, according to Langston (1927), Sim (1928), Brimley (1938), Ritcher (1940), Sanderson (1944), and Fattig (1944). In Kentucky the species has been found only in the southeastern part of the state in the Eastern Pennyroyal and Eastern Coal Field regions.

[1] The investigation reported in this paper is in connection with a project of the Kentucky Agricultural Experiment Station and is published by permission of the Director.

Adults are in flight in May in Kentucky. Eight specimens were found feeding on persimmon leaves, one specimen was taken from oak, and one from hickory. According to Fattig (1944) pecan and sourwood are also host plants. The comparative rarity of the species in Kentucky is indicated by the fact that only 21 specimens were found in a total collection of over 40,000 May beetles and their grubs. In Georgia, Fattig (1944) collected 178 specimens out of a total of 17,967 beetles.

Little is known about the habits of the larvae. Three adults were taken behind the plow, April 4, 1940, near Livingston, Kentucky, in a fairly high, well-drained pasture. Five third-stage larvae were collected from the soil of a steep hillside pasture in Wolfe county. These records suggest that like other "rare" species, *P. barda* may prove fairly common in certain local areas.

P. barda belongs in Horn's (1887) Group IX. It has long been a curiosity because of its peculiar male genitalia. It is apparent, however, that the larva belongs in Böving's Group 16 with such species as *P. anxia* (LeConte), *P. drakei* (Kirby), *P. marginalis* (LeConte), *P. fusca* (Froelich), *P. vehemens* (Horn) and *P. fervida* (Fabricius).[2] The larva is most like that of *P. marginalis* (LeConte) and may be separated from that species by differences in the number of pali. The following description is patterned after the descriptions given by Böving (1942) in his monograph of the genus.

Phyllophage barda (Horn). Third-stage larva

(Figs. 1 to 3)

Description based on the following material:

Five cast skins of 5 third-stage larvae taken May 26, 1944, near Malagda, Kentucky, in Wolfe county, behind the plow in a steep hillside pasture. Larvae reared to the adult stage. (Two cast skins, and associated adults, deposited in the U. S. National Museum.)

Posterior part of labrum with a slightly irregular, transverse row of 5 to 8 long setae on each side. Anterior margin of frons with an irregular transverse series of 5 to 7 long setae on each side. Dorso-epicranial setae, 2 in number. Dorso-molar region of right mandible with a patch of about 30 setae; dorso-exterior region with from 21 to 33 punctures (Fig. 3); scrobis with about 12 to 14 punctures in an irregular longitudinal row; ventro-lateral carina with a row of 4 to 7 long setae; baso-lateral region with a patch of 9 long and 3 shorter setae. Epipharynx (Fig. 2) with 10 to 12 heli; proplegmatium subelliptical to clavate

[2] The adult of *P. barda* belongs in the same group. In Böving's key to groups of adults (1942), however, the second half of couplet 1 (page 57) should be modified to read "Claspers asymmetrical. (Apical membrane *usually* continuous with the ventral membrane; inner spur of hind tibia of male fixed.)" This change is necessary since the male genital claspers of *P. barda* are asymmetrical but the "bridge" is present.

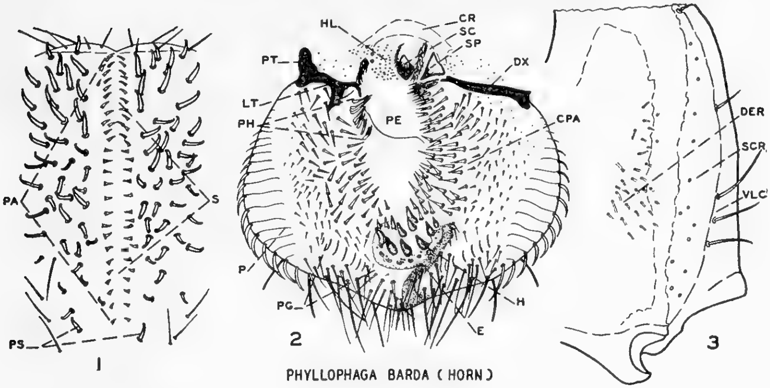


Fig. 1. Third stage, raster. PA, palidium; PS, preseptular hamate setae; S, septula. Fig. 2. Third stage, epipharynx. CPA, chaetoparia; CR, crepis; DX, dexiotorma; E, epizygum; H, helus, HL, haptolachus; LT, laeotorma; P, plegma; PE, pedium; PG, proplegmatium; PH, phoba, PT, pternotorma; SC, sense cone (nesium internum); SP, sclerotized plate (nesium externum). Fig. 3. Third stage, right mandible (pars), dorsal view. DER, dorso-exterior region; SCR, scrobis; VLC, ventro-lateral carina.

with 6 to 11 curved proplegmata; right chaetoparia with a very few or no punctures among the setae; crepidal punctures from 40 to about 50. Septula narrow, subrectangular; each palidium with one rather regular, sparsely set row of 22 to 33 pali of about same size (Fig. 1); pali compressed slightly at tips; distance between pali usually about equal to the length of a palus; with 1 or 2 preseptular hamate setae. (Width of head about 6.5 mm.).

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A NEW GENUS AND SPECIES OF TETRANYCHID MITE FROM CALIFORNIA

By E. A. McGregor, *Whittier, Calif.*

Monoceronychus, new genus

This is an aberrant mite, and any attempt to associate it with known genera has been futile. In common with *Bryobia* and the *Tenuipalpus* complex it has the precephalothoracic plate, but it lacks the tarsal claws of these genera. It bears some resemblance to *Tetranychina* in the structure of the palpus and the leg-joint proportions, but differs from this genus in many respects. *Monoceronychus* is herewith described by the following characters:

Body flattened, twice as long as wide, bearing dorsally 16 clavate-foliaceous setae, and on caudal margin 6 similar setae, these all borne on tubercles; a suture separating cephalothorax from abdomen. Two eye corneae on each side even with coxae II. A restricted plate projecting from the anterior margin of cephalothorax, bearing a median finger-like process, and laterally 2 strong tubercles from each of which arises a foliaeceous seta. Legs I longest, but much shorter than body; tarsus I shorter than preceding joint. Tip of tarsus devoid of claws, but bearing 2 pairs of longish tenant hairs between which arises a double series of short tenent hairs. Palpus evidently of 4 segments, the last forming a "thumb" to the third segment which is produced dorsoapically into a strong claw. Anus ventral, near caudal end; female genital opening just in front of anus.

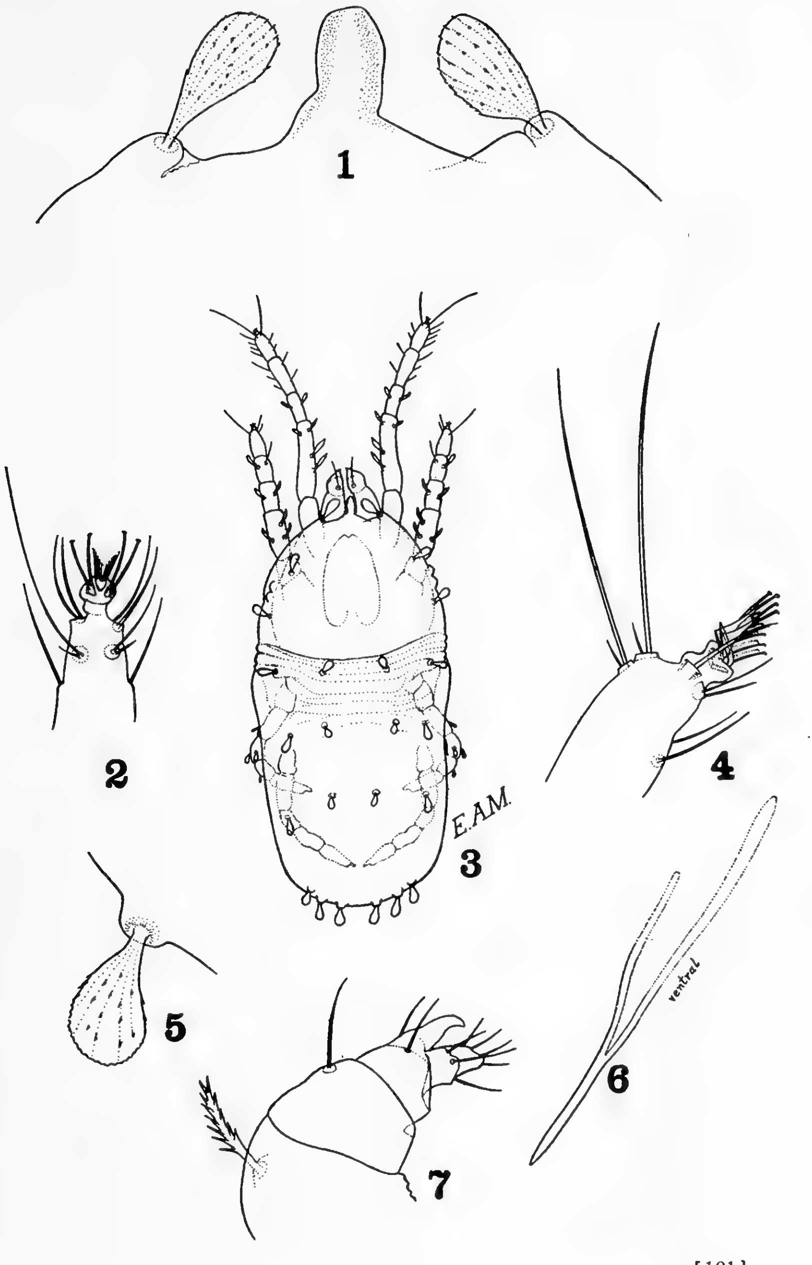
Genotype.—Monoceronychus californicus, n. sp.

Monoceronychus californicus, new species

Female.—Length, 0.33 mm. Much flattened mites, elongate-elliptical in outline, length to front of cephalothorax fully twice as great as width. Two eye corneae each side even with coxae II. Mandibular plate wide, subrectangular, tapering slightly in front to a blunt, notched tip. Cephalothorax between one-third and one-half as long as body, separated from abdomen by a suture; a series of transverse lines in the dorsal integument behind the main suture. Dorsal cuticular integument nonreticulated, but with weak, scattered striae. Sixteen widely clavate or foliaceous setae, arising from tubercles, on the dorsum in five transverse rows as follows: One over trochanters II, one behind the eyes,

Explanation of Plate

Monoceronychus californicus. Fig. 1, anterior plate of cephalothorax with two lobes bearing foliaceous setae, and median "unicorn." Fig. 2, tip of tarsus of female, viewed dorsally. Fig. 3, female mite, viewed dorsally. Fig. 4, tip of tarsus of right leg I of female, viewed laterally. Fig. 5, last seta at caudal tip of female. Fig. 6, penis, viewed laterally. Fig. 7, palpus of female, viewed laterally.


1
2
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ventral
7

a series of four behind the main suture, a series of four between legs III and IV, and a series of four even with the middle of legs IV; six foliaceous setae along the caudal margin of abdomen. The front margin of cephalothorax aberrant in that it bears medially a projecting, free, fingerlike process, and this is flanked on either side by a strong tubercle, bearing an ample feather- or scale-like seta. Legs I longest, but only about four-sevenths as long as body; other legs subequal, unusually short; the femur of leg I much the longest segment, tarsus I not longer than preceding segment. Tip of tarsus devoid of claws, bearing two pairs of longish knobbed tenent hairs between which is a pulvillus bearing a paired series of numerous shorter tenent hairs. Dorsoterminally the tarsi of legs I bear two tactile hairs, longer than the joint itself, and a very short spine-like seta arises close to the base of each of these. A collar trachea could not be discerned. Palpi evidently of four segments; the first bearing dorsally a strong, pectinate seta; the third segment produced dorsally into a strong claw, barely as long as the last segment ("thumb"); "thumb" bearing six or seven needle-like setae. Anus ventral, near caudal end; genital opening just in front of anus; anus bordered by three pairs of setae; four additional setae across caudal end of venter. Venter of rostrum with a pair of simple hairs anteriorly, and a similar pair of setae below coxae I.

Male.—Body outline resembling that of female. All setae of legs appear to be nonfoliaceous. Palpus lacking the hornlike spur dorsally, common with certain tetranychid mites. Penis with inner portion cylindrical, tapering backward to form the styliform distal portion.

Type slide, U. S. N. M. Cat. No. 1466.

The type material is from Laguna Beach, Calif., September 6, 1937, from tufted "salt grass," probably *Distichlis spicata* (L.) Greene, collected by the author.

MINUTES OF THE 552d REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, Feb. 1, 1945

The 552d regular meeting of the Society was held Thursday, February 1, 1945, at 8 P. M., in Room 43 of the National Museum. President Poos presided and there were 44 members and 20 visitors present. The minutes of the previous meeting were read and approved.

President Poos reported that at a meeting of the Executive Committee held on January 10, 1945, Mr. C. F. W. Muesebeck was selected as the nominee to represent this Society as Vice President of the Washington Academy of Sciences. At the last annual meeting Mr. Rohwer was chosen for this office. There was a misunderstanding as Mr. Rohwer is no longer a member of the Washington Academy and is, therefore, ineligible to represent this Society in the Washington Academy.

Mr. J. S. Wade and Mr. H. G. Barber were appointed by Dr. Poos to prepare for publication in the Proceedings an obituary notice of William T. Davis.

Capt. Willis W. Wirth of the U. S. Public Health Service was elected to membership in the Society.

Dr. P. N. Annand presented his address as retiring President: The Basis and Significance of Recent Developments in Entomology:

Dr. Annand stated that the war has brought about a tremendous development in the field of Entomology and of all sciences, in spite of shortages in personnel and materials. The factors which influenced this development were given as: 1) the urgency of the demand, which enabled all efforts to be channeled into the paramount problems of the armed forces and of war-time agriculture; 2) early recognition by the Army and Navy of the need for help, and their appreciation of the potentialities in recognized entomological agencies; 3) immediate utilization of results, with a corresponding stimulus to research and an unparalleled opportunity for quick testing and modification; 4) increased financing of entomological work; 5) the wide-spread and thorough cooperation between research agencies by which results of experiments became available to research workers as soon as known; 6) the thorough background in research developed during peace times, without which the startling increase in wartime results would have been impossible. Dr. Annand next discussed the activities of the Bureau of Entomology and Plant Quarantine with particular emphasis on their background of previous research. One of the first requests received was for detailed study and cataloguing of the insect vectors of disease in the various war theaters. and for the training of military personnel in the identification of mosquitoes. The Division of Insect Identification was able to meet this demand because of previous research available, and the successful results should gain increased support for world studies on the biology and taxonomy of mosquitoes. Testing technique in use at the Orlando Laboratory originated in work developed for other purposes, such as screwworm studies. The use of methyl bromide for louse control and the formulation of the MYL louse powder were based on prewar agricultural research. The basic patents in aerosols were applied for before Pearl Harbor. Interest has been aroused in new methods of insecticide distribution, especially in aerosols and in an expanded use of various types of aircraft. Dr. Annand reviewed briefly the development of airplane dusting and spraying since Houser's initial experiment against the catalpa sphinx in 1921. Efficient handling of military and agricultural war problems and widespread publicity were cited as reasons for the great improvement evident in the public attitude towards entomology. A continued demand for further research to adapt wartime discoveries to civilian needs may be expected. In conclusion, Dr. Annand said that "Science must have a past before it can have a future," and expressed the conviction that a national policy of self-protection requires the maintenance of research at a high level. (Secretary's Abstract.)

Dr. Cory expressed appreciation for the clear, comprehensive, and instructive review given by Dr. Annand. He spoke of the stress placed on the dependence of wartime entomological achievements on a background of fundamental training, and observed that if the war continues we will be from 7 to 8 years behind in the training of entomologists to replace those retiring. He urged concerted efforts to bring promising material into our colleges and to arouse the interest of the younger generation in Entomology.

Dr. W. T. M. Forbes of Cornell University presented the second paper on the regular program: The Basic Classification of the Lepidoptera:

In the most primitive Lepidoptera, many structures take a form quite unlike that normal for the order: In the Micropterygidae, the mouth parts are mandibulate, with a digestive system for handling solid food; the female reproductive system is very simple, the venation similar in both pairs of wings, and a larva not at all caterpillar-like, with antennae on the face and the vestige of a compound eye. In the development of the standard structure each organ system develops by itself, while other organs remain unchanged; in the Eriocraniidae the digestive system takes its final form, the reproductive system is transformed, with a piercing ovipositor, and the larva is of different type and habits, while the venation is wholly unchanged. Then with the Incurvariidae, the venation and caterpillar take their final form in all essentials, while the reproductive system remains the same; finally with the Tineidae it is again the reproductive system that takes its final form in turn, while by the wing alone it is impossible to separate a Tineid from an Incurvariid. The subdivision of the higher Lepidoptera is based on lesser points, the main structure having been standardized with the Tineidae. Originally Linnaeus made his subgenera of moths on the basis of characters of form of body, development of mouth parts and the like, which really reflected habits and ecology more than true relationships. After some abortive trial of palpal characters the late 19th century worked out a scheme based first of all on venation, and especially on the development and position of media (vein 5 of the Herrich-Schaeffer system) and the first anal (1c), with little consideration of body structures or early stages, even after Packard, Dyar and Chapman had put many of these characters on record. In fact two or three very recent textbooks still present what are essentially slight improvements of this system. A modern classification must consider also the tympanum and chaetosema, perhaps put more emphasis on the arrangement of the subcosta (vein 8) and cell of the hind wing, the upright or "flat-type" egg, arrangement of larval setae and hooks on the prolegs, and incomplete (active) and obtect (essentially immovable) type of pupa. Examples cited were the association of the Notodontidae with the Noctuidae and many other families, on a combination of egg, larval and tympanal characters; the grouping of the Thyatiridae and Drepanidae on tympanum, supported by larva and pupal texture; similarly of the Uraniidae and Epiplemidae, which have a curious sexually divergent type of tympanum, the Cossidae. Tortricidae and Castniidae by their practically identical early stages. However, the Pyralididae and Geometridae, with identical tympanum, are obviously not related. It was noted that the tympanum, while in structure an auditory organ, must on account of its very few end-organs and complex resonators, have some function not that of ordinary hearing;—and it is believed to be an organ to pick up the reflection of the wing-beat from walls and obstructions, thus giving a guide to safe flight. (Author's Abstract.)

There was discussion by Snodgrass, Heinrich, and others.

The following visitors were introduced to the Society: Major and Mrs. Abbott Kagan; L. I. Hewes. Two members were also requested to rise: C. M. Gjullin from Portland, Oregon, and the new member, Capt. W. W. Wirth.

The meeting adjourned at 9:35.

INA L. HAWES,
Recording Secretary.

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PROCEEDINGS OF THE

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A TAXONOMIC OUTLINE OF THE NEARCTIC SPECIES OF PACHYNEMATUS (Tenthredinidae, Hymenoptera)

By Herbert H. Ross

Illinois State Natural History Survey, Urbana, Illinois

Sawflies reared in the last few years from wheat at Manhattan, Kansas, by Dr. R. H. Painter and associates have brought out information which requires a new approach to the taxonomy of the genus *Pachynematus.* This material demonstrated that several species exist in the *extensicornis* group which are easily differentiated on the basis of male genitalia but are remarkably similar in the female sex. Study of the other species in the genus has brought to light other segregates based primarily on these characters. It now appears necessary to base most identifications of the entire *extensicornis* group on characters of the males, and, at least for the present, certain species cannot be distinguished in the female sex. Following is a brief synopsis of the nearctic fauna of the genus. Types described in this paper are deposited in the Illinois Natural History Survey collection unless otherwise stated.

I wish to acknowledge my gratitude to Dr. B. D. Burks, Illinois Natural History Survey, Mr. E. T. Cresson, Jr., Academy of Natural Sciences of Philadelphia and Mr. R. A. Cushman, United States National Museum, for comparing specimens with types; and to the officers of the Academy of Natural Sciences of Philadelphia and the United States National Museum for placing facilities at my disposal on many occasions to study sawfly types in those institutions.

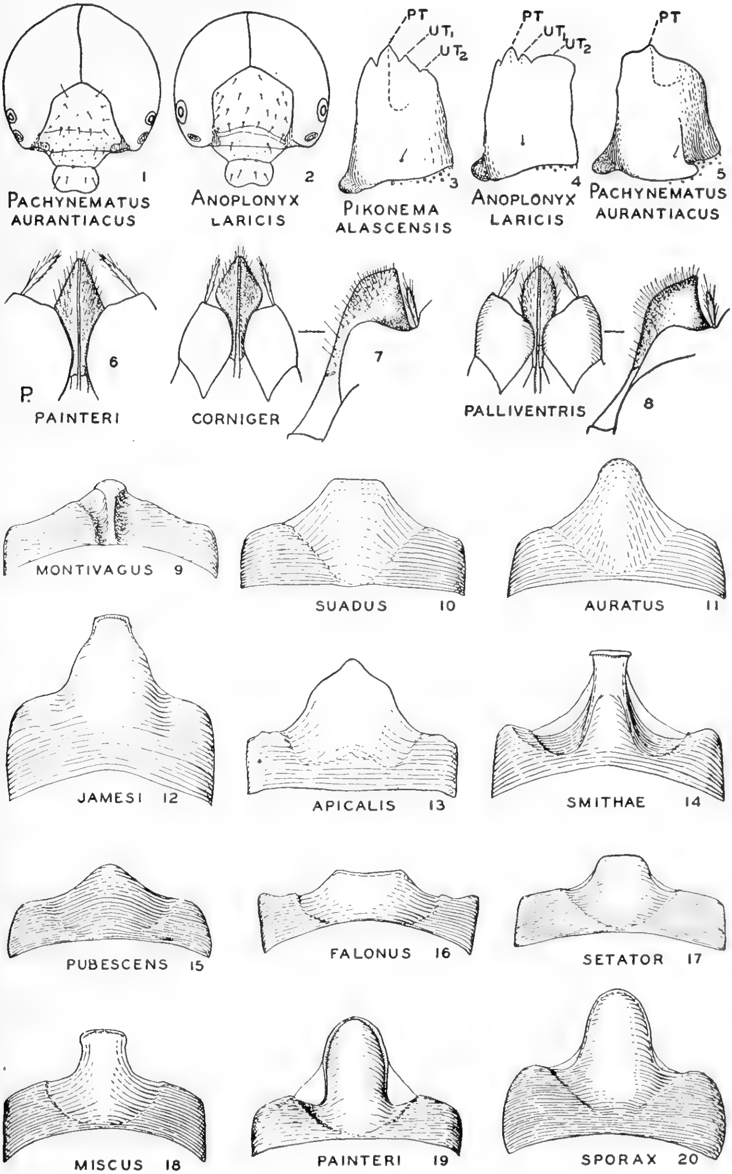
Rearing records for the genus are interesting, although few in number. The entire *extensicornis* group is apparently single brooded, the larvae appearing early in spring, soon becoming full grown, and aestivating during the summer. Adults appear early the following year. All reared species of this group feed on grasses; three species have been reared from wheat and it is probable that many more may attack this crop. Two species, *nigritibialis* and *pallidiventris*, appear considerably different in general appearance from the other species; the host of these two is not known. The *corniger* group appears restricted to *Carex* sedges and allied genera; some species, at least in Illinois, produce succeeding broods throughout the spring and summer.

The generic definition used here is that given by Ross (1937), with this modification. Certain small males of *Nematus* will key out to *Pachynematus* because the inner tooth of the tarsal claws is minute. These males may be separated readily from all species of *Pachynematus* by having no notch between the spur and lateral flap of the penis valves, fig. 21.

The larvae of *Pachynematus* belong to the group of nematine genera in which (1) the antennae are reduced to flat plates usually subdivided into crescentic platelets and (2) the apex of the abdomen is without a pair of dorsal points or protuberances. This group includes *Pachynematus*, *Pikonema*, *Amauronematus*, *Euura*, *Micronematus*, and *Anoplonyx*. *Pachynematus* differs from all of these in having no upper teeth on the left mandible, fig. 5, the entire corner of this mandible above the primary tooth forming a curved, even cutting edge. In all the other genera listed, two upper teeth are differentiated, figs. 3 and 4. In *Anoplonyx* one of these teeth, fig. 4 UT_2, is enlarged into a large ovate lobe. This lobe is somewhat similar in general appearance to the dorsal corner of the mandible of *Pachynematus*, but in *Pachynematus* UT_1 is not differentiated. *Anoplonyx* further differs in having the frons larger and parallel sided, fig. 2; in *Pachynematus* the frons is widened anteriorly, fig. 1. To date so few larvae are associated with adults that it is impractical to give a key to species.

Key to Species or Groups of Adults

1. Apex of abdomen with undivided sternites (males) 2
   Apex of abdomen divided on venter by a saw (females) 16
2. Procidentia of 8th tergite with a definite high ridge or carina at least on basal portion, fig. 9 .... *corniger group*
   Procidentia without a carina, figs. 10–20 .... *extensicornis* group, 3
3. Head and most of mesothorax reddish-yellow; procidentia similar to fig. 10 .... *thoracicus*
   Head and thorax almost entirely black 4
4. Head and body clothed with long, black hair which is longer than width of femora; procidentia only indistinctly set off, fig 15 .... *pubescens*
   Head and body with short hair; procidentia well differentiated, figs. 11–14, 16–20 5
5. Procidentia long, narrow and truncate, with the tip thickened and raised, fig. 14; penis valve as in fig. 28 .... *smithae*
   Procidentia wider or shorter, figs. 11–13, 16–20 6
6. Procidentia long, wide at base and with sinuate sides, apex pointed or rounded, figs. 12, 13, the whole somewhat trianguloid in general outline 7
   Procidentia more regular sided, fig. 11, or narrowed at base, fig. 19 8
7. Procidentia with extreme tip pointed, fig. 13, penis valve with spur and apex of lateral flap short, fig. 26 .... *apicalis*



Figs. 1 and 2.—Larval heads, anterior aspects; 3–5.—Left larval mandible, lateral aspect. PT–principal tooth, UT–upper tooth; 6–8.—Female sheaths of *Pachynematus*, ventral and lateral aspects; 9–20.—Procidentia of *Pachynematus* males.

Procidentia with extreme tip wider and rounded, fig. 12; penis valve with spur and apex of lateral flap long, narrow, and pointed, fig. 27 *jamesi*

8. Procidentia long and somewhat conical, tapering evenly to a round apex, fig. 11; penis valve as in fig. 25 .... *auratus*
Procidentia not at all conical, figs. 10, 16–20 9

9. Wings with basal half dark, abdomen frequently reddish yellow; procidentia long, fig. 10 .... *suadus*
Wings entirely hyaline; procidentia either shorter, fig. 16, or more parallel-sided, figs. 17–20 10

10. Procidentia very long, the apex round, figs. 19, 20 11
Procidentia shorter, apex more truncate, figs. 16–18 12

11. Penis valve with spur narrow, apical lobe of lateral flap scarcely produced, fig. 35 .... *painteri*
Penis valve with spur longer and stout, apical lobe of lateral flap long and narrow, fig. 34 .... *sporax*

12. Procidentia very broad and short, fig. 16; penis valve wide, spur slender and well separated from apex of lateral flap, fig. 31 ...... *falonus*
Procidentia longer and narrower, fig. 17; penis valve otherwise 13

13. Penis valve with spur very long, reaching to base of cleft, and mesal flap produced as a long, slender point, fig. 29 .... *setator*
Penis valve either with spur not reaching base of cleft, fig. 30, or mesal flap rounded at apex, fig. 33 14

14. Penis valve with spur slender for its entire length; mesal flap wide and angling fairly abruptly from body of valve; lateral flap with large body below spur, fig. 32 .... *miscus*
Penis valve with spur stout at base; mesal flap curving evenly from body of valve; lateral flap with only small body below spur, figs. 30, 33 15

15. Penis valve, fig. 30, with ventral margin nearly straight, base of lateral flap truncate, apex of mesal flap sharp .... *extensicornis*
Penis valve, fig. 33, with ventral margin markedly sinuate, base of lateral flap acutely angled, apex of mesal flap round .... *uvator*

16. Ventral aspect of sheath forming a wide, short, diamond-shaped apical head, fig. 7 .... *corniger* group
Ventral aspect of sheath with apex longer and not markedly constricted at base, fig. 6, 8 .... *extensicornis* group, 17

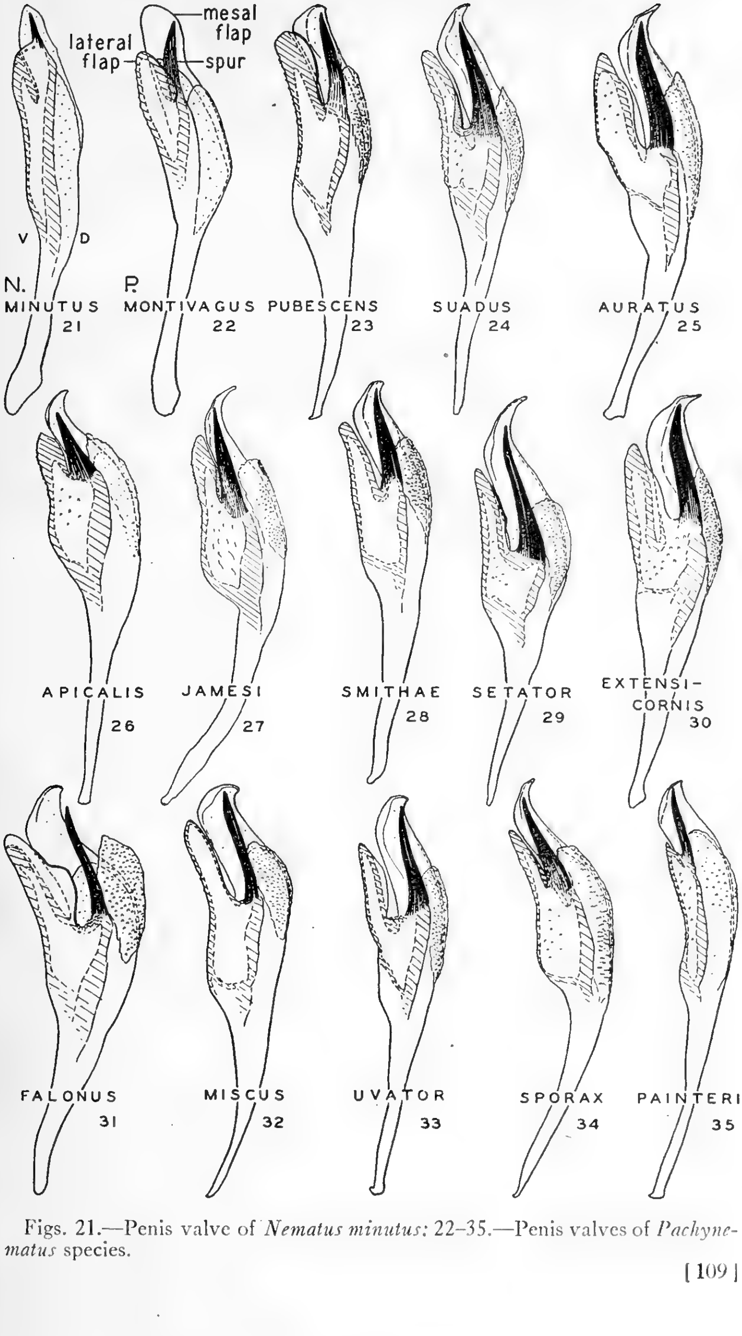
17. Stigma brown 18
Stigma straw-color, transparent 21

18. Dorsum almost entirely black 19
Dorsum with most of head and much or nearly all of mesonotum yellow 20

19. Hind femora mostly black .... *palliventris*
Hind femora pallid except for a slight darkening at base.... *clypeatus*

20. Hind tibiae and tarsi and apical third of hind femur black, rest of legs yellow; each lobe of mesonotum with a black patch.... *nigritibialis*
Hind tibiae and all femora yellow; mesonotum with black mark only on scutellum .... *auratus*

21. Mesonotum and mesopleura entirely black ...... *absyrtus*, *coloradensis*, *painteri*, *academus*, *ater*, *graminis*.



Figs. 21.—Penis valve of *Nematus minutus;* 22–35.—Penis valves of *Pachynematus* species.

Mesonotum with at least borders of praescutum pallid, with part or all of mesopleura yellow 22

22. Base of wings stained with yellow; dorsum of abdomen with an apical yellow band on each segment, sometimes with apical segment entirely yellow . . . . *suadus*

Wings hyaline over entire area; abdomen with banding absent or with several basal tergites entirely black . . . . *painteri, extensicornis, apicalis, setator, pleuricus, robinsonae.*

Extensicornis Group

This group is characterized by a uniformly tapering sheath in the female, figs. 6 and 8; in the male the procidentia is large, convex but not carinate, figs. 10–20, and the penis valve has a long spur and a mesal flap curved dorsad at apex, figs. 23–35. This aggregate corresponds roughly with Marlatt's Group II in his revision of the genus in 1896; this Group II was based on the relatively swollen female head of most of the species considered. The male genitalia and female sheath indicate, however, that this head character does not separate all the species along phylogenetic lines.

Pachynematus pubescens Marlatt

Pachynematus pubescens Marlatt, U.S.D.A., Div. Ent., Tech. Series, Bull. 3:100; 1896. ♀

Pachynematus venustus MacGillivray, Calif. Acad. Sc. Proc. 11(14) (4th series): 190; 1921. ♂, ♀. *New synonymy.*

Pachynemateus vernus MacGillivray, Calif. Acad. Sc. Proc. 11(14) (4th series): 191; 1921. ♂. *New synonymy.*

The body of the male is almost entirely black; the female is also predominantly black with reddish brown areas behind the eyes, on the mesopleura and along the edges of the mesonotal sutures. In both sexes the body is clothed with long, shaggy hair, much longer than in any other member of the genus. Other species may have relatively long hair, however, so that this single character must be used on a comparative basis. The male procidentia, fig. 15, is the simplest one in the genus.

Known from Alaska and New Hampshire, probably occurring across the entire subarctic portion of North America.

Pachynematus suadus (Cresson)

Nematus suadus Cresson, Amer. Ent. Soc. Trans. 8:10; 1880. ♀.

Pachynematus infumatus Marlatt, U.S.D.A., Div. Ent., Tech. Series, Bull. 3: 107; 1896. ♂. *New synonymy.*

Pachynematus refractarius MacGillivray, N. Y. Ent. Soc. Jour. 29:31; 1921. ♀. *New synonymy.*

Unusual color variation is exhibited by the male of this species, the abdomen varying from entirely black to entirely rufous; some of the intergrating forms have a banded appearance. The female is predominantly yellow with dark markings as outlined in the key.

Known from Alberta, Illinois, Indiana, Maine, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New York, Saskatchewan, South Dakota, and Wisconsin.

Pachynematus thoracicus Marlatt

Pachynematus thoracicus Marlatt, U.S.D.A., Div. Ent., Tech. Series, Bull. 3: 108; 1896. ♂.

Known only from the type, from Montana. As pointed out by Marlatt, there is a possibility that this is a gynandromorph. The procidentia is similar to fig. 10, and the wings are hyaline. This type is very similar in color to the female of *auratus*, but the procidentia is almost identical with that of *suadus*.

Pachynematus auratus Marlatt

Pachynematus auratus Marlatt, U.S.D.A., Div. Ent., Tech. Series, Bull. 3: 99; 1896. ♂, ♀.

The bright yellow head and thorax of the female contrast markedly with the brown venation and black antennae and dorsum of the abdomen. The male is mostly black, distinguished by characters of the procidentia, fig. 11, and penis valves, fig. 25.

Known from Illinois, Indiana, Iowa, Kansas, Montana, and New York.

Pachynematus apicalis Marlatt

Pachynematus apicalis Marlatt, U.S.D.A., Div. Ent., Tech. Series, Bull. 3: 107; 1896. ♂.

Female.—Length 7 mm. Head light yellow with eyes, antennae and small dots around ocelli black; thorax pallid with pectus, pro- and metapleura, central area on praescutum, scutal lobes, and posterior half of scutellum, black; abdomen black above, pallid beneath; sheath black; legs pallid with base of coxae, base of femora and most of tibiae brown; wings hyaline, veins dark brown, costa and stigma pallid.

Allotype, female.—Cheyenne Co., Kansas, May 12, 1939, reared from wheat, R. H. Painter.

The curious procidentia, fig. 13, separates this species from others in the genus. The short spur and apex of the lateral lobe of the penis valve, fig. 26, indicate this as one of the more primitive members of the genus. The female is extremely similar to that of *extensicornis* and others.

Reared from wheat; known from Colorado, Kansas, Montana, and Texas.

Pachynematus jamesi, new species

Male.—Length 8 mm. Color black with the following parts brownish yellow: labrum, mandibles, irregular areas behind eyes, edges of pronotum, tegulae, femora beyond middle, most of tibiae, irregular areas on tarsi and apical sternite and tergite of abdomen; wings entirely clear, most of veins dark brown, costa and stigma pallid. General structure typical for group. Procidentia, fig. 12, large, projecting far beyond tergite, its sides sloping and sinuate, its apex fairly broad and truncate. Apical sternite somewhat triangular at apex, the tip almost truncate. Penis valve, fig. 27, curved; the mesal flap elongated, narrow, tapering to a very narrow tip; lateral flap with a broad and rectangular base, the spur stout and long, the apical lobe long and finger-like with a wide sclerotized margin, and stiuated very close to the spur.

Holotype, male.—Boulder, Colorado, May 28, 1933, M. T. James.

This species is most closely related to *apicalis* from which it is differentiated by the more elongate parts of the penis valves. A few females collected at Boulder may be this species, although taken on different dates from the holotype. They agree fairly well with the description given above for the female of *apicalis*.

Pachynematus extensicornis (Norton)

Nematus extensicornis Norton, Bost. Soc. Nat. Hist. Proc. 8:159; 1861. ♂.
Nematus marylandicus Norton, Ent. Soc. Phil., Proc., 3:7; 1864. ♀.
Nematus aureopectus Norton, Amer. Ent. Soc. Trans., 1:219; 1867. ♀.
Pachynematus affinis Marlatt, U.S.D.A., Div. Ent., Tech. Series, Bull. 3:97; 1896. ♂, ♀. *New synonymy.*
Pachynematus tritici Marlatt, ibid., 106. ♂. *New synonymy.*

Norton's two species *marylandicus* and *aureopectus* are placed according to traditional usage; the types are lost or damaged beyond recognition. This is one of the commonest and most widespread species in the genus. Frequently the larvae are found in abundance early in spring feeding on wheat.

The male is predominantly black, with irregular small areas of yellowish brown, similar to the following species. The procidentia is practically as in fig. 17; the penis valve is illustrated in fig. 30.

There is a considerable doubt as to the amount of variation in the color of the female. Collections to date indicate that the entire venter is usually yellow, sometimes with dark areas on the pectus. Specimens in which the pectus and pleura are mostly black with somewhat yellowish areas (similar in color to type of *pleuricus*) are apparently restricted to the northwestern part of the continent, and may or may not represent dark specimens of *extensicornis*. In addition to variation in color there is considerable variation in proportions of the female sheath.

Study of series from the same locality has shown all intergrades between the greatest extremes. There are at least four species which can not yet be separated from *extensicornis* in the female so that in this complex males are necessary for specific identification.

Known from Alberta, Illinois, Indiana, Kansas, Maryland, Massachusetts, Michigan, Montana, New Hampshire, New York, Ohio, Saskatchewan, Wisconsin, and Wyoming.

Pachynematus setator, new species

Male.—Length, 8 mm. Body black with small areas on the head and irregular areas on the knees, yellowish brown; wings entirely clear, veins brown. General structure typical for the group. Differences confined chiefly to the genitalia. Procidentia, fig. 17, of moderate length, the produced portion wide and truncate. Apical sternite triangular, the tip narrow and slightly emarginate. Penis valve, fig. 29, nearly straight, the foot slender; mesal lobe long, broad at base, the apex tapering, arcuate and tipped with a slender point; lateral flap with base short and wide, spur very long, its base reaching to the base of the mesal flap; apical lobe of lateral flap long, narrow and finger-like, separated from the spur by considerable distance.

Holotype, male.—Savoy, Illinois: April 10, 1930, Frison and Ross.

Paratypes.—ILLINOIS.—Champaign: April 10, 1930, Frison and Ross, 3 ♂♂. Chebanse: April 24, 1929, Frison and Ross, 1 ♂. Mt. Carmel: April 15, 1930, Frison and Ross, 1 ♂. Savoy: April 9–10, 1930, Frison and Ross, 5 ♂♂. Seymour: April 15, 1929, Frison and Ross, 1 ♂. Urbana: April 16, 1929, T. H. Frison, 1 ♂. NEW YORK.—Potsdam: May 26, 1924, 1 ♂ (New York State Museum). OREGON.—D. Wilbur, 1 ♂ (Ohio State University).

This species is most closely related to *extensicornis*, differing markedly in structure of penis valves. In Illinois we have taken *setator* and *extensicornis* from the same localities. We have no positively associated males and females of *setator* but the female is undoubtedly present in the collection but not distinguishable as yet from *extensicornis*.

Pachynematus falonus, new species

Male.—Length, 8.0 mm. Color and general structure similar to preceding. Procidentia very wide, polished, and only slightly convex, wide and projecting only slightly beyond the rest of the tergite, fig. 16. Apical sternite moderately wide and somewhat triangular at apex. Penis valve, fig. 31, very broad and curved; mesal flap wide, the apex curved and slightly narrowed; lateral flap with basal portion small, spur long and narrow and well separated from apical lobe; this lobe is enlarged near base, beyond this suddenly narrowed to a thumb-like apex; the serrulate membrane dorsad of the spur is unusually prominent.

Holotype, male.—Edmonton, Alberta, May 15, 1930, E. H. Strickland.

This species is related to *extensicornis*, but differs from this and all other species in the curious, wide procidentia and unique shape of the penis valves.

Pachynematus miscus, new species

Male.—Length 7.5 mm. Color and general structure similar to preceding; differences confined chiefly to the genitalia. Procidentia, fig. 18, convex, fairly narrow, somewhat parallel sided, polished and with the apex nearly truncate. Penis valve, fig. 32, with mesal flap wide, blunt and slightly curved at apex; lateral flap with a large rectangular basal portion, and with a long and very narrow spur which is well separated from the long apical lobe; this lobe has a few minute teeth along its ventral margin and is pointed at its tip.

Holotype, male.—Corvallis, Oregon, March 24, 1926.

Paratype.—San Francisco, California, March 25, 1926, 1 ♂, (California Academy of Sciences).

The species is closely related to *falonus*, but differs in the rectangular base, more slender spur and longer apex of the lateral flap of the penis valve. No females have been associated with these males.

Pachynematus uvator, new species

Male.—Length 8.0 mm. Color black with brownish yellow areas on knees and apex of abdomen, and all tibiae slightly more yellow. General structure typical for group. Procidentia of moderate length, polished, truncate at apex, its general shape as in fig. 18. Apical sternite long, the apex somewhat triangular, the tip rounded. Penis valve, fig. 33, moderately narrow; mesal flap sinuate, its apex stocky; lateral flap with spur and apical lobe both long and slender, far apart even at base; foot of valve long.

Holotype, male.—Bountiful, Utah, May 12, 1929, H. J. Pack.

Paratypes.—BRITISH COLUMBIA.—Vernon: April 26, 1908, 1 ♂ (Canadian National Museum). WASHINGTON.—Pullman: April 18, 1929, 1 ♂; May 10, 1910, 1 ♂.

This species is closely related to *extensicornis*, differing in the shape of the penis valves. To date no females have been associated with the above males.

Pachynematus sporax, new species

Male.—Length 8.0 mm. Color and general structure similar to *setator;* diagnostic differences apparently confined to genitalia. Procidentia, fig. 20, long, rounded, and margined at apex, base less constricted than in the following. Apical sternite moderately long and rounded at apex. Penis valve, fig. 34, stocky, markedly curved, base slender; mesal flap slender, slightly pointed at tip; lateral flap with a deep incision, spur fairly long and stout at base, apical lobe long and slender, its ventral margin scarcely serrate; body of lateral flap more or less rectangular.

Holotype, male.—Parma, Idaho, 2224 ft. elevation, May 5, 1927, C. Wakeland.

Paratypes.—IDAHO.—Lenore: May 19, 1937, alt. 1000 ft., C. C. Ball, 1 ♂. Lewiston: April 15, 1937, alt. 550 ft., R. E. Miller, 1 ♂. OREGON.—Medford: April 1, 1918, L. G. Gentner, 1 ♂. SASKATCHEWAN.—Saskatoon: May 8, 1939, K. M. King, 1 ♂ (Canadian National Museum). WASHINGTON.—Pullman: C. V. Piper, 1 ♂; June 8, 1907, 1 ♂.

The male of this species is readily separated from *uvator* and *miscus* by the long procidentia and the short spur of the penis valve; these three species (and probably others) occur in the same localities and it is not yet possible to associate females with the different males.

Pachynematus painteri, new species

Male.—Length 7.5 mm. Color in general black, with apex of femora, all tibiae, basal tarsal segments, and apex of abdomen, straw-color; head with slight reddish marks behind eyes; wings hyaline, costa, radial stem and stigma, straw-color, remainder of venation brown. General structure typical for group. Procidentia, fig. 19, long, broad, rounded and margined at apex, slightly constricted at base. Apical sternite long, narrow and evenly rounded at apex. Penis valve, fig. 35, very narrow and slightly curved; mesal flap wide, evenly rounded on ventral quadrant; lateral flap very narrow, with a long, slender spur which projects a considerable distance beyond the very small and narrow apico-ventral lobe, which has its ventral margin minutely serrate.

Female.—Length 7.5 mm. Color black with a yellow pattern as follows: head yellow with antennae, ocellar area and posterior aspect black; thorax and abdomen black with edges of praescutum and scutum, anterior half of scutellum, indefinite area on mesopleura, and apex of abdomen yellow; legs yellow, with coxae and all but ends of femora black; wings as in male. General structure typical as for male. Sheath triangular, fig. 6. Paratypes show that the color varies considerably; the light areas may be more or less extensive than those outlined above.

Holotype, male.—Manhattan, Kansas, March 22, 1938, reared from wheat, R. H. Painter.

Allotype, female.—Same data.

Paratypes.—KANSAS.—Manhattan: March 22–24, 1938, R. H. Painter, 11 ♂♂, 10 ♀♀; April 5, 1938, 1 ♂; November, 1938, R. H. Painter, 3 ♀♀. Dickinson Co.: April 23, 1937, R. H. Painter, 1 ♂, 4 ♀♀; October 28, 1937, R. H. Painter, 1 ♂. Solomon: April 22–23, 1937, R. H. Painter, 1 ♂, 2 ♀♀. Lindsborg: April 23, 1937, R. H. Painter, 1 ♂, 3 ♀♀. All types reared from wheat. Paratypes are deposited in the collections of the Illinois Natural History Survey and Kansas Agricultural College.

The female of this species is extremely variable in color but smaller and stockier than most of the eastern species. The very small apical lobe of the penis valve is unique in the genus.

Pachynematus smithae, new species

Male.—Length 6.5 mm. Color black, with yellowish areas on head, legs and apex of abdomen as in *painteri*. General structure typical for genus. Procidentia, fig. 14, long, base wide, apex narrow and truncate, with a sharp carina across the tip. Apical sternite only moderately long, the tip sharp. Penis valve, fig. 28, straight and moderately robust; mesal flap short, the tip produced only slightly; lateral flap with basal portion fairly long and rectangular, spur long and apical lobe also long, the latter tapering gradually to a blunt and fairly narrow tip.

Holotype, male.—Mt. Washington, New Hampshire, 5200 ft., elevation, June 27, 1939, Marion E. Smith.

Paratypes.—NEW HAMPSHIRE.—Mt. Washington: 1 ♂ (Cornell University); same data as holotype, 1 ♂; same data but June 28, 1 ♂ (Mass. Agr. Coll.).

No other species of the genus exhibits a procidentia at all like this species. The penis valve resembles that of *suadus* in many respects but the procidentia is very different in that species.

Pachynematus nigritibialis Rohwer

Pachynematus nigritibialis Rohwer, Can. Ent. 41:17; 1909. ♀.

No males have ever been associated with this interesting species, so that its exact relationship cannot be determined. The habitus, sculpture, and sheath of the female seems typical for the *extensicornis* group. The striking color pattern has a bright reddish yellow ground color with antennae, eyes, spot around ocelli, large marks on each mesonotal sclerite, broad stripe on abdomen and all of pectus, black; the legs are yellow, with apex of hind femur and all of hind tibia and tarsus black.

Known from Illinois, Kansas, Michigan, Nebraska, New York, and Ohio.

Pachynematus clypeatus Marlatt

Pachynematus clypeatus Marlatt, U. S. D. A., Div. Ent. Tech. Series, Bull. 3:102; 1896. ♀.

This species seems to be quite distinctive although no males have been linked with it to date. The coloration is quite similar to *corniger* but the sheath is long, narrow and not constricted at base; the color is almost entirely black with the venter of the abdomen, many segments of the legs and other minor points whitish.

Known from Alberta, Manitoba, and Montana.

Pachynematus palliventris (Cresson)

Nematus palliventris Cresson, Amer. Ent. Soc. Trans. 8:5; 1880. ♀.
Pachynematus boulderensis Rohwer, U. S. Nat. Mus. Proc. 57(2312): 218; 1920. ♀. *New synonymy.*

The male of this interesting species is not known. The female is unique in the fairly long sheath, fig. 8, which is thick to near apex on the ventral aspect. In color it is very similar to small specimens of *corniger* which have the legs fairly dark, but *corniger* has a different type of sheath, fig. 7.

Distribution very widespread, known from British Columbia, Colorado, Massachusetts, Nevada, New York, Quebec, Rhode Island, and Wisconsin.

Unplaced Names—Extensicornis Group

Nine names belonging to the *extensicornis* group are known only from female types. No non-intergrading characters have been found either to separate these from each other and from other species of similar color, or to associate them definitely with males. For the present no specific diagnosis can be presented for them. They are listed here with bibliographic and locality data, and placed in the key to females at the point where they run out.

absyrtus MacGillivray, Univ. Ill. Bull. 20:27; 1923. ♀, Mary's Peak, Corvallis, Oregon.

academus MacGillivray, Univ. Ill. Bull. 20:27; 1923. ♀, Corvallis, Oregon.

ater (MacGillivray), *Messa*, Can. Ent. 25:238; 1893. ♀ (type apparently lost), Olympia, Washington.

coloradensis Marlatt, U. S. D. A., Div. Ent. Tech. Series Bull. 3:102; 1896. ♀, Colorado.

ebenus (Cresson), *?Aulacomerus*, Amer. Ent. Soc. Trans. 8:10; 1880. ♀, Colorado (Morrison).

graminis Marlatt, U. S. D. A., Div. Ent. Tech. Series Bull. 3:101; 1896. ♀, Nevada.

pleuricus (Norton), *Nematus*, Amer. Ent. Soc. Trans. 1:208; 1867. ♀, Colorado.

robinsonae (Rohwer), *Lygaeonematus*, U. S. Nat. Mus. Proc. 49:212; 1915. ♀, Boulder, Colorado.

sahlbergi Konow, Zeit. f. Hymen. 8:83; 1908. Type not seen; Alaska.

Corniger Group

The species comprising this assemblage are relatively uniform in morphological characters. The sheath, fig. 7, is shaped like a spearhead at apex; the procidentia is carinate at the base and usually expanded into a fan at apex, fig. 9; and the penis valve, fig. 22, has a stout spur of medium length, an ovate lateral flap which usually overlaps the spur slightly, and a rounded mesal flap. As is usual in the Nematinae, marked color differences exist between the two sexes of the same species. Reared species of this group feed on *Carex*. The *corniger* group as here used corresponds roughly with Marlatt's Group III of the genus. As pointed out before, the width of head is not a good criterion, the best being the sheath in the female, and procidentia and penis valves in the male. Color differences present fairly reliable differences between the females of the eastern species, but no characters have yet been found to separate the males. There is also some doubt regarding the status of three species described from the western states.

Key to Females of Eastern Species of Corniger Group

1. Abdomen almost entirely castaneous 2
   Abdomen with dorsum almost entirely black 3
2. Pectus and pleura entirely castaneous; stigma and costa uniformly amber yellow .... *rufocinctus*
   Pectus black, pleura either castaneous or black; stigma either entirely dark brown to black, or with lower portion shading to dark brown.... *aurantiacus*
3. Stigma and costa entirely translucent amber yellow .... *montivagus*
   Stigma dark brown, shading to black, costa sometimes with yellowish areas 4
4. Hind legs lemon yellow to straw color, frequently with apex of tibiae and femora brown or black; this dark area may cover the apical two-thirds of both tibiae and femora .... *corniger*
   Hind legs with femora rufous, tibiae either rufous or shading into black towards apex .... *corticosus*

Pachynematus aurantiacus Marlatt

Pachynematus aurantiacus Marlatt, U. S. D. A., Div. Ent., Tech. Series, Bull. 3: 95; 1896. ♂, ♀.

Pachynematus punctulatus Marlatt, U. S. D. A., Div. Ent., Tech. Series, Bull. 3: 103; 1896. ♀. *New synonymy.*

Pachynematus allegatus MacGillivray, Can. Ent. 55: 162; 1923. ♀. *New synonymy.*

The males of this species are usually entirely black but may have the abdomen castaneous. In the female, the thorax varies from entirely black with a few light marks on the scutum and scutellum, to almost entirely castaneous with the pectus black and a black mark in the center of each lobe of the mesoscutum. The species has been reared from Carex.

Known from Alberta, Illinois, Manitoba, Massachusetts, Minnesota, Montana, New Hampshire, New York, North Dakota, and Quebec.

Pachynematus rufocinctus MacGillivray

Pachynematus rufocinctus MacGillivray, Conn. Nat. Hist. Geol. Surv. Bul'. 22: 117; 1916. ♂, ♀.

Known only from the type series of two females and one male, from Orange and New Haven, Connecticut. The species is very similar in many color characteristics to light specimens of *aurantiacus* and may eventually prove to be the same.

Pachynematus montivagus Marlatt

Pachynematus montivagus Marlatt, U. S. D. A., Div. Ent., Tech. Series, Bull 3: 101; 1896. ♀.

This species is known only from the vicinity of the White Mountains and Durham, New Hampshire. The female is colored almost exactly like *pubescens*, with black body, straw colored legs, and pale stigma and costa. The male is similar in color, differing chiefly in dark shading at the bases of the femora. The genitalia of both male and female are typical of the *corniger* group.

Pachynematus corniger Norton

Pachynematus corniger Norton, Bost. Soc. Nat. Hist. Proc. 8: 159; 1861. ♂.
Pachynematus subalbatus Norton, Ent. Soc. Phil. Proc. 3: 7; 1864. ♀. *New synonymy.*
Pachynematus repertus MacGillivray, N. Y. Ent. Soc. Jour. 29: 31; 1921. ♀. *New synonymy.*
?*Pachynematus remissus* MacGillivray, N. Y. Ent. Soc. Jour. 29: 32; 1921. ♀.

Interpretation of the limits of variation of this species is open to serious question. Color of legs runs through a considerable range. In light forms the hind legs may be almost entirely lemon yellow, in darker forms the apices of hind tibiae and femora are brown, and in still darker forms the entire apical halves or two-thirds of both hind femora and tibiae may be black. The type series of *remissus* has only the basal fourths of the femora and tibiae pale. Size also is variable, ranging from 5.0 to 8.0 mm. to tip of abdomen. A few specimens with pale type legs also have the dorsal area of the mesopleura yellow. Intergradations connect these stages in color variation to such an extent that it seems advisable at present to consider the complex as a single species.

As defined above, the species is widely distributed over Canada and the northern half of the United States east of the Rocky Mountain Region.

Pachynematus corticosus MacGillivray

Pachynematus corticosus MacGillivray, N. Y. St. Mus. Bull. 47: 584; 1901. ♀.
Pachynematus roscidus MacGillivray, N. Y. Ent. Soc. Jour. 29: 31; 1921. ♀. *New synonymy.*

This species is very similar to *corniger* except for the red ground color of the legs. It is not as widespread southward as *corniger*, but is distributed through the north central and northeastern states and adjoining portions of Canada. Records are available for Alberta, Idaho, Illinois, Massachusetts, Michigan, Minnesota, Montana, New York, Ontario, and Quebec.

UNPLACED NAMES—CORNIGER GROUP

abdominalis Marlatt, U. S. D. A., Div. Ent., Tech. Series, Bull. 3: 104; 1896. ♀, Skokomish River, Washington, May 14, 1892, Trevor Kincaid.

carolinensis Marlatt, U. S. D. A., Div. Ent. Tech. Series, Bull. 3: 109; 1896. ♂, North Carolina.

koebelei Marlatt, U. S. D. A., Div. Ent., Tech. Series, Bull. 3: 108; 1896. ♂, Oregon.

robustiformis Rohwer, N. Y. Ent. Soc. Jour. 16: 108; 1908. ♀, Sierra Blanca, Costillo Co., Colorado, elev. 10,000–11,500 ft., June 22, 1907, L. Bruner.

robustus Marlatt, U. S. D. A., Div. Ent., Tech. Series, Bull. 3: 102; 1896. ♀, Montana.

SPECIES DESCRIBED OR PLACED IN PACHYNEMATUS, BUT HERE TRANSFERRED TO OTHER GENERA

hoodi Marlatt=*Pristiphora*
minutus Marlatt=*Nematus*
nevadensis Marlatt=*Nematus*
nigropectus Cresson=*Nematus*
occidentalis Marlatt=*Pristiphora*
orarius Kincaid=*Amauronematus*
oronus Kincaid=*Nematinus*
vernalis Rohwer=*Nematus*
wrangeli Marlatt=*Nematus*

CHARACTERS OF TAXONOMIC IMPORTANCE IN THE PRETARSUS OF AUCHENORHYNCHA (Homoptera)

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Before dealing with the subject indicated in the title the writer wishes to take this opportunity of correcting an error of lettering in figure 4 accompanying his paper on the morphology of the tegmina and wings in Fulgoroidea (*Proc. Ent. Soc. Wash.*, vol. 46, no. 7, plate 14). In this figure of the tegmen of *Mnemosyne arenae* Fenn. the anterior branch of the media has been incorrectly assigned to the radial sector, and the lettering of the apical veinlets of the radius and media should be as follows; R1, Rs, MP1, MP2, MP3a, MP3b, MP4a, MP4b.

In the present paper an attempt is made to assess the taxonomic significance of differences in the structure of the pretarsus in the four superfamilies of the Auchenorhyncha, principally with reference to the Fulgoroidea; to clarify the meaning of the terms used a brief account is offered below of the morphology of the pretarsus as found in this Series. The auchenorhynchous pretarsus (Figs. 5, 6) comprises (1) a pair of tarsal claws, or *ungues* (U), which articulate basally with a small condyle (C) projecting from the upper side of the apical margin of the third tarsal joint; (2) a membranous sac, the *arolium* (A) which is essentially an extension of the membrane at the apex of the tarsus between the tarsal claws, and (3) a strongly sclerotised *unguitractor plate* (P), which lies ventrally at the base of the arolium, being partly invaginated into the third tarsal joint. Distally the unguitractor plate is expanded into a broad line of fusion with the arolium; basally it is narrowed and connected to a sublinear plate (S) from which a long thread-like tendon passes through the leg to the femur, giving attachment to the levator and depressor muscles of the claws and of the tarsus. When the depressors are contracted the tendon pulls the unguitractor plate basad, and this in turn pulls on the lower portion of the base of the ungues, causing them to become deflexed, and also by tensing the plantar surface of the arolium brings its marginal lip into contact with the substratum. This lip is narrow and delicately corrugated at right angles to the margin; it is likely that it adheres under tension to surfaces too smooth to offer purchase to the ungues. The dorsal surface of the arolium is partly sclerotised, either in a single large plate or in a more or less elongated tract inside and basally closely adjoining each of the ungues (Fig. 15, DLP). The latter, together with the dorso-lateral plates and the plantar surface of the arolium may be ornamented with setae. The pretarsus of the fore and middle leg is generally larger than that of the hind leg, but is of similar structure. The pretarsus of the nymphal stages in general resembles that of the adult; in fulgoroid nymphs the dorsolateral aroliar sclerites may be absent or scarcely perceptible and the setae on the sides of the ungues fewer, while the fanlike folds of the upper surface of the arolium may be sclerotised and pigmented.

In his search for morphological characters whereby the Auchenorhyncha might be divided into natural groups Hansen in 1890 (Ent. Tidskr. 11:19–34) briefly considered the structure of the pretarsus, and after recording the principal features of this organ in a number of genera in the Cercopoidea, Fulgoroidea, Jassoidea and Membracoidea concluded that characters which distinguished major groups resided in the shape of the distal margin of the arolium and the apparent extent of the lateral attachment of the arolium to the ungues. With these two characters he was able to separate the "Cercopidae" (*sensu lato*), "Fulgoridae" (*s. l.*) and "Jassidae" (*s. l.*) the last including the Membracidae.

The present study was undertaken partly to test the applicability of Hansen's observations by using different material, but chiefly to seek new data which might illuminate major relationships in Auchenorhyncha, and in particular add to our scant knowledge of the affinities of the Tettigometridae. The material examined by the writer included the following: Cicadoidea: *Fidicina* sp.; Cercopoidea: *Tomaspis saccharina* Dist.; Membracoidea: *Horiola picta* Coq.; Jassoidea: *Oncometopia* sp., *Diestostemma* sp., *Tettigoniella lineata* (Sign.), *Graphocephala humeralis* Osb. *Platygonia praestantior* (Fowl.) (Tettigoniellidae), Fulgoroidea: *Euphyonarthex phyllostoma*, Schmidt, *Hilda undata* (Wlk.) (Tettigometridae), *Pintalia decorata* (Uhl.) (Cixiidae), *Syntames* sp., *Derbe semifusca* Fenn. (Derbidae), *Delphacodes teapae* (Fowl.), *Perkinsiella vitiensis* Kirk. (Delphacidae), *Nisia atrovenosa* (Leth.) (Meenoplidae), *Bytrois nemoralis* Fenn. (Kinnaridae), *Taosa herbida* (Wlk.), *Toropa ferrifera* (Wlk.), *Hyalodictyon truncatum* (Wlk.) (Dictyopharidae), *Laternaria laternaria* L., *Cathedra serrata* (F.) (Fulgoridae), *Catonia intricata* Uhl. (Achilidae), *Remosa cultellator* (Wlk.), *Cyphoceratops* sp. (Tropiduchidae), *Bladina fuscana* Stal, *Nogodina reticulata* (F.) (Nogodinidae), *Acanalonia* sp. (Acanaloniidae), *Colpoptera* sp., *Thionia musca* (Uhl.), *Ugoa glauca* Fenn. (Issidae), *Poekilloptera phalaenoides* (L.) and *Ormenis antoniae* Mel. (Flatidae) in the adult stage, and one or more nymphal stages of one Membracid, 3 Jassoids and the Fulgoroids *Ormenis* sp., *Colpoptera* sp., *Toropa ferrifera*, *Ugoa glauca* and *Alcestis* sp.

The pretarsal structure found in these species is shown in the accompanying figures: such examples as have been omitted are virtually identical in pretarsal structure with the species of the same family that is shown.

The morphological features which the writer considers to be of value in characterising superfamilies of Auchenorhyncha are summarised as follows:

Cicadoidea: *Ungues simple. Arolium reduced, bearing one or two plates in the middle line. Unguitractor plate subrectangular with distal margin transverse, with a narrower and distinct lobe basally, both ornamented with transverse rows of minute oval callosities.*

Cercopoidea: *Ungues with a decurved subapical tooth projecting from ventral margin. Arolium with a broad median plate dorsally, beset with three setae near each latero-apical angle; medially, distad of this plate, a long seta arising from a tubular base; ventrally a pair of oblique narrow sclerotised bands traversing plantar surface from unguitractor plate to margin, each bearing four long setae inserted in a row in its distal half; apical margin of arolium entire and transverse. Unguitrac-*

tor plate quadrangular, ornamented with minute oval callosities in oblique series.

Jassoidea and Membracoidea: *Ungues simple, ornamented with very distinct imbrication, overlapping arolium dorsally on their inner faces. Arolium exceeding ungues, medially cleft on distal margin, with two or three pairs of setae on plantar surface; dorsally a pair of subquadrate sclerotised plates each bearing a long seta. Unguitractor plate subfusiform, ornamented with minute oval callosities in oblique series.* It may prove possible to separate these superfamilies as follows:

Distal portion of unguitractor plate subquadrate, imbricate, not spiculate. Ungues bearing setae laterally............................Membracoidea

Distal portion of unguitractor plate conical, usually densely spiculate. Ungues devoid of setae..Jassoidea

Fulgoroidea: *Ungues simple, smooth, or ornamented with faint broad imbrication, not overlapping arolium on inner face, or scarcely so (Remosa), usually beset with setae laterally. Arolium rarely reaching to apex of ungues, distal margin entire, truncate; a pair of setae on plantar surface, a pair of more or less narrowed sclerotised rods or plates dorso-laterally, each loosely articulating basally with a minute projection on inner face of unguis at its basal third. Unguitractor plate elongate-triangular, distally expanded and truncate, ornamented with transverse ridges, somewhat trilobitiform.*

The structural differences exhibited by the pretarsus in various families are of much smaller magnitude than those in different superfamilies, but in Fulgoroidea, the only superfamily whose families have been compared in this regard with any degree of completeness, they appear sufficiently distinct to provide corroborative evidence in settling the affinities of puzzling genera. It is likely that pretarsal structures will be found to be of similar value in the Jassoidea. The features at present considered likely to be constant in various families of Fulgoroidea are respectively as follows:

Arolium approximately reaching to apex of ungues, dorso-lateral sclerites broad, prominent: Tettigometridae; *one or two spines on each unguis, or none, dorsolateral sclerites slender, straight or curved, arolium sometimes narrowed*: Cixiidae, Delphacidae, Derbidae, Meenoplidae, Kinnaridae; *dorsolateral sclerites narrow, rather long, tapering distally, distinctly articulated at base with condyle on unguis; unguis with three or four setae*: Dictyopharidae; *ungues large, arolium and dorsolateral sclerites reduced*: Fulgoridae *pars*; *dorsolateral sclerites two-thirds length of ungues forming a deep* V: Tropiduchidae; *ungues stout, bi- or tri-setose, dorsolateral sclerites relatively small*: Acanaloniidae, some Issidae; *dorsolateral sclerites broad, curved, placed laterally rather than dorsally*: Achilidae; *ungues tri- or quadrisetose, dorsolateral sclerites rather broad, placed laterally to a marked extent and only partially seen in dorsal view*: Nogodinidae, Flatidae.

The pretarsal structure in all the species examined agrees well with such details as are given by Hansen for his material in corresponding families, and there appears good reason to believe that the structural patterns noted for each superfamily will be found in all included species. The most interesting single fact which has emerged in the present study is that in the Tettigometridae the pretarsus is of orthodox fulgoroid structure. It would seem on present evidence that a pair of setae on the plantar surface of the arolium, dorsolateral sclerites devoid of setae, and a triangular and transversely ridged unguitractor plate constitute the most fundamental of all fulgoroid characters, transcending in their universality both the presence of tegulae and the non-segmented condition of the antennal flagellum. If it be supposed that the general patterns typical of the other superfamilies are no less fundamental, the fact that the jassoid and membracoid types are almost indistinguishable would indicate that these groups are far more closely allied than is revealed by their present status as separate superfamilies.

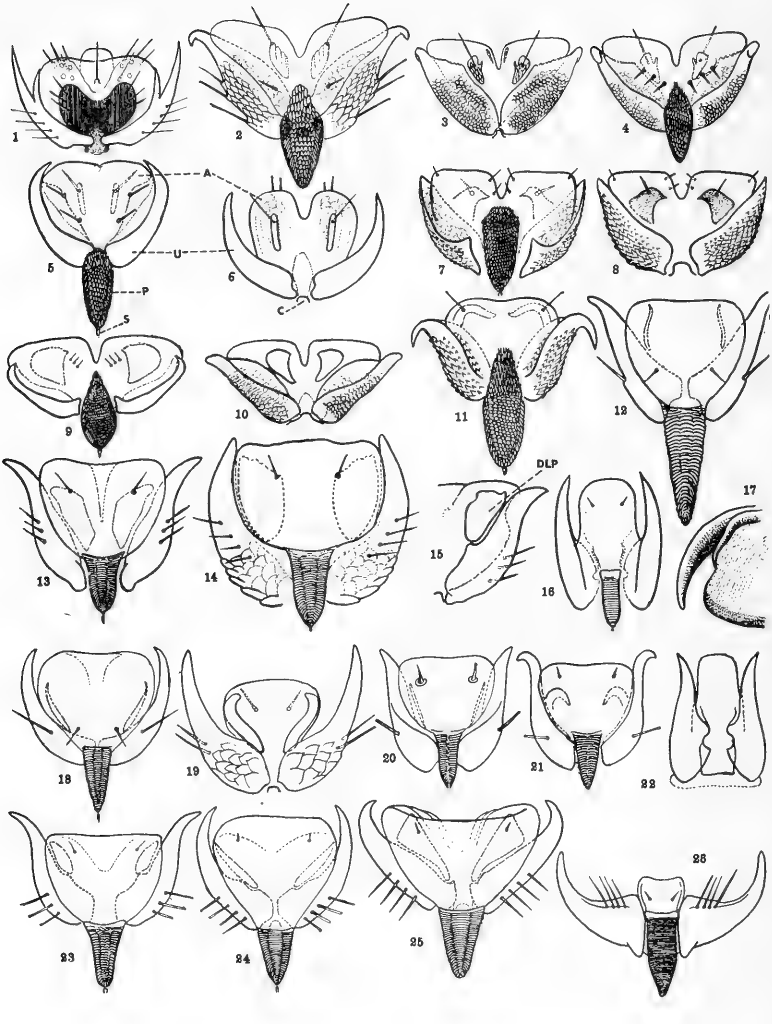
The minor structures which serve to distinguish families or groups of families show a certain degree of plasticity for which due allowance must be made in assessing the value of resemblances in pretarsal structure between families. If the varying degrees of curvature of the dorsolateral sclerites, and in two families the narrowing of the arolium are ignored, the Cixiidae, Delphacidae, Derbidae, Meenoplidae and Kinnaridae share a common type of pretarsus, from which that found in the Dictyopharidae is not greatly different. In the most generally accepted classification of the Fulgoroidea, that of Muir, the first three of these families fall into a group which is separated from that which contains the last three by the great fission (considered as having arisen only once) between the simple tubular aedeagus and the invaginated aedeagus; if this be accepted, then the similarity of the pretarsus in the families listed above may indicate a natural relationship between the first three families, and also between the last three, but between these two sets the resemblance must be explained as being the result of parallel evolution.

In trying to trace evolutionary trends in a structure it is necessary to characterise a primitive or ancestral type. The writer is inclined to the view that such a type is reproduced in the nymphal stages of unspecialised Fulgoriodea, and includes merely the following elements: *Ungues simple, unisetose or unornamented; arolium well developed with two setae on plantar surface, dorsolateral sclerites absent or indicated merely as slight thickenings of the aroliar wall, without definite boundaries; unguitractor plate triangular, transversely ridged but ventrally convex in section rather than trilobed-convex.* On this view it is possible to regard the tri- or quadrisetose condition of the ungues and the condylar development on their inner faces as specialisations, while the presence of dorsolateral sclerites in close association with this condyle is a parallel specialisation. It is not possible to decide whether the broad form of dorsolateral sclerite or the linear form is more primitive, and the two forms occur respectively in the most generalised groups—the Tettigometridae and the Pintaliine Cixiidae.

The claim may be advanced that the simplified structure of the pretarsus in the family Fulgoridae (Fig. 26), which is not far removed from the generalised nymphal pattern, represents the most primitive of all pretarsi in adult Fulgoroidea. On balance, the writer considers that the fulgorid pretarsus has attained its present form as a result of specialisation in the direction of adaptation to environment, for the following reasons: (1) the arolium is greatly reduced, whereas in nymphal Fulgoroidea it is well developed; it is well developed in such generalised insects as Orthoptera, as well as in other orders. (2) the ungues are quadrisetose, while the ungues of nymphal forms, and of such generalised families as Tettigometridae, Cixiidae and Delphacidae are not more than bisetose, so that it may be presumed that those of Fulgoridae are specialised in this respect; (3) the dorsolateral sclerites of other adult Fulgoroidea appear in this family, on the basis of the forms examined, to be represented by an immobile, stiffened, but not pigmented, ridge at each lateral margin of the reduced arolium where it lies against the basal portion of the strongly divergent ungues: no such development is seen in nymphal forms, where the arolium is quite pliable and thin-walled in this region; (4) the nearest approach to the pretarsal proportions of the large Fulgoridae is found in the pretarsus of the equally large Cicadidae. This family has the arolium reduced, but on its narrow lower surface between the base of the ungues are one or two adventitious sclerites apparently not represented elsewhere in Auchenorhyncha. Both Fulgoridae and Cicadidae in the adult stage spend their time on the bark of trees, usually on surfaces that, microscopically considered, are roughened and uneven. It is suggested that the similar form of the pretarsi found in these two families has been reached independently by adaptation to the type of surface on which they are used, with relation to the stress to which they are subjected by the weight of the insect.

Explanation of Plates

1. *Tomaspis saccharina* Dist., pretarsus of hind leg of adult, dorsal view.
2. *Horiola picta* Coq., pretarsus of hind leg of adult, ventral view.
3. *Oncometopia* sp., pretarsus of hind leg of adult, dorsal view.
4. *Oncometopia* sp., do., ventral view.
5. *Tettigoniella lineata* (Sign.), pretarsus of hind leg of adult, ventral view.
6. *Tettigoniella lineata* (Sign.), pretarsus of hind leg of adult, dorsal view.
7. *Platygonia praestantior* (Fowler), pretarsus of hind leg of adult, ventral view.
8. *Platygonia praestantior* (Fowler), do., dorsal view.
9. *Diestostemma* sp., pretarsus of hind leg of adult, ventral view.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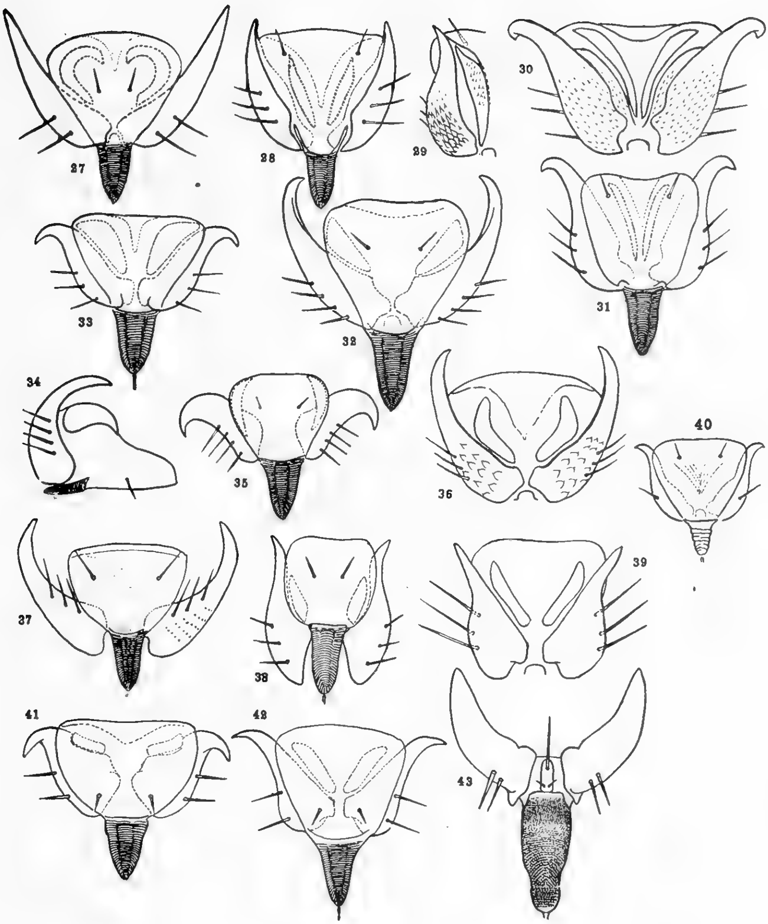
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10. *Diestostemma* sp., do., dorsal view.
11. *Graphocephala humeralis* Osb., pretarsus of hind leg of adult, ventral view.
12. *Pintalia decorata* (Uhl.), pretarsus of hind leg of adult, ventral view.
13. *Euphyonarthex phyllostoma* Schmidt, pretarsus of hind leg of adult, ventral view.
14. *Hilda undata* (Wlk.), pretarsus of hind leg of adult, ventral view.
15. *Euphyonarthex phyllostoma* Schmidt, one side of hind pretarsus of adult, dorsal view.
16. *Delphacodes teapae* (Fowl.), pretarsus of hind leg of adult, ventral view.
17. *Syntames* sp., pretarsus of hind leg of adult, one half shown, viewed semilaterally.
18. *Syntames* sp., pretarsus of hind leg of adult, ventral view.
19. *Derbe semifusca* Fenn., pretarsus of hind leg of adult, dorsal view.
20. *Nisia atrovenosa* (Leth.), pretarsus of hind leg of adult, ventral view.
21. *Bytrois nemoralis* Fenn., pretarsus of hind leg of adult, ventral view.
22. *Delphacodes teapae* (Fowl.), pretarsus of hind leg of adult, dorsal view.
23. *Hyalodictyon truncatum* (Wlk.), pretarsus of hind leg of adult, ventral view.
24. *Toropa ferrifera* (Wlk.), pretarsus of hind leg of adult, ventral view.
25. *Taosa herbida* (Wlk.), pretarsus of hind leg of adult, ventral view.
26. *Cathedra serrata* (F.), pretarsus of hind leg of adult, ventral view.
27. *Catonia intricata* Uhl., pretarsus of hind leg of adult, ventral view.
28. *Cyphoceratops* sp., pretarsus of hind leg of adult, ventral view.
29. *Cyphoceratops* sp., do., dorsal view.
30. *Remosa cultellator* (Wlk.), pretarsus of hind leg of adult, dorsal view.
31. *Remosa cultellator* (Wlk.), pretarsus of hind leg of adult, ventral view.
32. *Nogodina reticulata* (F.), pretarsus of hind leg of adult, ventral view.
33. *Bladina fuscana* Stal, pretarsus of hind leg of adult, ventral view.
34. *Poekilloptera phalaenoides* (L.), pretarsus of hind leg of adult, side view.
35. *Poekilloptera phalaenoides* (L.), pretarsus of hind leg of adult, ventral view.
36. *Ormenis antoniae* Mel., pretarsus of hind leg of adult, dorsal view.
37. *Ormenis antoniae* Mel., do., ventral view.
38. *Acanalonia theobromae* Fenn., pretarsus of hind leg of adult, ventral view.
39. *Acanalonia theobromae* Fenn., do., dorsal view.
40. *Colpoptera* sp., pretarsus of hind leg of fifth instar, ventral view.
41. *Ugoa glauca* Fenn., pretarsus of hind leg of adult, ventral view.
42. *Thionia musca* (Uhl.), pretarsus of hind leg of adult, ventral view.
43. *Fidicina* sp., pretarsus of hind leg of adult, ventral view.

THE STATUS OF CORIMELAENA WHITE, 1839, EUCORIA MULSANT AND REY, 1865, AND ALLOCORIS McATEE AND MALLOCH, 1933 (Heteroptera: Pentatomidae)

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In 1933 McAtee and Malloch published A Revision of the Subfamily Thyreocorinae of the Pentatomidae (*11*). This truly monumental work removed this subfamily from the status of one of the least known and most difficult groups of all the Heteroptera to one of taxonomic order and stability which have been attained in few comparable subfamilies. However, during the course of a recent study of material in the United States National Museum collection and the Francis Huntington Snow collection at the University of Kansas, I have had occasion to review the grounds on which these authors dropped the name *Corimelaena* White and replaced it with *Allocoris* "nom. nov." The evidence at hand indicates that this action was not warranted and that *Allocoris* must become a synonym of *Corimelaena*. It might also be noted here that for reasons set forth in this paper the subfamily name Thyreocorinae is replaced by Eucoriinae.

Corimelaena White, 1839

Corimelaena was established in 1839 by Adam White (*2*, p. 539), *Tetyra lateralis* F. being designated as type. For the most part this generic name has been used for the American species of the group including *lateralis* (F.), or *gillettii* Van Duzee. In 1917 Van Duzee (*7*, pp. 13–17) cited all these species under the name *Thyreocoris* Schrank, 1801; however, in 1919 (*9*, pp. 206–207) Malloch stated that *scarabaeoides* (L.), the type of *Thyreocoris*, is not congeneric with the American species and reestablished *Corimelaena* for these species except those which he placed in his new genus *Cydnoides* and in *Galgupha* A. & S. This arrangement was followed by all workers except Horvath, 1919 (*9*, pp. 212–214) until McAtee and Malloch, 1933 (*11*, p. 358). In the latter paper it was contended that the genotype of *Corimelaena*, *Tetyra lateralis* F., is unidentifiable and *Allocoris* "nom. nov.," genotype *Corimelaena gillettii* Van Duzee, was employed for this group. In effect *Allocoris* was proposed as a new genus for what McAtee and Malloch treated as *Corimelaena* of authors. Thus it is evident that should *lateralis* be shown as identifiable and as an older name for *gillettii*, *Allocoris* and *Corimelaena* become isogenotypic through synonymy and *Corimelaena*, as the older name, must be accepted as the valid name of the genus.

The original description of *Tetyra lateralis* Fabricius, 1803 (*1*, p. 142), is as follows:

"T. atra, elytris albis: vitta lata atra. Habitat in Carolina. Mus. Dom Bosc.

"Statura parva T. pallipes. Corpus glabrum atrum, nitidum elytris solis albis: vitta lata atra, quae tamen apicem haud attinget. Alis vero complicatis sub scutello margo elytrorum albus tantum apparet. Ale albohyalinae."

Translated this reads:

Black, elytra white: vitta broad, black. Habitat, Carolina. Mus. Dom. Bosc.

In size, a small *T. pallipes*. Body glabrous, black, shining, the elytra alone white: a broad black vitta, which, however, scarcely attains the apex. Since the wings, indeed, fold under the scutellum, the margin of the elytra appears white thus far [exposed portion of elytra white]. Wings whitish hyaline.

McAtee and Malloch (11, p. 369) contend that this description cannot apply to a species "characterized by chiefly black elytra with the pale vitta strictly confined to the costa * * *" It is on the strength of this discrepancy that *lateralis* is declared unidentifiable. I believe this conclusion to be based upon a misinterpretation of Fabricius' description. That Fabricius based his description upon a specimen having the forewings entirely exposed is indicated by his remark, "Alis vero complicatis sub scutello." This happens frequently when a pin is thrust through the scutellum. When the wing is thus exposed it is possible to consider the coriaceous portion as white with a broad median black band pointed apically and not quite attaining the apex of the corium (see fig. 3). This condition is more pronounced in some individuals than in others, but normally there is a white band between the "black vitta" and the hyaline, membranous portion of the wing. McAtee and Malloch, by interpreting the description as applying to the wing in the normal resting position, failed to see the pale inner band which is then covered by the scutellum. Fabricius' further elaboration "margo elytrorum albus tantum apparet" can be explained only as an attempt to describe how he believed the wings would appear in a resting position. He erroneously believed they would be covered to the extent of those of ("*T. pallipes*") = *Brachyplatys testudonigra* (Degeer), with which he compares this species.

McAtee and Malloch also state that *lateralis* "may be a prior term for *pulicaria*"; however, Fabricius' statement, "In size, a small *T. pallipes*," eliminates this species from consideration. The species recognized by Stål, Signoret, Montandon, and others as (*Tetyra pallipes* F. = *Brachyplatys pallipes* (F.)) = *B. testudonigra* (Degeer) measures from 4 to 6 mm. in length. Two specimens in the United States National Museum collection, determined by Signoret, are 5.25 mm. in length. The species treated here as *lateralis* ranges from 3.0–4.5 averaging 4 mm. in length. *Pulicaria* averaging barely 3 mm., could hardly have been compared with "*T. pallipes*" in the above manner. All other species can be eliminated on grounds of description and distribution.

From the above discussion it would therefore seem that *lateralis* (F.) is identifiable and identical with the form considered by McAtee and Malloch as *lateralis* of authors, and for which they resurrected *gillettii* Van Duzee. It follows that, with *gillettii* Van Duzee a synonym of *lateralis* (F.), *Allocoris* and *Corimelaena* become isogenotypic through synonymy, and *Corimelaena*, as the older name, becomes the valid name of the genus.

EUCORIA Mulsant and Rey, 1865

Eucoria was established in 1865 by Mulsant and Rey (*3*, pp. 12–14) with *marginipennis* described at the same time as the only included species. Questionably placed by Puton, 1881 (*5*, p. 5), and Horvath, 1919 (*8*, pp. 212–213), *Eucoria* was declared unidentifiable by McAtee and Malloch, 1933 (*11*, p. 391). Again the problem is that of determining the identity of the genotype, here *marginipennis* Mulsant and Rey. Fortunately this species is much more adequately described than *Tetyra lateralis* F. and without doubt would have been definitely placed years ago except for uncertainty as to the origin of the specimen upon which the description was based and the general lack of knowledge concerning the subfamily.

Puton, 1881 (*5*, pp. 5–6), seems to have been the first to recognize the adventitious nature of the specimen involved, and pointed out that it was sent to Mulsant and Rey by a Mr. Wachanru "who dealt particularly with insects in imported products." He adds that he has a specimen of the same species in his collection "found in Marseilles in foreign wool" and that Mr. Signoret gave him "under the name of *Thyreocoris pulicaria* Germar, an insect from Brazil[1] identical to mine, but Mr. Reuter wrote me from Berlin that the type of Germar has spinose tibiae." Horvath, 1919 (*8*, p. 212), went so far as to use *Eucoria*, placing *Corimelaena marginella* Dallas, *C. extensa* Uhler, *Thyreocoris championi* Distant, *T. montanus* Van Duzee, and two new species here. Not mentioning Puton's work he stated that *Eucoria marginipennis* Muls. & Rey is the genotype and probably is a synonym of *Odontoscelis pulicarius* Germ.

[1]Undoubtedly a specimen of *Corimelaena tibialis* (F.). This species was confused by early workers, including Germar, with *pulicaria* (Germar). Mulsant and Rey's description of the antennae is sufficient, however, to distinguish *marginipennis* from *tibialis*.

From this action it appears, as Van Duzee, 1923 (*10*, p. 303), points out, that Horvath either overlooked *Corimelaena* White or did not believe *lateralis* and *pulicaria* to be congeneric.

McAtee and Malloch (*11*, p. 391) avoided the entire issue by declaring *marginipennis* unidentifiable. While admitting that the description "does for the most part agree" with *pulicaria* they pointed out that "tibia not spined" is one of the principal key characters of Mulsant and Rey's new genus, and, therefore, *marginipennis* could not be a *Corimelaena* in which the tibia is spinose. This line of reasoning breaks down at two important points. In the first place Mulsant and Rey qualify the statement made in the key when they say in their generic diagnosis "Cuisses et tibias inermes, ou à peu pres." Secondly it should be pointed out that they were using for comparison *Thyreocoris scarabaeoides* (L.) (see figs. 1 and 2). In this species the tibial spines are strongly developed, and when compared with *pulicaria*, where these spines are, for practical purposes, absent on the fore tibiae except at the apices and appear as little more than strengthened hairs on the remaining tibiae, it seems entirely possible that the expression femora and tibiae without spines or *nearly so* could be applied.

This premise being accepted, *marginipennis* is congeneric with *lateralis* in the sense used by White, therefore making *Eucoria* a synonym of *Corimelaena*. Once *marginipennis* is recognized as belonging in this genus, specific placement appears to be a relatively easy matter. The following descriptive remarks, translated freely, are selected from Mulsant and Rey's description as the bases for recognition of *marginipennis*.

Length, 2.8 mm.—width, 1.6 mm.; * * * Pronotum slightly curved along a line up to three-fifths of its lateral margin, sinuate between this point and the lateral angles, * * * elytra dirty white or reddish on the exocorium and the posterior half of the mesocorium, * * * the second (antennal segment) equal to a fifth of the third; * * * tibiae without spines or almost so.

Corimelaena pulicaria (Germar) and *C. championi* Distant are the only known species to which the characters set forth above would seem to apply. *C. pulicaria* is an exceedingly common species ranging from Massachusetts west to British Columbia and south to Guatemala. *C. championi* is known only from the type series described from Mexico. In view of these facts it is here submitted that *Eucoria marginipennis* Mulsant & Rey, 1865, is a synonym of *Corimelaena pulicaria* (Germar), 1839.

The recognition of *Eucoria* assumes additional importance since it involves the subfamily name Eucoriens Mulsant & Rey, 1865 (*3*, p. 11), which is the oldest supergeneric name used for this group of insects. The use of Thyreocorinae (McAtee

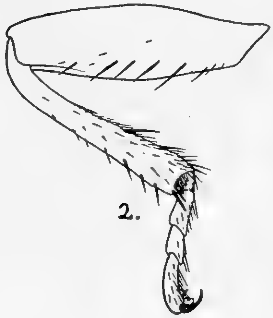

Fig. 1. Foreleg of *Thyreocoris scarabaeoides* (L); Fig. 2. Foreleg of *Corimelaena pulicaria* (Germar). Fig. 3. Section of forewing including coriaceous portion, *Corimelaena lateralis* (F.).

and Malloch as well as others) is based upon the principle of accepting the oldest known genus as the type. While this method of fixing family names has been vigorously advocated by a number of authors it is not obligatory (Opinion 133, International Commission for Zoological Nomenclature), and apparently most zoologists have not employed it. The usual procedure is to accept as type the genus on which the oldest supergeneric name (vernacular names not excluded) is based. Most authors, however, exclude such names if the genus involved now stands in synonymy. A recent development in supergeneric nomenclature, and one with which I concur as promoting ultimate stability, is that proposed by Sabrosky, 1939 (*12*, pp. 600–603), and followed by China, 1943 (*14*, p. 235), which would retain the family name when the type genus is a true synonym. Following this rule Eucoriinae, based on Eucoriens Mulsant & Rey, 1865, should be used instead of Corimelaeninae based on Corimelaenidae Uhler, 1871 (*4*, p. 471).

Summary of Synonymy

Eucoriinae Mulsant and Rey, 1865 (Eucoriens)
(=Corimelaeninae Uhler, 1871 (Corimelaenidae)), n. syn.
(=Thyreocorinae Van Duzee, 1907 (Thyreocoridae)), n. syn.

Corimelaena White, 1839
(=*Eucoria* Mulsant and Rey, 1865), n. syn.
(=*Allocoris* McAtee and Malloch, 1933)
Corimelaena lateralis (F., 1803)
(=*Allocoris gillettii* (Van Duzee, 1904))
Corimelaena pulicaria (Germar, 1839)
(=*Eucoria marginipennis* Mulsant and Rey, 1865), n. syn.

With the exception of the following species, the new combinations resulting from the synonymizing of *Allocoris* with *Corimelaena* have already been established by Torre-Bueno (*13*, pp. 191–196):

(*Allocoris corallina* McA. & M.)=*Corimelaena corallina* (McA. & M.)
(*Allocoris digitata* McA. & M.)=*Corimelaena digitata* (McA. & M.)
(*Allocoris elegans* McA. & M.)=*Corimelaena elegans* (McA. & M.)
(*Allocoris limata* McA. & M.)=*Corimelaena limata* (McA. & M.)
Allocoris gillettii subsp. *mexicana* McA. & M.)=*Corimelaena lateralis* subsp. *mexicana* (McA. & M.)
(*Allocoris micans* McA. & M.)=*Corimelaena micans* (McA. & M.)
(*Allocoris palmeri* McA. & M.)=*Corimelaena palmeri* (McA. & M.)
(*Allocoris signoretti* McA. & M.)=*Corimelaena signoretii* (McA. & M.)

Corimelaena tibialis (F.) (=*Allocoris tibialis* (F.)) is not a new combination, having been used by Uhler in 1886 (*6*, p. 2); however, his citation should be synonymized with *Corimelaena incognita* (McAtee and Malloch).

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A new name for Acantholoma Stal (Hemiptera: Scutelleridae). It has recently been shown in Neave's Nomenclator Zoologicus (vol. I, p. 16, 1939) that *Acantholoma* Stål, 1867 (Oefversigt Vetensk. Akad. Förhandl. XXIV: 491), is preoccupied by *Acantholoma* Castelnau, 1843 (Ess. Silur. Amér. Sept., p. 23) in Trilobita. *Acantholomidea* is therefore proposed as a new name for Stål's genus. *Acantholoma denticulata* Stål, 1870, is the genotype and only known species belonging to the genus.—R. I. Sailer.

NOTE CONCERNING SOLUBEA POSTPOSITA BERGROTH, 1914 (Heteroptera: Pentatomidae)

By R. I. Sailer,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The name *Solubea postposita* Bergroth, 1914 (Pentatomides Nouveaux de la Guyane Française; Ann. Soc. Ent. France 83: 427–429), was overlooked and failed to be accounted for in my paper, "The Genus *Solubea* (Heteroptera: Pentatomidae)" (Proc. Ent. Soc. Wash. 46 (5): 105–127, 1944). From Bergroth's description it seems clear that this name, proposed for a single female specimen collected in French Guiana, is a synonym of *Solubea poecila* (Dallas). His description indicates that the pronotum in his specimen was concolorous, and for this reason alone it is not surprising that he failed to identify it as *poecila*. Dallas' description of the latter species indicated the presence of two large, yellow, reniform spots on the pronotum. In addition *poecila* was still considered as belonging to the genus *Mormidea*, thus making it more unlikely that the true identity of his specimen would have been recognized by Bergroth.

Solubea poecila, as now understood, exhibits a high degree of variation in size, color, and development of the humeral spines. It is possible that with additional material from all parts of its range some explanation for this variation or some further division of the species will be possible. The specimen described by Bergroth as *postposita* would seem to represent, in the zoological sense, a reasonably typical form of the species.

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THE TROPIDUCHIDAE OF THE LESSER ANTILLES (Homoptera: Fulgoroidea)

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In 1881 Lethierry described two tropiduchid species (*triangulator* and *longiceps*) collected by M. Delauney in Guadeloupe, and referred them to the genus *Alcestis* Stål; his descriptions, however, leave no doubt that he was dealing with species belonging to two genera of the tribe Tambiniini. In 1895 Uhler, dealing with the Homoptera collected in St. Vincent by H. H. Smith, described the genus *Tangidia* with a new species, *alternata*, as the monotype, and two other new species, *angustata* and *emarginata*, which he placed in *Tangia* Stål and *Dictyophara* Germar respectively. Nineteen years later Melichar recognised the generic distinctness of *Tangia angustata* Uhler and in his monograph of the Tropiduchidae made this species the genotype of his new genus *Neotangia*, which was distinguished principally by its rather short rounded vertex, on which the median carina was forked in the basal half, by the absence of cross-veins along the costal margin, and by the tegminal veins Sc+R and M reaching the transverse nodal line before forking. Melichar did not include *Dictyophara emarginata* Uhl. in his monograph of the Tropiduchidae or in that of the Dictyopharidae. In 1931 Muir, after examining the material in the British Museum, placed this species in *Neotangia* Mel., considering it to be typical of the genus, and described a new species, *uhleri*, from Grenada, B.W.I., which he referred to *Tangidia* Uhl., though apparently with some hesitation, as he added the note "I doubt if *Neotangia* Melichar, will be able to stand apart from *Tangidia*." (1931 Ann. Mag. Nat. Hist. 10(7):306).

Such is the history of the species described from the Lesser Antilles. In the present paper reference is made to tambiniine genera known only from the Greater Antilles, these being *Remosa* Distant, *Neurotmeta* Guerin-Meneville, and *Cyphoceratops* Uhler, the second of which has Lesser Antillean representatives. *Remosa* was erected by Distant in 1906 to receive *Dictyophora cultellator* Walker from Santo Domingo, and in the following year Van Duzee considered that some specimens taken by him in Jamaica belonged to Walker's species, and he listed them as such under the combination *Tangia cultellator* (Wlk.). In the writer's collection there are several specimens of *Remosa* taken in the same locality which agree with Van Duzee's brief notes; these are close to *R. cultellator* (Wlk.) but not conspecific, and are placed below in a new species. The type of *Neurotmeta* Guerin-Meneville was fixed by Myers (1928) as *sponsa* Guerin-Meneville, and Metcalf and Bruner (1930) considered that *Monopsis viridis* Wlk. from St. Thomas, Virgin Is., belongs to *Neurotmeta.* The writer provisionally accepts this view, pending a detailed comparison of *viridis* Wlk. with the genotype, and assigns to *Neurotmeta* four new species described below.

The material on which the present study is based comprises the writer's collection of some two hundred specimens of West Indian Tropiduchidae, together with a number of species from this area in the collections of the Museum of Comparative Zoology, the American Museum of Natural History and the United States National Museum. Types or authoritative genotype material of almost all the genera discussed have been seen. It is perhaps worth recording that no specimen agreeing accurately with the figures of *Monopsis tabida* Spinola has been seen, and the writer is inclined to question whether a valid distinction can be drawn between *Monopsis* and *Neurotmeta.*

In order to avoid confusion later it has been considered advisable to include the description of a new genus (*Aripoa*) from Trinidad, so that its position with regard to the *Neotangia* complex of the Lesser Antilles can be clearly indicated; the present opportunity has been taken to present a description of a new species of *Alcestis* Stål (*sensu lato*) from the same island.

The writer is greatly indebted to Mr. W. E. China for comparing material with types in his charge, and for making three drawings from type specimens which have been incorporated in the plates. Types of species described in this paper have been placed in the U. S. National Museum.

The separation of the genera *Remosa*, *Roesma* and *Neurotmeta* from each other and from the remainder presents no difficulty, but in the case of *Neotangia* and *Tangidia*, the new Lesser Antillean genera *Dictyotangia* and *Dioxyomus*, and the new Trinidadian genus *Aripoa*, all of which in existing classifications would fall into *Tangidia* or *Neotangia*, it has proved necessary to seek new characters for generic separation. Such characters have been found, and among them the most fundamental appear to be the shape of the peri-opercular ornamentation on the egg and the general pattern of the aedeagal armature; other excellent characters are provided by the proportions of the vertex, the shape of its lateral margins and median carina, the presence or absence of a thick callus along its anterior margin, the shape of the pronotum, the distinctness of the submarginal pronotal carinae, the flatness or concavity of the lateral intercarinal surfaces of the pronotum, the proportions of the tegmina, the position of the fork of Sc+R, the proportionate distance of the nodal line of cross-veins from the base, the relative widths of the costal area, costal and radial cells, the typical number of apical areoles, the number of "rows" (traceable rank-groupings) of cross-veins in the membrane, the straightness or obliquity of the sutural margin distad of the claval apex, the typical form of wing venation (which is subject to minor variation within species), the number of teeth on the third valvulae of the ovipositor, the shape of the dorsal margin of the genital styles of the male, the relative body size and the colour. It is a matter for satisfaction that the genera separated on the basis of all the above characters are very distinct; for the systematist it is hardly less satisfying that the genera can conveniently be separated merely by reference to a few obvious characters, as indicated in the key given below.

The opercular structures of the egg differ in form between genera, while differences in details offer in some genera a very reliable, though rather inconvenient, means of separating true species. The operculum is a slightly domed cap, on which rows of minute cells make a reticulate lattice-like pattern, and is provided anteriorly with a chorionic process apparently traversed by a fine canal. This process in its simplest form, as in *Aripoa* (described below), is short and tubular, and slightly dilated at the apex. From this condition one line of advance consists in elongation of the tube, as found in *Tangidia*, *Neurotmeta* and *Dioxyomus* (described below), culminating, as far as present knowledge extends, in the structure found in *Dictyotangia* (described below). Alternatively the elongation of the chorionic process may be accompanied by extensive lateral dilation, with the result that the structure assumes the form of a foliate lamina, which is more or less reticulate and, throguh incurving of the edges, somewhat scoop-shaped in profile; a process of this type may be dilated only in its lower part, as in *Chasmacephala* (described below) or, as in *Neotangia* and *Remosa*, along its entire length. The lumen of the canal in the chorionic process does not become expanded, and in most cases the tubular walls of the process can be observed traversing the lamina. It would seem that in this type of ornamentation a portion of the margin of the operculum has been drawn up with the elongating chorionic process, as is suggested by the condition found in the proximal half of the process of *Dictyotangia*, or has itself undergone elongation and has carried the stoma of the chorionic aperture forward on its anterior margin, finally producing the condition seen in *Remosa* and *Neotangia*. In addition to the above ornamentation, which is developed on the margin of the operculum, and is detachable with it, a chitinous rim or collar may be developed on the egg-wall around the edge of the operculum. This peri-opercular rim may be insignificant (*Aripoa*), or anteriorly somewhat raised, but posteriorly represented by little more than a slight thickening (*Tangidia*, *Neurotmeta*, *Chasmacephala*), or more or less raised anteriorly and posteriorly (*Dioxyomus*), or prominently raised all round (*Neotangia*, *Remosa*). The peri-opercular rim of *Dictyotangia* is of the second type, but the anterior margin is prolonged to an exceptional degree.

The distribution of the species discussed shows that each island of the Lesser Antillean archipelago has a single endemic species of each of the genera that are present. The genus *Remosa*, known from the Greater Antilles (Cuba, Jamaica, Haiti), does not occur in the Windward and Leeward Islands; *Neurotmeta*, found in the Greater Antilles and in the Virgin Islands, is also apparently represented in all islands at least as far south as Dominica; *Neotangia* has not yet been found north of Dominica, and occurs in all islands to the south where search has been made as far as Grenada, while on present evidence it must be presumed that *Tangidia* and *Dioxyomus* have a closely similar distribution; *Dictyotangia*, the haplotype of which is a comparatively common insect in St. Vincent, has been found nowhere else. The case of *Cyphoceratops*, *Parahydriena* and *Chasmacephala*, is of considerable interest: it would seem that an old genus, characterised by an elongate sunken vertex and a cixiid-like pronotum, and occupying an isolated position in the tribe to which it belongs, divided into three forms by bizarre development of the vertex: of these *Cyphoceratops* is now found in Cuba and Haiti, *Parahydriena* in Santo Domingo and Puerto Rico, and *Chasmacephala* in the Windward Islands. The last of these broke up into island races which in course of time attained such a high degree of morphological differentiation, pervading male and female genital structures as well as those of the egg, that they must now be considered to be reproductively isolated. The writer has not had opportunity of comparing in a similar manner material of *Parahydriena* and *Cyphoceratops* from different islands, but a specimen of the former from Santo Domingo differed from the Puerto Rican type in the size of the crest on the vertex, suggesting that further differences of a more fundamental nature may exist. Until a close comparison can be made of the genital and egg structures of these two genera the writer feels constrained to recognise their present status, and to consider them, along with *Chasmacephala*, as members of a supergenus, though it is probable that fuller study will show that they would be more properly ranked as subgenera.

It was not without reluctance that the writer reached the conclusion that the series of mutually representative species that comprise most of the Antillean genera discussed below cannot each be regarded as a single polytypic species. It is from such a species that each of the existing series has undoubtedly arisen, as the differences between their component members are of equal magnitude, and there is no evidence of successive invasions from any mainland source. The differences which now separate the endemic species are of the same type and magnitude as those used to separate species in the remainder of the Homoptera, and include characters of the vertex (*Remosa*), pygofer, genital styles, anal segment in both sexes, shape of the periandrium, armature of the penis and periandrium, first valvulae of the ovipositor, and the complex architecture of the opercular end of the egg. No intergradation has been found between any two members of a series in the characters employed for its subdivision. Direct proof of the reproductive isolation of each species is lacking; the writer's belief that such isolation exists rests on the facts that the observed specific differences almost entirely occur in structures connected with reproduction and pre-nymphal growth, and are of equal magnitude to those found between species of other families of Fulgoroidea in the same islands for which clear-cut evidence of reproductive isolation is abundantly available.

Terms used in the descriptions are conventional and do not necessarily imply homology with similarly named structures in other orders: the names "penis" and "periandrium" are applied respectively to the soft, membranous, protractile, frequently spinigerous distal portion of the aedeagus and the tough, vitreous, sclerotised, immobile sheath which forms the basal part of the aedeagus.

In addition to the generic key to New-World Tambiniini, a synopsis is given below of the principal characters of the four genera most difficult to separate.

A SUMMARY OF THE PRINCIPAL CHARACTERS OF ARIPOA G. N., NEOTANGIA MEL. TANGIDIA UHL. AND DIOXYOMUS G. N.

Shape of median carina on vertex.	*Aripoa* ⅄	*Neotangia* ⅄	*Tangidia* Λ	*Dioxyomus* Λ
Sides of vertex before eyes.	scarcely curved	incurved	straight, incurved apically	straight
Vertex: width to median length.	1.1 : 1	1.25 : 1	1.6 : 1	1.6 : 1
Lateral margins of frons meeting lateral margins of vertex.	no	yes	no	no
A thick callus on anterior margin of vertex.	yes	no	yes	yes

Sub-marginal carinae of pronotum.	distinct	distinct	absent	very prominent
Lateral and mesal margins of pronotal lateral obes.	converging posteriorly	subparallel	subparallel	subparallel
Lateral pronotal lobes: length to width.	2 : 1	11 : 8	2 : 1	2 : 1
Ventral margin of lateral pronotal lobes.	rounded	obliquely truncate	rounded	rounded-truncate
Tegmen: length to width	2.7:1	3:1	2.9:1	2.8:1
Proportionate distance of nodal line from base.	5/9	2/3	3/5	7/11
Number of apical areoles	17	14	13–15	15
Number of irregular rows of cross-veins.	6	6–8	3	5
Sutural margin distad of clavus.	straight	oblique	slightly oblique	almost straight
Wing: average number of branches of Culb.	3	3	2	4
Number of teeth on third valvulae.	9	9	9	10
Egg: peri-opercular collar.	absent	well developed	not prominent, though raised anteriorly	distinct
Egg: chorionic process.	tubular	laminate	tubular	tubular
Approximate length, vertex to apex of tegmina.	7.2 mm.	7.0 mm.	6.3 mm.	8.6
Colour.	green	green	tawny, marked with brown	green

Subfamily TAMBINIINAE

Tribe ALCESTINI

ALCESTIS Stål

Stål 1862 K. Svenska Vet. Akad. Handl. 3 (6): 11. Genotype, *A. pallescens* Stål ibid.

Vertex broader than long in middle, lateral margins parallel, apex rounded, posterior margin shallowly excavate, median carina usually present, sometimes obsolete; frons longer than broad (about 1.5:1), usually medially carinate, carina sometimes anchor-like near suture, lateral margins subparallel basally, somewhat arcuate distally; clypeus rather small, lateral margins not carinate, antennae short. Pronotum as long as vertex, tricarinate, lateral carinae diverging posteriorly, anterior margin arcuately convex, posterior margin excavate, sometimes with a median notch; mesonotum broader than long, tricarinate, lateral carinae arcuate, joined to median carina anteriorly. Tegmina broad, costal margin strongly curved, sutural margin straight, a prominent cell present at base anterior to Sc+R, subcosta and sometimes costa giving off several branches, often distally bifurcate, to margin. Post-tibiae with 3 spines.

Alcestis lunata, new species

(Figs. 21–23)

Female. Length, 6.3 mm.; tegmen, 8.0 mm; length with tegmina 9.3 mm.

Vertex twice as broad as long, flattened, lateral margins straight, anterior margin shallowly convex, posterior margin shallowly excavate, median carina obsolete; frons longer than broad (1.5:1), median carina broad.

Tegmina longer than broad (2.3:1), costa remote from margin strongly arcuate giving off 4 veins to anterior margin, the basal 2 veins simple, the distal vein forked, Sc giving off 7 branches to margin, basal costal cell 3.5 times longer than broad, R with 2 branches at margin, M with 5, Cu1a with 5, Cu1b with 3; Sc + R forking near basal quarter, M forking near middle of tegmen, Cu1 forking rather more basad than M, about level with injunction of calval veins. Wings with R, M, Cu1a and Cu1b forked once before apex, Cu2 simple, the first two veins united to apical quarter.

Pale green; tegmina hyaline, veins pallid green, cross veins of the sam colour, wings hyaline.

Ovipositor with third valvulae armed with 8 spines on apical margin.

Described from one female collected by the writer in Caura Valley, Northern Range, Trinidad, B.W.I. (March 10, 1936) on forest undergrowth. This species is close to *melichari* Schmidt from which it differs in the shape of the basal cell and in its larger size.

Tribe Tambiniini

Key to the New World Genera of the Tribe Tambiniini

(1) (2) Vertex with a cephalic process at least as long as pro- and mesonotum............(19)
(2) (1) Vertex produced before eyes but not forming a large cephalic process............(3)
(3) (4) Tegmina with one or no transverse line distad of nodal line............(3)
(4) (3) Tegmina with numerous cross veins distally in irregular series....(5)
(5) (6) Vertex with median carina simple, unbranched..........(7)
(6) (5) Vertex with median carina ∧- or λ- shaped ....(11)
(7) (8) Frons ecarinate, sides of vertex parallel..........*Pelitropis* Van Duzee
(8) (7) Frons medially carinate, sides of vertex converging anteriorly....(9)
(9) (10) Media forking near base of tegmen..........*Monopsis* Spinola.
(10) (9) Media forking near middle of tegmen...*Neurotmeta* Guerin-Meneville
(11) (12) Vertex distinctly longer in middle than broad, directed upward distally..........*Dictyotangia* gen. nov.
(12) (11) Vertex not longer in middle line than broad across base......(13)
(13) (14) Vertex with median carina λ-shaped, lateral margins slightly incurved before eyes..........(15)
(14) (13) Vertex with median carina ∧-shaped, lateral margins straight.(17)
(15) (16) Vertex as broad as long in mid-line, lateral margins of frons not meeting lateral margins of vertex, a broad callus on anterior margin of vertex..........*Aripoa* gen. nov.

(16) (15) Vertex distinctly broader than long in middle, lateral margins of frons meeting lateral margins of vertex, anterior margin of vertex not callussed........................*Neotangia* Melichar.
(17) (18) Submarginal carinae of pronotum obsolete, represented only by a hump, species about 6 mm. long, tawny, marked with spots of darker brown................................*Tangidia* Uhler.
(18) (17) Submarginal carinae of pronotum very sharp, arcuate, species about 8.6 mm. long, uniformly pale green....*Dioxyomus* gen. nov.
(19) (20) Median carina of vertex simple, unbranched basally ..*Remosa* Distant
(20) (19) Median carina of vertex forked in basal third........*Roesma* Fennah.
(21) (22) Vertex longer than broad..(27)
(22) (21) Vertex broader than long..................................(23)
(23) (24) Vertex three times as broad as long............*Colgorma* Kirkaldy.
(24) (23) Vertex twice as broad as long.............................(25)
(25) (26) Species more than 7 mm. long; lateral pronotal fields and mesopleurites green..............................*Neorudia* gen. nov.
(26) (25) Species less than 7 mm. long; lateral pronotal fields at margin and a spot on mesopleurites piceous............... *Amapala* Melichat
(27) (28) A row of subapical areoles present..............................*Athestia* Melichar
(28) (27) No such row..*Bituga* Fennah

REMOSA Distant

Distant 1906 Ann. Mag. Nat. Hist. (7) 18:355. Genotype, *Dictyophora cultellator* Walker.

"Head longly produced in front of eyes, cephalic process broad at base, gradually but much narrowed on apical half, strongly centrally carinate, the lateral areas oblique, the lateral margins carinate; face long, narrowed in front of eyes, margins subparallel from anterior margins of eyes to a little before clypeus, where they are inwardly oblique, strongly centrally carinate; clypeus centrally carinate, pronotum about as long as eyes, tricarinate; mesonotum about twice as long as pronotum, tricarinate, tegmina about two and a half times as long as broad, subopaque, minutely tuberculate, costal area broad, one-third width of costal cell, devoid of cross-veins, apical area finely and closely reticulate and inwardly defined by an almost straight series of transverse veins, a few cross-veins present on corium basad of nodal line; wings hyaline, with a discal subapical transverse vein; posterior tibiae with three spines." Third valvulae of ovipositor with 13 teeth on apical margin. Aedeagus broad, laterally compressed, apically truncate. Egg subcylindrical, rounded at one pole, obliquely truncate at the other; opercular process laminate, prominent, peri-opercular rim broad, collar-like.

Key to the Species of Remosa Distant

(1) (2) Telson projecting for a third of its length beyond lateral lobes of anal segment; median notch of ventral hind margin of abdominal segment 7 in profile raised into a blunt point (Cuba)...... *spinolae* Guerin-Meneville
(2) (1) Telson not exceeding lateral lobes of anal segment..............(3)

(3) (4) Cephalic process scarcely three times as long in middle as wide across base between eyes (Haiti, Sto. Domingo)..........*cultellator*

(4) (3) Cephalic process 3.8 times as long in middle as wide across base (Jamaica)..........*kontorhina*, n. sp.

Remosa cultellator (Walker)

(Figs. 45–47)

Dictyophora cultellator Walker, 1858 List Hom. Suppl.:62.

Male. Length, 8.0 mm.; tegmen, 6.5 mm.

Cephalic process about 2.8 times as long in middle as wide across base between eyes; tegmina with intervenal areas of corium minutely papillate.

Pale green; tegmina vitreous with veins and papillae green, wings hyaline, spines on post-tibiae and tarsi tipped with black.

Anal segment with telson not exceeding length of lateral lobes. Aedeagus laterally flattened, dorsal margin concave in profile, ventral margin convex, apex obliquely truncate, width approximately half the length; ventrally a pair of spines, one lying along ventral margin and projecting dorsad at its tip, the second two-thirds as long as the preceding, arising at about the same point, curved to right and upward, a short stout spine at the tip of a broad lobe subapically on right side. Genital styles subovate in lateral view, ventral margin convex, strongly curved upward distally, dorsal margin with a prominent tooth-like lobe near base, and a pair of hooked processes, one directed outward, the other upward and inward, distad of it.

Described from one male taken at Port au Prince, Haiti, by Dr. J. G. Myers (August 17, 1931) and compared by Mr. W. E. China with Walker's female type from the same island.

Remosa kontorhina, new species

(Figs. 7, 43, 44, 71, 72)

Male. Length, 8.8 mm.; tegmen, 5.6 mm. Female. Length, 9.0 mm.; tegmen, 6.0 mm.

Cephalic process 3.8 times as long in middle as wide across base between eyes. Tegmina with intervenal areas of corium minutely papillate.

Pale green; tegmina vitreous with veins and tubercules green, wings hyaline, spines of post-tibiae and tarsi black-tipped.

Anal segment with telson not exceeding length of lateral lobes. Aedeagus laterally flattened, dorsal margin in profile slightly concave, ventral margin convex, apex obliquely truncate; ventrally a pair of spines arising on right side and directed posteriorly, the posterior spine extending near ventral margin to a point two-thirds from base of aedeagus, the anterior spine somewhat remote from the ventral margin, extending for one-third from base; a flattened pigmented lobe, parallel-sided and apically rounded, parallel to ventral margin, arising about two-thirds from base and extending on right side to near apical margin, but not attaining it; distad of this, at apical margin, a small broad-based spine at tip of a subquadrate lamina. Genital styles with ventral margin convex, dorsal margin with a tooth-like lobe near base, and a pair of hooked processes distad of it.

Egg with opercular process laminate, scoop-like, directed somewhat obliquely upward, peri-opercular rim deep, bowl-like in profile, dorsal margin curved. Length 0.9 mm.; length with process 1.4 mm.; width, 0.35 mm.

Described from 6 males and 7 females taken by the writer at Kingston and near Hope, Jamaica, B.W.I. (Nov. 17, 24, 1940) on bushes and on Jasmine. The most obvious points of difference from *cultellator* Wlk. lie in the proportions of the cephalic process and the arrangement of the aedeagal spines. It is almost certainly this species that Van Duzee took at Kingston and Hope and Montego Bays and subsequently assigned to "*Tangia cultellator* Walker" (Bull. Buff. Soc. Nat. Sci. VIII, 5:35, 1907.)

NEUROTMETA Guerin-Meneville

Guerin-Meneville, 1856, Hist. Fisica, Homopteros, p. 180. Genotype, *Neurotmeta sponsa* Guerin-Meneville loc. cit., Myers 1928.

Vertex flattened, more or less produced, lateral margins approximately straight between eyes, then rounded into anterior margin, which is convex, posterior border excavate, at middle about level with anterior margin of eyes, median carina present, not branched before posterior margin; frons longer than broad, lateral margins carinate, gradually and sinuately expanding to below level of antennae, thence more sharply curved inward to suture, which is impressed, median carina present throughout, narrow, not prominent, clypeus with median carina. Pronotum strongly convex anteriorly, posterior margin deeply concave, disc flattened, median carina present, lateral carinae arcuate, diverging posteriorly, a carina near each lateral margin between eye and upper margin of tegula, lateral margin carinate, the carina extending between eye and anterior margin of tegmen; mesonotum broader than long, disc flattened, tricarinate. Tegmina vitreous, about 2.9 times as long as wide, anterior margin slightly convex, apex rounded, sutural margin slightly oblique distad of apex of clavus, costal area scarcely half as wide as costal cell, Sc+R, M, and Cu forking before transverse nodal line, R forking about three-fifths from base, M forking half-way from base, Cu1 forking about one-third from base, the medial sector often branched before nodal line, about 15–17 apical areoles, and 5 or 6 very irregular rows of cross-veins on membrane beyond nodal line; wings typically with R simple to apex, M forked, Cu1a forked, Cu1b simple to apex, Cu2 simple to apex, first and second anal veins joined at their mid-points by a very short transverse bar. Hind tibia with 3 spines. Pygofer in profile with margins sinuately convex. Anal segment elongate, lateral lobes produced, almost twice as long as telson. Aedeagus flattened laterally with several spinose appendages. Genital styles with ventral margin convex, dorsal margin concave, with a pair of hooked processes midway from base, apical margin rounded-truncate. Ovipositor with third valvulae bearing 10 teeth on apical margin. Egg subcylindrical, rounded at one pole, in profile obliquely truncate at the other, peri-opercular rim somewhat deeper anteriorly, insignificant posteriorly, chorionic process tubular.

Neurotmeta bipatriata, new species

(Figs. 6, 26, 27)

Male. Length, 4.8 mm.; tegmen, 4.5 mm. Female. Length, 6.0 mm.; tegmen, 5.4 mm.

Vertex flat, slightly wider across base than long in middle, produced before eyes for distance subequal to length of eye, anterior margin broadly rounded, lateral margins slightly converging anteriorly, posterior border angularly excavate with a small median notch reaching to level of anterior border of eyes, median carina simple, lateral and apical margins carinate.

Pale green; tegmina vitreous, wings hyaline.

Aedeagus with 3 short transverse spines directed towards right at ventral junction of penis with periandrium, the outer two curving slightly posteriorly, the middle curving slightly anteriorly, membrane of penis with 4 subequal spines directed posteriorly, the lower pair curving markedly upward distally, the third not reaching quite as far as the others and less curved distally, the dorsal spine almost straight.

Described from 4 males and 6 females collected by the writer at Mosquito Bay, Nevis, B.W.I. (Jan. 18, 1942) on *Coccoloba uvifera*. A long series of this species was taken by the writer on the same host near Sandy Point, St. Kitts, B.W.I. (Jan. 23, 1942).

Neurotmeta oreas, new species

(Figs. 28, 29)

Male. Length, 5.1 mm.; tegmen, 5.0 mm. Female. Length, 6.0 mm.; tegmen, 5.9 mm.

Vertex flat, slightly wider across base than long in middle, produced before eyes for distance subequal to length of eye, anterior margin broadly rounded, lateral margins slightly converging anteriorly, posterior border angularly excavate with a small median notch reaching to level of anterior border of eyes, median carina simple, lateral and apical margins carinate.

Pale green; tegmina vitreous, wings hyaline.

Aedeagus with 2 short transverse spines at the apparent junction of penis with periandrium ventrally, directed towards the right, the anterior spine broad and flattened, curved somewhat posteriorly at tip, the median spine directed obliquely caudad, penis with 4 slender spines directed posteriorly, the ventral spine curved upward near its tip, the middle pair short, straight, closely approximated, the dorsal spine long, tapering, with the tip slightly deflexed and projecting beyond posterior margin of membrane.

Described from 2 males and 1 female collected by the writer at 1,500 ft. on Chance's Mountain, Montserrat, B.W.I. (May 18, 1940) in forest undergrowth.

Neurotmeta litoralis, new species

(Figs. 30, 31)

Male. Length, 5.3 mm.; tegmen, 4.9 mm. Female. Length, 6.0 mm.; tegmen, 5.9 mm.

Vertex flat, slightly wider across base than long in middle, produced before eyes for distance subequal to length of eye, anterior margin broadly rounded, lateral margins slightly converging anteriorly, posterior border angularly excavate with a small median notch reaching to level of anterior border of eyes, median carina simple, lateral and apical margins carinate.

Pale green; tegmina vitreous, wings hyaline.

Aedeagus with 3 short spines ventrally at apparent junction of penis with periandrium, the spine arising on the left side broad, directed posteriorly at tip, the second spine emerging near its tip, directed to right and obliquely cephalad, the third arising more basally, directed to right and obliquely caudad, crossing the preceding approximately at right angles, penis with 4 slender spines directed posteriorly, the lower pair curved upward distally, the third distinctly shorter and straight, the dorsal spine straight, directed posteriorly and projecting beyond the edge of the membrane.

Described from 15 males and 19 females collected by the writer at Half-moon Bay and at Cades Bay, Antigua, B.W.I. (Aug. 20, Sep. 2, 1943) on *Coccoloba uvifera* and *Caesalpinia* sp.

Neurotmeta dominicana, new species

(Figs. 24, 25, 32, 33)

Male. Length, 5.8 mm.; tegmen, 5.3 mm. Female. Length, 6.4 mm.; tegmen, 6.0 mm.

Vertex flat, slightly wider across base than long in middle, produced before eyes for distance subequal to length of eye, anterior margin broadly rounded, lateral margins slightly converging anteriorly, posterior border angularly excavate with a small median notch reaching to level of anterior border of eyes, median carina simple, lateral and apical margins carinate.

Pale green; tegmina vitreous, wings hyaline.

Aedeagus with 3 short spines ventrally at apparent junction of penis with periandrium, the spine on left side broad, flattened, directed to right, the other two spines approximated and incurved to resemble a closed chelate claw, directed to right, penis with 2 slender spines directed posteriorly, arising distally in upper half, the lower spine slender, rather short, curved upward at its tip, the dorsal spine straight, directed posteriorly, projecting beyond edge of membrane.

Described from 5 males and 6 females collected by the writer at 1,000 ft. in forest undergrowth near Imperial Road, Dominica, B.W.I. (June 11–July 8, 1939.)

NEOTANGIA Melichar

Melichar 1914 Verh. Naturf. Ver. Brunn 53: 77. Genotype, *Tangia angustata* Uhler, Proc. Zool. Soc. Lond. 1895: 59.

Vertex flattened, four-fifths as long in middle as wide across base between eyes, produced before eyes, lateral margins straight between eyes, slightly incurved distad of them, anterior margin broadly rounded, posterior margin roundly excavated, median carina λ-shaped, the common stalk not quite attaining anterior margin, the fork occurring slightly distad of anterior margin of eyes, the posterior arms approximately trisecting posterior margin, but the distance between them at margin rather less than that on each side (carina to lateral margin), lateral margins carinate, anterior margin only a little thickened; frons with lateral margins meeting anterior carina of vertex, slightly diverging between eyes to below level of antennae, thence curving inwards to suture, median carina percurrent, suture slightly impressed, clypeus medially carinate. Pronotum flat, slightly more than one-half length of vertex, anterior margin excavate behind eyes, strongly convex in middle, posterior margin convex just mesad of tegulae, angularly emarginate in middle, median carina present, lateral carinae of disc diverging posteriorly, slightly curved, a carina on each side sublaterally between eye and inner edge of tegula, lateral margins carinate, extending between eye and costal margin of tegmen; mesonotum broader than long, disc flattened, tricarinate. Tegmina three times as long as wide, anterior margin slightly convex, apical margin asymmetrically rounded, sutural margin straight to apex of clavus, slightly oblique distad of it, costal area about one-fifth width of costal cell, costal cell 1.6 times width of radial cell two-thirds from base, Sc+R not forking before nodal line, but its fork distinctly basad of those of M, Cu1a and Cu1b, Cu1 forking just distad of junction of claval veins, nodal line of cross-veins rather irregular, about 14 areoles at apical margin, 6 to 8 very irregular and incomplete curved lines of cross-veins in membrane; wings typically with R simple at apex, M two-branched, Cu1a three-branched, Cu1b two-branched, Cu2 simple, the first and second anal veins joined at their middle by a distinct transverse bar. Hind tibia with 3 spines.

Anal segment with lateral lobes produced, telson equalling or slightly exceeding them. Pygofer with margin almost straight in profile, lateral angles prominent, forming a right angle. Genital styles with ventral margin convex, apical margin rounded, dorsal margin with a triangular lobe basally, with a pair of hooked processes distad of it, one process being directed outward, the other upward.

Ovipositor with third valvulae armed with 9 teeth on apical margin.

Egg subcylindrical, rounded at one pole, in profile obliquely truncate at the other, chorionic process laminate, scoop-like, peri-opercular rim well developed all round, with a transverse furrow anteriorly.

Neotangia angustata (Uhler)

(Figs. 4, 10, 11, 50, 52, 69, 70)

Tangia angustata Uhler, 1895, Proc. Zool. Soc. Lond.: 59.

Male. Length, 5.1 mm.; tegmen, 5.2 mm. Female. Length, 6.0 mm.; tegmen, 6.1 mm.

Vertex four-fifths as long in middle as wide across base between eyes, lateral margins slightly converging distad of eyes, anterior margin smoothly rounded.

Pale green; tegmina vitreous, wings hyaline.

Aedeagus laterally compressed, ventral margin convex, dorsal margin concave, apex oblique, rounded-truncate, devoid of spines, a single elongated thick flagellar process arising from ventral line midway along base, directed dorsally, looped anteriorly and ventrally, then curved posteriorly upward and outward to left, the terminal portion sclerotised and markedly sinuate, as shown in figure.

Egg 1.27 mm. long, 0.28 mm. wide; chorionic process on operculum laminate, broadly mitrate in anterior view, scoop-like in profile, narrowly reticulate, the reticulation obscure or absent near margin, canal of process traversing middle, bent near base; peri-opercular rim elevated, more so anteriorly, where it bears a deep transverse groove near distal margin.

Redescribed from 2 males and 6 females taken by the writer in Sharps Valley, St. Vincent B.W.I. (Aug. 19, 1941.) on *Tecoma* and at Kingstown (Aug. 18) on Fiddlewood.

Neotangia mitrata, new species

(Figs. 51, 67, 68)

Male. Length, 4.9 mm.; tegmen, 5.0 mm. Female. Length, 5.7 mm.; tegmen, 5.7 mm.

Vertex four-fifths as long in middle as wide across base between eyes, lateral margins slightly converging distad of eyes, anterior margin rounded.

Pale green; tegmina and wings transparent, veins greenish.

Aedeagus as in *angustata*, laterally compressed, devoid of spines, a single elongated thick flagellar process arising from ventral line midway along base, directed dorsally, looped anteriorly and ventrally, then curved posteriorly upward and outward to left, the terminal portion sclerotised and markedly sinuate.

Egg 1.27 mm. long, 0.33 mm. wide, opercular process mitrate in anterior view, scoop-like in profile, hexagonally reticulate, the reticulation strongly developed to margin, canal of process traversing middle quite straight near base; peri-opercular rim well developed, its sides in anterior view almost straight, a narrow but distinct transverse groove anteriorly near upper margin.

Described from 4 males and 3 females and 8 eggs collected by the writer at Grand Anse, Grenada, B.W.I. (Oct. 17, 1943) on *Coccoloba uvifera.* This species closely resembles *angustata* (Uhl.), but differs in the curvature of the penial flagellum, and in the female in the relative length of the lateral lobes of the anal segment. In *mitrata* the first valvulae of the ovipositor end in 2 large triangular teeth, of which the inner is larger: in *angustata* they end in a moderately prominent outer tooth with a small triangular tooth at the apex. The mitrate lobe on the operculum of the egg in the Grenadan species is hexagonally reticulate to the recurved margins, the hexagons being regular or nearly so; in *angustata* the lobe is not reticulate in the marginal area, and the cells of the reticulum are markedly elongated. The peri-opercular rim has its dorsal lip protruded to a marked extent in *angustata*, while the wall below it is strongly convex. The rim posteriorly is somewhat deeper in *angustata* than in *mitrata*, while the cells that form the roof-like opercular lid are very distinctly broader in *angustata*. These differences have been found constant in a comparison of 8 eggs of *mitrata* with 10 of *angustata*. It is undoubtedly this species that Uhler had in mind when he wrote of two specimens of *Tangia angustata* taken in St. Vincent:—"They are precisely like others which were secured on the island of Grenada."

Neotangia coronata, new species

(Figs. 65, 66)

Female. Length, 6.0 mm.; tegmen, 6.1 mm.

Vertex as long in middle as wide across base between eyes, lateral margins slightly converging distad of eyes, anterior margin smoothly rounded.

Pale green; tegmina and wings transparent, veins greenish.

Egg subcylindrical, 0.95 mm. long to base of operculum, 1.05 mm. long including chorionic process, 0.28 mm. broad, rounded at one pole, obliquely truncate in profile at the other; chorionic process laminate, about 1.7 times longer than broad, mitrate, but with sides not much incurved basally, reticulation elongated; peri-opercular rim strongly developed all round, dorsal margin concave on sides, rim viewed anteriorly much expanded distally, in lateral view anteriorly convex, with a constriction at junction with egg.

Described from one female and eggs taken by the writer at Soufriere, St. Lucia, B.W.I. (Feb. 21, 1940) on *Inga* sp. This species is distinguished by the proportions of the vertex and by the relatively narrow chorionic lamina of the egg and the diverging sides of the peri-opercular rim as seen in anterior view.

Neotangia caribea, new species

(Figs. 48, 49)

Male. Length, 4.9 mm.; tegmen, 5.9 mm. Female. Length, 6.3 mm.; tegmen, 6.5 mm.

Vertex four-fifths as long in middle as wide across base between eyes, lateral margins slightly converging distad of eyes, anterior margin smoothly rounded.

Pale green; tegmina and wings transparent, veins greenish.

Aedeagus laterally compressed, ventral margin convex, dorsal margin concave, apex obliquely rounded-truncate, devoid of spines, a single elongated thick flagellar process arising from ventral line midway from base directed dorsally, looped anteriorly and ventrally, then curved posteriorly upward and outward to left, the terminal portion sclerotised and evenly, not sinuately curved, as shown in figure.

Egg 1.2 mm. long, 0.28 mm. wide, subcylindrical, chorionic process laminate, mitrate in anterior view, scoop-like in profile, reticulation elongated, canal of middle line visible only at apex; peri-opercular rim deep, well-developed, with sides convex and with a broad deep furrow anteriorly below upper edge, which is thickened and protruded; the lateral row of parallel vertical furrows not deep.

Described from 15 males and 20 females taken by the writer at 1,000 ft. near Saltoun, Dominica, B.W I. (June 18–26, 1939) on forest undergrowth, chiefly *Palicourea crocea* and *Miconia* sp. This species differs from *angustata* in the shape of the flagellar process of the aedeagus, and from this and all the other species in the details of the opercular ornamentation of the egg.

DICTYOTANGIA, new genus

Vertex flattened basally, slightly tectiform and upturned distally, produced before eyes for one and a quarter times their length, longer in middle than wide across base between eyes (3:2), lateral margins slightly diverging anteriorly between eyes, sinuately narrowed distally, anterior margin rounded, posterior margin angularly excavated, lateral margins carinate, median carina simple in anterior two-thirds, forked in basal third, the portion of posterior margin included between the arms being greater than that on each side; frons longer than wide (2.1:1), lateral margins sinuately expanding to below level of antennae, thence incurved to suture, median carina present throughout; clypeus short, medially carinate. Pronotum short, flat, anterior margin concave behind eyes, convex in an acute angle in middle, posterior margin convex just mesad of tegulae, angularly emarginate mesally, median carina present, lateral carinae of disc diverging posteriorly, slightly curved, not quite attaining margin, a submarginal carina present near each side between eye and tegula, lateral margins carinate between eye and costal border of tegmen; mesonotum broader than long, disc flattened, tricarinate. Tegmina 2.7 times longer than wide, anterior margin convex, apical margin asymmetrically rounded, sutural margin straight, scarcely oblique distad of apex of clavus, costal margin less than one-sixth width of costal cell, which is 1.4 times as wide as radial cell, Sc+R and M forking at nodal line, Cu1 forking slightly distad of junction of claval veins, about 15 apical areoles present and about 4 broken irregular lines of cross-veins in membrane, costal area and corium devoid of cross-veins. Wings typically with R simple to apex, M forked before apex, Cu1a forked once before apex, Cu1b forked once, Cu2 simple, the first and second anal veins joined in middle by a short transverse bar. Hind tibia with 3 spines.

Anal segment with lateral lobes produced, telson slightly exceeding them. Pygofer with margins straight, lateral angles produced and acute. Aedeagus laterally flattened, with a single spine curved in a semicircle basad of middle. Genital styles with ventral margin convex, apical margin semicircularly rounded, dorsal margin concave with a rounded eminence near base and 2 hooked spines distad of it, the outer spine being one-third as long as the inner.

Ovipositor with third valvulae beset with 9 teeth on apical margin.

Egg subcylindrical, chorionic process of operculum elongated with a tapering flange on each side in basal half, simple and tubular in apical half, slightly expanded at apex, directed anteriorly, periopercular rim insignificant posteriorly but greatly produced anteriorly, one-sixth of the length of the egg, dorsal margin with lip curved outward.

Genotype, *Dictyophara emarginata* Uhler.

Dictyotangia emarginata (Uhler), new combination
(Figs. 5, 9, 16, 17, 41, 42, 63, 64)

Dictyophara emarginata Uhler, 1895 Proc. Zool. Soc. Lond.: 58.

Male. Length, 5.5 mm.; tegmen, 5.4 mm. Female. Length, 6.2 mm.; tegmen, 6.0 mm.

Pale green; tegmina and wings transparent, veins greenish.

Aedeagus laterally compressed, ventral margin convex, dorsal margin concave with a basal eminence, apical margin irregularly rounded, a single slender spine arising on left near base, curving through 180° upward to point antero-vertically at tip.

Egg 1.1 mm. long, 0.3 mm. wide, subcylindrical, rounded at one pole, operculate at the other, chorionic process tubular, laterally flanged in basal half, tubular and directed obliquely anteriorly in distal half, peri-opercular rim very narrow posteriorly, extended upward for one-sixth length of egg anteriorly, with distal margin curved outward in a short lip, surface of produced rim transversely rugose.

Described from 10 males and 8 females taken by the writer at Petit Bordel, St. Vincent, B.W.I. (Aug. 15, 1941) on *Croton* and low bushes. Muir placed this species in *Neotangia* Mel. but the resemblance is not more than superficial, as the vertex is longer than in *Neotangia*, the median carina of the vertex is more widely forked, the tegmina are proportionately shorter (length: width), and more bluntly rounded at apex, the proportionate width of costal area, costal cell and radial cell are different, and the number of rows of cross-veins is markedly less, while the genital styles, the aedeagus and the egg all differ in form from the corresponding structures in *Neotangia*, and in the case of the aedeagus and egg the differences are profound. Nothing resembling this genus has been found elsewhere.

DIOXYOMUS, new genus

Vertex flattened, broader than long (about 1.6:1), lateral margins straight, carinate, anterior margin rounded, very markedly thickened between vertex and frons, median carina $\wedge$-shaped with the common stalk scarcely one-half as long as either arm of fork, not quite attaining anterior margin, posterior arms of fork equally trisecting posterior margin; frons almost flat, lateral margins almost straight between eyes, sinuately diverging to below level of antennae thence curved inward to suture, median carina rather broad, percurrent; clypeus short, medially carinate. Pronotum with anterior margin deeply concave behind eyes, strongly convex before disc, posterior margin angularly concave at tegulae, angularly convex just mesad of tegulae, angularly emarginate in middle, median carina distinct, lateral carinae of disc prominent, diverging posteriorly, arcuate, a very prominent submarginal carina near each side between eye and tegula, slightly arcuate, lateral margin between eye and costal margin of tegmen sharply carinate, the areas between lateral carinae of disc and submarginal carinae, and between latter and marginal carinae markedly hollowed out. Tegulae prominently carinate; mesonotum broader than long, disc almost flattened, tricarinate. Tegmina 2.8 times as long as wide, anterior margin convex, apical margin asymmetrically rounded, sutural margin straight to apex of clavus, very slightly oblique distad of it; costal area one-sixth width of costal cell, the latter 1.3 times width of radial cell, veins Sc+R, M, Cu1a and Cu1b not forked before nodal line of transverse veins, Cu1 forked just distad of junction of claval veins; nodal line occurring seven-elevenths from base of tegmen, approximately 15 apical areoles present, and about 5 irregular broken lines of cross-veins in membrane. Wings with R simple to apex, M forked, with 2 branches reaching margin, Cu1a with 2 branches at margin, Cu1b with 4 branches, Cu2 simple to apex, the first two anal veins joined by a distinct transverse bar at middle. Hind tibia with 3 spines.

Anal segment of male with lateral lobes produced, telson subequal to them in length, or very slightly longer. Pygofer with lateral margins almost straight, lateral angles obtuse, rounded. Aedeagus deep, laterally compressed, ventral margin convex, dorsal margin almost straight, apex oblique, a single curved spine near base. Genital styles with ventral margin convex, dorsal margin with a triangular eminence near base, with a pair of hooked processes distad of it, the shorter process directed outward at apex.

Ovipositor with third valvulae armed with 10 teeth on apical margin.

Egg subcylindrical, rounded at one pole, obliquely truncate in profile at other, chorionic process of operculum tubular, slender, directed upward and anteriorly, slightly expanded at apex; peri-opercular rim distinct posteriorly and at sides, anteriorly produced upward and forward, with dorsal margin curved into a shallow lip.

Genotype, *Tangidia uhleri* Muir.

Dioxyomus uhleri (Muir), new combination
(Figs. 2, 62)

Tangidia uhleri Muir, 1931 Ann. Mag. Nat. Hist. 10(7):305.

Male. Length, 5.4 mm.; tegmen, 6.2 mm.

Vertex broader than long (1.6:1).

Pale green, tegmina vitreous with a greenish tinge, veins green, wings hyaline.

Aedeagus laterally compressed, ventral margin convex, dorsal margin rather less convex, apex rounded, with a cleft longitudinally in lower half; a slender spine arising on left side near base and curving through 180° as shown in figure.

Described from two males taken by the writer at Grande Anse, Grenada (Mar. 31, 1941) on *Coccoloba uvifera*. A drawing of the dissected genitalia was compared with those of Muir's type and was found to correspond exactly. The drawing reproduced in the plates was made by Mr. China from the type. This species is apparently confined to Grenada.

Dioxyomus major, new species
(Figs. 73, 74)

Female. Length, 7.1 mm.; tegmen, 7.4 mm.

Vertex broader than long (1.4:1).

Pale green; tegmina vitreous, tinged slightly green, veins green, wings hyaline.

Egg subcylindrical, rounded at one pole, obliquely truncate in profile at the other, 1.1 mm. long without chorionic process, 0.3 mm. wide, chorionic process tubular, slender, directed obliquely anteriorly upward, slightly expanded at apex; peri-opercular rim slightly raised posteriorly, narrow on sides, raised anteriorly obliquely upward.

Described from 3 females and 3 eggs taken by the writer at 1,000 ft. in forest near Saltoun, Dominica, B.W.I. (June 15, 1939) on *Gonzalagunia spicata* and *Miconia* sp. The species is distinguished by the proportions of the vertex and by the shape of the opercular ornamentation of the egg, and is apparently confined to Dominica.

Dioxyomus ganymedes, new species
(Figs. 18, 19, 75)

Female. Length, 7.8 mm.; tegmen, 7.5 mm.

Vertex 1.6 times broader than long.

Pale green; tegmina vitreous, tinged slightly greenish, wings hyaline.

Egg subcylindrical, rounded at one pole, obliquely truncate in profile at other, 1.05 mm. long with opercular rim, 0.3 mm. wide, chorionic process of operculum tubular, slender, sinuately directed anteriorly; peri-opercular rim deep all round, anterior side slightly convex and produced, posterior side straight, with a short lip on upper margin, sides rugose in lattice-like pattern.

Described from 2 females collected by the writer in Sharps Valley, St. Vincent B.W.I. (Aug. 27, 1941) at 800 ft. on *Inga* sp. This species is apparently confined to St. Vincent, and differs from *uhleri* in the proportions of the vertex and from *major* in the deeper and cuplike peri-opercular rim of the egg.

Dioxyomus (?) longiceps (Lethierry)

Alcestis longiceps Lethierry, 1881. Ann. Soc. Ent. Belgique XXV,:13.

"Pallidissima, fere alba; homelytris translucidis; vertice longitudine non latiore, antice rotundato, elevato-marginato, lateribus rectis, elevato-marginatis; in medio carinula postice furcata, marginem anticum non attingente, instructo. Scutellum tricarinatum, carinis lateralibus arcuatis. Tegmina ampla, abdomine duplo longiora et latiora. Long. 10 mill. Guadeloupe, 1 ex."

The characters of the vertex and of its median carina serve to place this species in *Neotangia* or *Dioxyomus*, while the length, if it is permissible to judge from known species, would certainly show it to belong to the latter genus. The data of value in distinguishing this species are the length (which is that of the insect measured from apex of vertex to apex of folded tegmina) somewhat exceeding the length of the largest species described above, and the distribution (Guadeloupe) which must be considered an important part of the specific description.

TANGIDIA Uhler

Uhler, 1895 Proc. Zool. Soc. Lond.: 59. Genotype, *Tangidia alternata* Uhler.

Vertex flat, slightly sunken between carinae, broader than long (about 1.6:1), lateral margins straight between eyes, curving inward distally and becoming thickened, anterior margin rounded and thickened, posterior margin excavate, middle of border not reaching to level of anterior margin of eyes, median carina thick, $\wedge$-shaped with its apex not quite attaining the anterior margin, lateral margins coarsely carinate; frons longer than broad (1.3:1), curved, lateral margins diverging to level of antennae, thence curved inward to suture, which is impressed, median carina distinct, percurrent, lateral margins carinate, clypeus short, medially carinate. Pronotum with anterior margin concave behind eyes, strongly convex on disc, posterior margin convex mesad of tegulae, angularly emarginate in middle, surface of disc somewhat hollowed between carinae, median carina present, coarse, lateral carinae of disc diverging posteriorly, slightly arcuate, no distinct submarginal carina between eyes and tegulae, lateral margins carinate; mesonotum broader than long, surface of disc slightly rounded, tricarinate. Tegmina 2.9 times as long as broad, anterior margin convex, apical border asymmetrically rounded, sutural margin straight to apex of clavus, very slightly oblique distad of it, costal margin one-sixth width of costal cell, the latter one and a quarter times as wide as radial cell; Sc+R forking twice before nodal line of transverse veins, M not forking before cross-veins, Cu forking just distad of junction of claval veins, nodal line, measured at M three-fifths from base of tegmen, 13–15 apical areoles, 3 broken and irregular lines of cross-veins on membrane. Wings typically with R simple to apex, M with 2 branches reaching margin, Cu1a with 2 branches, and Cu1b with 2, the first two anal veins contiguous at their mid-points, or at most linked by an extremely short transverse bar. Hind tibia with 3 spines.

Anal segment of male with lateral lobes produced, telson not or scarcely exceeding them. Pygofer with lateral angles acutely produced, lateral margins oblique, posterior ventral margin concave. Aedeagus laterally compressed, deep, with a basal periandrial spine and a short apical penial spine. Genital styles with ventral margin almost straight, slightly excavate, turned dorsally distally, apical margin obliquely truncate, dorsal margin with a prominent triangular eminence near base, a pair of spinose processes distad of it, the shorter directed outward, the longer twice as long as the preceding, sinuate, directed upward and mesad.

Ovipositor with third valvulae armed with 9 teeth on apical margin.

Egg subcylindrical, rounded at one pole, obliquely truncate in profile at other, chorionic process of operculum tubular, peri-opercular rim very shallow, though distinct, raised anteriorly.

All known members of genus yellowish brown, with darker brown markings on vertex, thorax, hind tibiae, abdominal tergites, and veins of tegmina, these colours being present in living as well as in preserved material.

Tangidia alternata Uhler

(Figs. 1, 12, 13, 34–38)

Uhler 1895 Proc. Zool. Soc. Lond.: 60.

Male. Length, 4.5 mm.; tegmen, 4.6 mm. Female. Length, 5.9 mm.; tegmen, 5.1 mm.

Vertex broader than long (1.6:1).

Tawny; dorsal margin and basal part of lateral carinae of frons piceous; a line across base of frons, a stripe before and behind each eye extending on to pronotal lobe, 3 spots on each side of median carina of vertex, a zig-zag broad line on each side of middle of pronotum, a line inside each lateral carina of mesonotum, and 3 short lines laterad of disc on each side, abdominal tergites on each side of middle, and a band across hind tibia, brown. Tegmina translucent yellowish, veins of corium interruptedly, apical veins and cross veins wholly brown. Wings hyaline.

Aedeagus deep, laterally compressed, ventral margin almost straight, curved upward distally, dorsal margin sinuate, slightly convex, apical margin rounded, a curved spine arising on left in basal half looping upward then forward and curving ventrally to point obliquely posteriorly, a short spine on upper half of penis directed posteriorly to margin then bent ventrad about its mid-point through 95° to point ventrally.

Egg subcylindrical, 0.9 mm. long, 0.28 mm. broad, rounded at one pole, obliquely truncate in profile at other, chorionic process slender, tubular, directed anteriorly; peri-opercular rim narrow, about twice as high anteriorly as posteriorly; operculum very slightly domed, traversed by a minute lattice of crossed furrows.

Redescribed from 2 males and 2 females taken by the writer at 200 ft. in Petit Bordel Valley, St. Vincent, B.W.I. Aug. 26, 1943) on low bushes.

Tangidia fugax, new species
(Figs. 39, 40)

Male. Length, 4.7 mm.; tegmen, 5.0 mm. Female. Length, 6.0 mm.; tegmen, 5.8 mm.

Vertex broader than long (1.8 to 1).

Tawny; margins of vertex, two oval spots inside lateral margins of vertex, a broad line along base and lateral margins of frons, a broad line overlying median carina of frons, and sometimes a short line overlying middle portion of median carina of clypeus, a round punctate spot on each side of middle of pronotum, a small spot behind each eye, an irregular suffusion on mesonotum, both on disc and on lateral fields, a small darker spot basally on each side of median carina, and veins of tegminal corium yellowish brown; carinae of mesonotum, tergites of abdomen, transverse veins of tegmina and veins of wings fuscous; wing membrane very slightly infuscate.

Aedeagus laterally compressed, ventral margin almost straight, curved upward distally, dorsal margin sinuate, apical margin rounded, a slender spine arising on left in basal half, directed posteriorly, looping upward then curving to point ventrally, a short spine on upper half of penis directed posteriorly and bent ventrally in middle through 45° to point obliquely postero-ventrally.

Egg subcylindrical 0.9 mm. long, 0.28 mm. broad, rounded at one pole, obliquely truncate in profile at other, chorionic process slender, tubular, directed anteriorly; peri-opercular rim narrow, about twice as high anteriorly as posteriorly; operculum very slightly domed, with a lattice-like pattern of crossed furrows.

Described from 9 males and 2 females taken by the writer at 1,000 ft. near Saltoun, Dominica, (June 11–20, 1939) on forest undergrowth. This species differs from *alternata* Uhler in the presence of a broad yellowish-brown band around the base and lateral margins of the frons, and overlying the median carina, and in other details of colouration. The proportions of the vertex and the shape of the aedeagal spines afford the principal morphological means of distinguishing the species. *T. fugax* has not been found outside Dominica, just as *alternata* Uhl. has not been found outside St. Vincent.

Tangidia triangulator (Lethierry), new combination

Alcestis triangulator Lethierry, 1881. Ann. Soc. Ent. Belgique, XXV,:14.

"Pallidissima: homelytris translucidis, fascia irregulari transversa sub-basali nigra, maculatisque nigris ante medium positis, una sub-suturali, caeteris minus distinctis, discoidalibus, ornatis: amplis, tertia parte abdomine longioribus. Vertice longitudine non latiore, antice et lateribus elevato-marginato, anterius rotundato; in parte basali carinae duae obliquae in angulum ante apicem conjunguntur. Scutellum tricarinatum, carinis lateralibus arcuatis. Long. 6 mill. Guadeloupe, 1 ex."

The characters of the vertex together with the size indicate that this species is a *Tangidia*. The specific characters include the colouration and the distribution, and the former, if typical of *triangulator*, sets it quite apart from the other species.

It is perhaps worth noting that in the description given in French the tegminal markings, apart from the irregular transverse fascia near the base, which is piceous, are given as brown, not black as quoted above.

ARIPOA, new genus

Vertex slightly broader than long (1.1:1), flattened, the surface slightly sunken, lateral margins almost straight, anterior margin acutely rounded, lateral margins carinate, thickened distad of eyes, anterior margin thickened, posterior margin widely excavate, median carina coarse, λ-shaped, the common stalk being almost as long as the arms, and not quite attaining anterior margin, arms of forked carina almost exactly trisecting posterior margin of vertex, frons longer than broad (1.5:1), slightly tectiform at base, flattened distally, lateral margins straight between eyes, thence diverging to level of antennae, and curving inward to suture, median carina percurrent, broad, rather shallow; clypeus short, medially carinate. Pronotum with anterior margin concave behind eyes, strongly convex in middle, posterior margin concave before tegulae, convex just mesad of tegulae, almost rectangularly emarginate in middle, median carina coarse, lateral carinae of disc diverging posteriorly, arcuate, scarcely attaining posterior border, submarginal carina on each side between eye and tegula distinct and thickened, lateral margins carinate between eye and costal margin of tegmen, the surface of the pronotum between submarginal and marginal carinae not hollowed out; ventro-lateral lobes of pronotum with ventral margin slightly tapering posteriorly towards lateral carina, apex of lobe evenly rounded; tegulae not carinate; mesonotum broader than long, tricarinate. Tegmina 2.7 times as long as wide, costal margin convex, apical margin slightly asymmetrically rounded, sutural margin straight, costal margin one-seventh width of costal cell, the latter 1.5 times as wide as radial cell, Sc+R, M, Cu1a and Cu1b forking at transverse line of cross-veins, which is situated five-ninths from base of tegmen; Cu1 forking slightly basad of junction of claval veins; about 17 apical areoles present and about 6 broken irregular lines of cross-veins on membrane. Wings with R simple to apex, M simple at apex, Cu1a with 2 branches at margin, Cu1b with 3 branches, Cu2 simple, the first and second anal veins joined distad of middle. Hind tibia with 3 spines.

Anal segment with lateral angles moderately produced, telson exceeding them. Ovipositor with third valvulae armed with 9 teeth on distal margin.

Egg subcylindrical, rounded at one pole, obliquely truncate in profile at other, operculate, chorionic process of operculum tubular, slender; peri-opercular rim insignificant.

Genotype, *Aripoa silvana* n. sp.

Aripoa silvana, new species
(Figs. 3, 20, 76, 77)

Female. Length, 6.2 mm.; tegmen, 6.3 mm.

Vertex broader than long (1.1:1).

Pale green; eyes red, tegmina vitreous, slightly tinged greenish, wings hyaline.

Egg 0.9 mm. long, 0.3 mm. broad, subcylindrical, smooth, peri-opercular rim absent, represented only by a slight thickening anteriorly, chorionic process of operculum slender, tubular, about one-quarter length of egg, directed obliquely anteriorly and upward, operculum very slightly domed.

Described from one female collected by the writer in St. John's Valley, Northern Range, Trinidad, B.W.I. (Sept. 20, 1942) on low bushes.

Aripoa munda (Muir), new combination

Neotangia munda Muir, 1931. Ann. Mag. Nat. Hist. 10(7):302.

Muir describes *munda* as differing from *Neotangia angustata* (Uhl.) in having the tegmina wider, the apex more bluntly rounded, the vertex narrower and its sides more parallel, its length in the middle being subequal to the width, and the median carina forking at about the middle. These characters, which are supported by other less significant details in the description, indicate that *munda*, a species from British Guiana, should be placed in *Aripoa*.

COLGORMA Kirkaldy

Kirkaldy, 1904. Ent. 37:279.
Genotype, *Achilus dilutus* Stål, 1859. Eugen. Resa, 4.: 271.

The writer has examined Godman and Salvin material identified by Fowler as this species. It is generically distinct, and is distinguished by the following characters.

Vertex about three times as broad as long, shallowly convex anteriorly, disc of pronotum broad, disc of mesonotum longer than broad. Tegmina with Sc+R not longer than M on corium, about as long, nodal line transverse from R to apex of clavus, not oblique; Sc+R and M not forked before nodal line, Cu forked once at distal third; outer subapical areole two-thirds length of middle pair.

NEORUDIA, new genus

Vertex wider than long (about 2:1), anterior margin rounded, posterior margin angulately excavate, disc depressed, lateral margins and median line stoutly carinate; frons not twice as long as broad. Pronotum with disc broad, carinae prominent, lateral carinae long, diverging from each other basad at an angle of about 70°, disc sunken between carinae; mesonotum with disc longer than broad, ovate. Tegmina with Sc+R and M not forked on corium, Cu forked once; Sc+R distinctly longer than M on corium, Cu forked once at distal fifth, nodal line arcuate towards base; 6 subapical areoles along nodal line, outer areole about half length of middle two.

Genotype, *Rudia proxima* Fowler, 1904, Biol. Cent.-Amer. Rhynch. Hom. I:104.

The remaining genera of West Indian Tambiniinae form a natural group and stand apart in having an elongate frons, a vertex not broad and a mesonotum that is about twice as wide as long, with the disc short and subquadrate, not ovate, and its lateral carinae not incurved basally. One genus of this group, *Arenasella* Schmidt (from Central and South America) would fall according to the existing tribal arrangement into the *Paricanini*, while the remainder would fall into the *Tambiniini*. Such a division would obscure the natural affinities of these genera so the writer proposes for their reception a new tribe, *Cyphoceratopini*, characterised by having the disc of the vertex narrow or semi-lunate, the disc of the pronotum small or replaced by a tectiform ridge with the median carina at the summit, the disc of the mesonotum short and subquadrate, not ovate, and the mesonotum about twice as broad as long; the tegmina with only a nodal and a subapical line of transverse veins. Members of this group all appear to be brightly marked with red or black, but the presence of these colours is not confined to this tribe. The genera placed here include *Cyphoceratops* Uhl. (type, *C. furcata* Uhl.), *Tangiopsis* Uhl. (type, *T. tetrastichus* Uhl.), *Parahydriena* Muir (type, *P. hyalina* Muir), *Achilorma* Metcalf (type *Achilus bicinctus* Spin.), *Arenasella* Schmidt (type *A. rubrovittata* Schmidt), *Ubis* and *Chasmacephala* described below.

KEY TO THE GENERA OF CYPHOCERATOPINI

(1)(2) Vertex narrow, longer than broad, hollowed out. (3)
(2)(1) Vertex as broad as long or broader, not hollowed. . . . . (7)
(3)(4) Disc of vertex deeply hollowed. . . . . (5)
(4)(3) Vertex with a vertical triangular plate medially
. . . . *Parahydriena* Muir.
(5)(6) Lateral margins of vertex pointed in middle. . *Cyphoceratops* Uhler.
(6)(5) Lateral margins of vertex horizontal. . . . . (11)
(7)(8) Vein Sc+R in corium longer than M. . . . . (9)
(8)(7) Vein Sc+R in corium shorter than M. . . . . . *Tangiopsis* Uhler.
(9)(10) Nodal line bisecting tegmen. . . . . *Arenasella* Schmidt.
(10)(9) Nodal line markedly distad of middle of tegmen. . . . .
Achilorma Metcalf.
(11)(12) Pronotum medially tectiform, devoid of disc. . . . .
Chasmacephala gen. nov.
(12)(11) Pronotum with an elevated disc. . . . . *Ubis* gen. nov.

Tribe CYPHOCERATOPINI

UBIS, new genus

Vertex longer than broad (1.5 to 1), anterior margin convex, lateral margins parallel, posterior margin angulately excavate, lateral margins raised, about horizontal in profile, median carina strong, as high as margins, disc much depressed, frons elongate, ampliate before suture. Pronotum with disc narrowly triangular, elevated, median and lateral carinae distinct, the latter diverging from each other at about 45°, mesonotum twice as broad as long, disc subquadrate, tricarinate. Tegmina with Sc+R and M simple on corium, of equal length, Cu forked in distal third, only nodal and subapical lines of transverse veins present, 6 subapical areoles, the outer not half as long as middle pair. Nodal line almost transverse, scarcely arcuate.

Genotype, *Rudia verticalis* Fowler, 1904. Biol. Cent.-Amer. Rhynch. Hom. I.:105.

CHASMACEPHALA, new genus

Vertex longer than broad (1.2:1), lateral margins subparallel, slightly incurved between eyes; anterior margin shallowly rounded, posterior margin deeply excavate, vertex deeply hollowed out between eyes, rounding smoothly into frons anteriorly, lateral margins raised, stoutly carinate; frons twice as long as broad, lateral margins sinuately expanding to below level of antennae, thence curved inward to suture, which is not impressed; lateral margins carinate, median carina broadly raised; clypeus short, broadly carinate in middle. Pronotum short, produced anteriorly into emargination of vertex, shallowly angularly emarginate posteriorly, median carina distinct, raised on a tectiform eminence, lateral carinae of disc absent, lateral margins carinate, submarginal carinae absent; tegulae not carinate, mesonotum much broader than long, tricarinate; tegmina with costal area one-sixth width of costal cell, devoid of cross-veins, costal cell subequal in width to radial cell, Sc+R and M forking at nodal line of transverse veins; Cu1 forking a little basad of apex of clavus, much distad of junction of claval veins; about 13 apical areoles present, a single line of transverse veins on membrane forming 6 subapical areoles. Wings with R simple to apex, M forked, Cu1a forked, with 2 branches reaching margin, Cu1b forked, with 2 branches, first two anal veins joined for a short distance distad of middle. Hind tibia with 3 spines.

Anal segment of male short, lateral angles thickened or shortly produced. Pygofer with lateral angles distinct, ventral posterior margin medially notched. Aedeagus laterally compressed, with about 4 spines present on penis. Genital styles broad, ventral margin convex, apical margin rounded, dorsal margin with a triangular eminence near base, with 2 processes distad of it, subequal in size, curved anteriorly at tip.

Ovipositor with third valvulae armed with 9 teeth.

Egg subcylindrical, rounded at one pole, obliquely truncate in profile at other, chorionic process of operculum principally laminate, with a short apical tubular projection, apparently canaliculate; peri-opercular rim distinct, narrow, somewhat produced anteriorly.

Genotype, *C. pluvialis* n. sp.

Chasmacephala pluvialis, new species

(Figs. 8, 14, 15, 58, 59)

Male. Length, 4.8 mm.; tegmen, 4.3 mm. Female. Length, 6.0 mm.; tegmen, 5.1 mm.

Vertex twice as long in greatest length as wide across base.

Bright green; lateral margins of frons, median carina of frons and clypeus broadly orange-yellow or crimson red, abdomen sometimes red; legs dark testaceous or brown; tegmina hyaline, tinged dull ivory, veins fuscous; wings hyaline, apical portion of anal lobe fuscous except in posterior third, veins fuscous.

Anal segment with lateral angles thickened, not produced, telson distinctly exceeding them in length. Pygofer with lateral angles not produced posteriorly in a point, but forming an obtuse angle. Aedeagus laterally compressed, ventral margin convex, dorsal margin concave, a small lobe on dorsal margin of periandrium at apex directed obliquely upward and backward; penis with 2 straight spines of equal length ventrally near base, directed posteriorly, 2 much smaller spines in middle of penis, the lower straight, directed posteriorly, the dorsal strongly curved. Genital styles with paired processes on dorsal margin adpressed to distal portion, being almost received into a groove, the triangular eminence at base of dorsal margin with a base much wider than the length of either side.

Egg subcylindrical, rounded at one pole, operculate at other, chorionic process tubular in distal portion, projecting somewhat anteriorly from the upper margin of an almost semi-circular laminate proximal portion, peri-opercular rim narrow, obliquely produced anteriorly. Length 1.0 mm., with ornamentation but excluding apical tube, 1.15 mm., width 0.3 mm.

Described from 18 males and 26 females taken by the writer at 1,000 ft. near Saltoun, Dominica (June 11—July 8, 1939) on ferns in forest. This species is distinguished by the shape of the pygofer, of the aedeagus and of the genital styles.

Chasmacephala tristis, new species

(Figs. 53, 54, 60, 61)

Male. Length, 4.5 mm.; tegmen, 4.3 mm. Female. Length, 5.4 mm.; tegmen, 5.4 mm.

Vertex twice as long in its greatest length as wide across base.

Bright green, median carina of frons orange yellow, tegmina hyaline, tinged dull ivory, veins fuscous, wings hyaline, apical portion of anal lobe, except in posterior third, fuscous, veins dark.

Pygofer with lateral angles acutely pointed, lateral margins slightly concave, ventral margin medially notched. Aedeagus laterally compressed, ventral margin convex, dorsal margin concave, periandrium with a flattened lobe, ovate in side view, projecting above apex of penis; penis with apex in form of a broad uncinate lobe, 2 spines basally on penis directed posteriorly, the anterior curved obliquely ventrally at tip, the posterior straight, near apex of penis 2 shorter spines directed posteriorly and obliquely upward, the lower spine straight, the dorsal spine very slightly curved upward in apical half. Genital styles rounded at apex, dorsal margin with the triangular eminence with its base wider than the length of its sides, the two processes distad of it subequal, remote from ascending dorsal margin distad of them.

The egg as in *pluvialis.*

Described from 4 males and 3 females collected by the writer at 1,000 ft. in forest near Three Rivers Settlement, St. Vincent B.W.I. Sept. 4th, 1941, on tree-ferns. This species is distinguished by the details of the male genitalia, and is apparently confined to St. Vincent.

Chasmacephala furtiva, new species

(Figs. 55–57)

Male. Length, 5.0 mm.; tegmen, 4.8 mm.

Vertex twice as long in greatest length as wide across base.

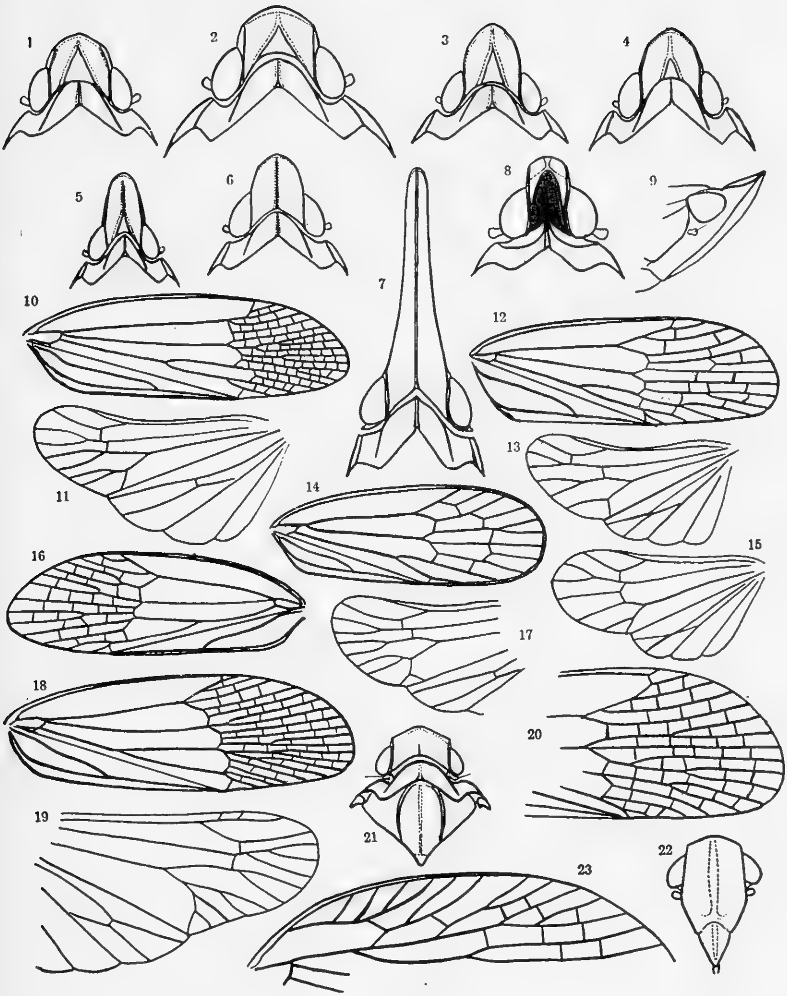
Bright green; lateral margins of frons, median carina of frons and clypeus broadly orange-yellow, legs dark testaceous; tegmina hyaline, tinged dull ivory, veins fuscous; wings wholly hyaline, veins testaceous.

Anal segment with lateral angles slightly produced, telson not exceeding them in length. Pygofer with lateral angles acutely pointed, lateral margins straight, oblique. Aedeagus laterally compressed with ventral margin convex, dorsal margin with a large anvil-shaped periandrial lobe directed posteriorly; penis curved upward distally into a broad sub-hamate lobe, the lobe touching that of the periandrium on its inner margin, causing the end of the aedeagus to appear rounded; a pair of penial spines ventrally, directed posteriorly, the basal spine slightly deflexed towards apex, the posterior spine almost straight, penis distally with 3 spines, 2 close together and directed posteriorly, the lower being slightly turned dorsad near its apex, the third spine very small, close to dorsal margin, distinctly basad of preceding two, curved obliquely upward and caudad. Genital styles with ventral margin convex, apical margin rounded, dorsal margin with a triangular eminence near base, with a pair of processes, hooked distally, behind it on margin, these processes not being adpressed to the distal part of the margin.

Described from 9 males collected by the writer at 1,000 ft. in forest near Quilesse, St. Lucia B.W.I. (Mar. 20-22, 1939), on *Cyathea*. This species is distinguished by the shape of the anal segment, aedeagus, and penial spines, and by the absence of fuscous markings on the anal lobe of the wings.

Explanation of Plates

1. *Tangidia alternata* Uhl., head and pronotum.
2. *Dioxyomus uhleri* (Muir), head and pronotum.
3. *Aripoa silvana*, n.sp., head and pronotum.
4. *Neotangia angustata* (Uhl.), head and pronotum.
5. *Dictyotangia emarginata* (Uhl.), head and pronotum.
6. *Neurotmeta bipatriata*, n.sp., head and pronotum.
7. *Remosa kontorhina*, n.sp., head and pronotum.
8. *Chasmacephala pluvialis*, n.sp., head and pronotum.
9. *Dictyotangia emarginata* (Uhl.), head in profile.
10. *Neotangia angustata* (Uhl.), tegmen.
11. *Neotangia angustata* (Uhl.), wing (drawn from type female by W. E. China.)
12. *Tangidia alternata* Uhl., tegmen.
13. *Tangidia alternata* Uhl., wing (drawn from male type by W. E. China.)
14. *Chasmacephala pluvialis*, n.sp., tegmen.
15. *Chasmacephala pluvialis*, n.sp., wing.
16. *Dictyotangia emarginata* (Uhl.), tegmen.
17. *Dictyotangia emarginata* (Uhl)., wing.
18. *Dioxyomus ganymedes*, n.sp., tegmen.
19. *Dioxyomus ganymedes*, n.sp., wing.
20. *Aripoa silvana*, n.sp., membrane of tegmen and apical margin.
21. *Alcestis lunata*, n.sp., head and thorax.
22. *Alcestis lunata*, n.sp., head, antero-ventral view.
23. *Alcestis lunata*, n.sp., anterior margin of tegmen.
24. *Neurotmeta dominicana*, n.sp., aedeagus, ventral view.
25. *Neurotmeta dominicana*, n.sp., aedeagus, right side.
26. *Neurotmeta bipatriata*, n.sp., ventral spines of aedeagus, ventral view.
27. *Neurotmeta bipatriata*, n.sp., aedeagus, right side.
28. *Neurotmeta oreas*, n.sp., ventral spines of aedeagus, ventral view.
29. *Neurotmeta oreas*, n.sp., aedeagus, right side.
30. *Neurotmeta litoralis*, n.sp., aedeagus, ventral view.
31. *Neurotmeta litoralis*, n.sp., aedeagus, right side.
32. *Neurotmeta dominicana*, n.sp., posterior margin of pygofer and left genital style.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33. *Neurotmeta dominicana*, n.sp., anal segment of male.
34. *Tangidia alternata* Uhl., posterior margin of pygofer and anal segment.
35. *Tangidia alternata* Uhl., left genital style.
36. *Tangidia alternata* Uhl., periandrium, left side.
37. *Tangidia alternata* Uhl., penis, left side.
38. *Tangidia alternata* Uhl., opercular ornamentation on egg, side view.
39. *Tangidia fugax*, n.sp., periandrium, left side.
40. *Tangidia fugax*, n.sp., penis, left side.
41. *Dictyotangia emarginata* (Uhl.), aedeagus, left side.
42. *Dictyotangia emarginata* (Uhl.), left genital style.
43. *Remosa kontorhina*, n. sp., aedeagus, right side.
44. *Remosa kontorhina*, n.sp., aedeagus, ventral view.
45. *Remosa cultellator* (Walker), aedeagus, ventral view.
46. *Remosa cultellator* (Walker), aedeagus, right side.
47. *Remosa cultellator* (Walker), right genital style.
48. *Neotangia caribea*, n.sp., flagellar process of aedeagus, dorsal view.
49. *Neotangia caribea*, n.sp., aedeagus, right side.
50. *Neotangia angustata* (Uhl.), aedeagus, right side.
51. *Neotangia mitrata*, n.sp., flagellar process of aedeagus, dorsal view.
52. *Neotangia angustata* (Uhl.), flagellar process of aedeagus, dorsal view.
53. *Chasmacephala tristis*, n.sp., opercular ornamentation of egg, anterior view.
54. *Chasmacephala tristis*, n.sp., opercular ornamentation of egg, side view.
55. *Chasmacephala furtiva*, n.sp., penis, right side.
56. *Chasmacephala furtiva*, n.sp., right genital style.
57. *Chasmacephala furtiva*, n.sp., periandrium, right side.
58. *Chasmacephala pluvialis*, n.sp., right genital style.
59. *Chasmacephala pluvialis*, n.sp., aedeagus, right side.
60. *Chasmacephala tristis*, n.sp., periandrium, right side.
61. *Chasmacephala tristis*, n.sp., penis, right side.
62. *Dioxyomus uhleri* (Muir), pygofer, anal segment, aedeagus and genital style, left side. (From drawing made by W. E. China from type.)
63. *Dictyotangia emarginata* (Uhl.), opercular ornamentation of egg, anterior view.
64. *Dictyotangia emarginata* (Uhl.), as above, side view.
65. *Neotangia coronata*, n.sp., opercular ornamentation of egg, anterior view.
66. *Neotangia coronata*, n.sp., as above, side view.
67. *Neotangia mitrata*, n.sp., opercular ornamentation of egg, anterior view.
68. *Neotangia mitrata*, n.sp., as above, side view.
69. *Neotangia angustata* (Uhl.), opercular ornamentation of egg, anterior view.
70. *Neotangia angustata* (Uhl.), as above, side view.
71. *Remosa kontorhina*, n.sp., opercular ornamentation of egg, anterior view.
72. *Remosa kontorhina*, n.sp., as above, side view.
73. *Dioxyomus major*, n.sp., opercular ornamentation of egg, anterior view.
74. *Dioxyomus major*, n.sp., as above, side view.
75. *Dioxyomus ganymedes*, n.sp., opercular ornamentation of egg, side view.
76. *Aripoa silvana*, n.sp., opercular ornamentation of egg, anterior view.
77. *Aripoa silvana*, n.sp., as above, side view.

A LIST OF THE MOSQUITOES OF THE DISTRICT OF COLUMBIA.[1]

By Newell E. Good, *U. S. Public Health Service.*[2]

The earliest reference to a species of mosquito in the District of Columbia appears to be that of Warden (1816, p. 167) who wrote:

> "Two insects abound in this place, (the estate of Harrison Smith) and torment the lovers of nature; the wood-louse and mosquito (*Culex pipiens*, L.) . . . The bite of the mosquito also creates inflammation, and it annoys the ear of the pensive or studious by its unpleasant buzz."

Since at that time only three of the species now know to occur here had been described, (*Culex pipiens* L., *Aedes aegypti* (L.), and *Psorophora ciliata* (Fabr.)), Warden's "*Culex pipiens* L." may have consisted of a complex of a number of species. In 1868 Baron Osten Sacken described *Aedes sapphirinus*, now *Uranotaenia*, with Washington, D. C. as a type locality, thus giving the District of Columbia its first definite specific mosquito record. The District of Columbia is likewise the type locality for *Orthopodomyia signifera* (Coquillett) 1896, the type of which is preserved in the U. S. National Museum.

Lists of mosquitoes including records of specimens collected in the District of Columbia were published by Howard in 1896, 1900, and 1901, by Howard, Dyar, and Knab 1915–1917, and Dyar 1922. These papers listed 9, 13, 10, 26 and 23 species respectively from the District of Columbia. Because of the inevitable changes in synonymy it is difficult to determine in each case from the published data just which of our present day species were represented in the collections of these writers. Fortunately, most of these, as well as many unreported specimens, are preserved in the collection of the U. S. National Museum. This collection contains specimens of 31 species of mosquitoes from the District of Columbia which were collected

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[1] The writer wishes to express his appreciation to Dr. Alan Stone, U. S. Bureau of Entomology and Plant Quarantine, for making final identifications of all of the specimens specifically listed in this paper and for his ever available aid in all phases of the work, and to Dr. E. A. Chapin and Mr. C. F. W. Muesebeck for giving permission to publish records of the specimens in the collection of the U. S. National Museum and for making available a microscope and working space during the winters of 1942–43 and 1943–44. The majority of the original identifications of the 1942 and 1943 collections were made by Asst. Sanitarian (R) John E. Porter who was assigned to the District of Columbia office from September 1942 to August 1943. The 1942–45 collections were made by MCWA entomologists and inspectors, particularly Engineering Aide, C. W. Travis.

[2] Passed Assistant Sanitarian (R), Malaria Control in War Areas.

prior to 1915. With one questionable exception it contains representatives of all species reported from the District of Columbia by either Howard, Dyar, and Knab 1915–1917 or Dyar 1922, with the addition of *Aedes canadensis* (Theob.), *A sollicitans* (Walk.), *A. sticticus* (Meig.), and *A. taeniorhynchus* (Wied.). There is also a single male of *Orthopodomyia*, collected in 1901 and originally determined as *O. signifera* (Coq.), which agrees with Baker's description of *O. alba* (1936) and must be referred to this species. The single exception is that of *Wyeomyia smithii* (Coq.) 1901, which is reported by Howard, Dyar, and Knab 1915, p. 101, as having been collected in Washington, D. C. by Miss Evelyn G. Mitchell as, "larvae in pitcher plant leaves in a green house." No date is given, and no records are available to prove that the pitcher plant in question had not been brought in recently from some other locality, with the eggs or larvae already in its leaves. The only existing specimens to which the above data could refer are preserved in alcohol in the collection of the U. S. National Museum. One vial labeled, "*W. smithii*, D. C., June 16", contains two pupae only. Three other vials labeled simply, "*W. smithii*", in handwriting identical with that of the first vial, contain many larvae of *W. smithii* but there is no further data. These may or may not be from the same lot as the first vial which again may or may not contain the specimens referred to by Howard, Dyar, and Knab. However, since *Sarracenia purpurea* L. has been taken within the District of Columbia, as proven by specimens in the U. S. National Herbarium, and the known range of *W. smithii* surrounds this area, we consider this species to have been definitely recorded here.

The years 1914 to 1942 appear to have produced no new District of Columbia species records which can be corroborated either by specimens or by records of determinations by specialists. General mosquito control work was carried on in the District of Columbia from 1930 to 1941, (see Robertson 1932–33, and Stephens and Fisher 1939) and many specimens were collected but few of these were preserved. During this same period, in 1932–33, specimens collected at a light trap in College Park, Maryland, three miles northeast of the District of Columbia and reported by Cory, et al, 1934, showed that four additional species should be present here. These were *Aedes cinereus* Meig,. *Aedes mitchellae* (Dyar), *Culex erraticus* D. & K., and *Culiseta melanura* (Coq.). In addition, *Anopheles barberi* Coq. was taken repeatedly on Plummers Island, Maryland (type locality) four miles west of the District of Columbia, and at other points near the Potomac River in Montgomery County, Maryland. All of these species, as well as 27 other species already represented in the U. S. National Museum collections and including *Orthopodomyia alba* Baker, have since been taken in the District of Columbia by the writer and his assistants. The addition of these five species raises the total number of species definitely recorded from the District of Columbia to 37. Of these, 33 species have been taken within the past five years and so are considered to be a part of the present District of Columbia fauna. There are no records of *Aedes aegypti* (L.), *Psorophora discolor* (Coq.), *Psorophora horrida* (D. & K.) nor *Wyeomyia smithii* (Coq.) during the past thirty years and they therefore must be considered to be either extinct or extremely rare as far as the District of Columbia fauna is concerned. *Aedes aegypti*, the yellow fever mosquito, may be of course reintroduced at any time and could propagate during the summer so a continual watch must be kept for this dangerous species.

Three other species, not definitely recorded from within the District of Columbia, have been taken in nearby Maryland or Virginia, or both north and south of these states, and must be listed as of probable occurrence. These are *Aedes grossbecki* D. & K. collected at Grassymead (Fairfax Co.?), Virginia, June 19, 1906, and at Baltimore, Maryland (specimens in U. S. National Museum); *Aedes dupreei* (Coq.), known from both New Jersey and Lake Drummond, Virginia (Dorer, et al., 1944) as well as from other more distant localities; and *Aedes cantator* (Coq.), a strong-flying salt marsh mosquito, similar in appearance to the very common *A. vexans*, and recorded by Cory, et al, to be common at Annapolis and Chesapeake Beach, Maryland, both less than 30 miles, air-line distance, from the District of Columbia.

The present Malaria Control in War Areas program has carried on an extensive entomological inspection in all parts of the District of Columbia since June 1942, under the continuous direction of the writer. Collections were made by means of light traps, natural and artificial resting places, biting records, and by dipping for larvae. During these three seasons 32 species were collected in the adult stage and 26 of these species were taken also as larvae. Five species were taken for the first time in the District of Columbia and a great deal of information on general abundance, seasonal abundance, and larval habitats has been gained.

Specific records on rare or unreported species, together with the larval habitats of specimens taken in the District of Columbia are given below. The following abbreviations and symbols are used: (T)—light trap; (S)—natural or artificial resting station; (R)—adult reared from larva or pupa; (B)—biting records; (L)—larva. Some, or all, of the specimens listed in each record are deposited in the U. S. National Museum.

All records from 1942–1945 are based on specimens collected by Malaria Control in War Areas personnel unless otherwise indicated.

Aedes aegypti (L.)

Dist. Col.: 3 ♂♂, July 3, 1901, J. Carroll; 1 ♀, Aug. 28, 1908, R. W. Van Horn; 1 ♂, Sept. 1, 1908, R. W. Van Horn.

Aedes atlanticus D. & K.

Chain Bridge, 1 ♀, Sept. 29, 1906, T. Pergande; 10th & G St., S. W.; (T) 2 ♂♂, 1 ♀, Aug. 21, 1942, 1 ♂, 2 ♀♀, Aug. 24, 1942; (L) 4, June 14, 1945, in shallow, shaded pond, N. E. Good.

Aedes atropalpus (Coq.)

This species is quite common in the area near Chain Bridge between the old C. & O. Canal and the Potomac River, where larvae may be found throughout the summer in pot holes in rocks. Larvae also were taken on one occasion in water in a fire barrel on a temporary bridge; Roosevelt Island, (L), 2, Sept. 23, 1942, J. E. Porter. Adults seldom have been taken more than one-fourth mile from known breeding places.

Aedes canadensis (Theob.)

Larvae of this species are the first to appear in the spring and are the most common species until the first part of May. They gradually are replaced by larvae of *Aedes vexans* and disappear in early June. They breed in shallow semipermanent ponds, particularly those in open fields, throughout the District of Columbia. (L), 50, Apr. 9, 1943, N. E. Good.

Aedes cinereus Meig.

Between Anacostia River and National Training School for boys; (L) 4, Apr. 16, 1943, J. E. Porter, in swampy ponds; (B), 3 ♀♀, May 26, 1943, J. E. Porter; (S), 1 ♀, May 26, 1943.

Aedes mitchellae (Dyar)

Zoo, (T), 1 ♂, May 11, 1944, 2 ♀♀, May 20, 1944, 1 ♀, July 13, 1944, 1 ♀, Aug. 2, 1944, 1 ♀, Oct. 7, 1944. A single female was taken between May 13 and May 27, 1944 in light traps at each of the following places: American University, Rock Creek Park, Army Medical Center, Hains Point, and Camp Simms. The Army Medical Center specimen was the first to be identified, this determination being made by S/Sgt. (now 1st Lieut., Sn.C.) D. D. Millspaugh of the Army Medical School, A. M. C.

Aedes sollicitans (Walk.)

Adult females of the salt marsh mosquito are taken commonly in light traps throughout the District of Columbia. Males also are taken, but less commonly and in the District of Columbia always have been confined to the eastern half. Larvae have been taken on a few occasions in small temporary ponds in the eastern half of the District. Saratoga and Montana Avenues, N. E., (L), 1, Aug. 13, 1942, in temporary pond; Bladensburg Rd. & 28th St., N. E., 1, Aug. 17, 1942, in temporary pond; Oklahoma Ave. & C St., N. E., 1, Aug. 21, 1942, in shallow temporary pond; Anacostia Park near Anacostia bridge, 1, Aug. 22, 1942, in shallow semipermanent pond.

Aedes sticticus (Meig.)

We have only two records of the floodwater mosquito in the District of Columbia; 1 ♂, May 18, 1914, F. Knab, in house; 17th and R. I. Ave., N. E., (T) 2 ♀ ♀, May 16, 1940 (D. C. Mosquito Control).

Aedes taeniorhynchus (Wied.)

Adult females are taken occasionally but males never have been taken. We have two larval records: (L), 1, Sept. 1902, J. Kotinsky; north of Naval Air Station, 1, Oct. 22, 1942, in shallow pond.

Aedes triseriatus (Say)

This species is found rather commonly throughout the District of Columbia breeding in tree holes, in bird baths on the ground in sheltered locations, and in water in barrels, buckets, and other containers.

Aedes trivittatus (Coq.)

Adults are taken occasionally in light traps throughout the District of Columbia, but most of our records are from a light trap at Minnesota Ave. and Hunt Place N. E. in 1942. We have only two larval records; Rock Creek Park, 2, Aug. 12, 1942, in shallow woodland ponds; West Va. Ave., & Fenwick St., N. E., (R), 2 ♀ ♀, Sept. 3, 1942, from woodland pool.

Aedes vexans (Meig.)

This is the most common species of *Aedes* in the District of Columbia and ranks second only to *Culex pipiens* in total numbers. It is especially numerous and troublesome after heavy summer rains. Larvae are found throughout the season in temporary rain-filled pools and shallow ponds where they often are seen in groups of several thousand. Sometimes there may be several separate groups in the open water of a pool well away from the banks and from emergent and floating vegetation.

Anopheles barberi (Coq.)

This rare species was originally described in 1903 from Plummers Island, Maryland, in the Potomac River four miles west of the District of Columbia. However, there were no District of Columbia records of this species until 1943 when nine males and six females were taken by M. C. W. A. personnel in natural resting places in Rock Creek Park, the Soldiers Home, and the Kenilworth aquatic gardens. Kenilworth, (S), 1 ♀, July 2, 1943; Soldiers Home, 2 ♂♂, July 3, 1943; Rock Creek Park, (L), 1, Aug. 12, 1944, N. E. Good, in small, shaded, tree hole. Larvae also have been collected by personnel of the Army Medical Center in tree holes in Rock Creek Park from August 1 to September 8, 1944.

Anopheles crucians, (Wied.)

This species is present but not very common in the District of Columbia. It is taken much more frequently in light traps than by other methods of collecting. The larvae breed in large lily ponds with dirt banks, in old borrow pits now bordered by vegetation, and in other types of unshaded ponds containing or bordered by vegetation. It usual habitats seem to be much the same as those of *A. quadrimaculatus* and we often have taken the two together. All of the larvae have been of the typical sub-species, *A. crucians crucians.*

Anopheles punctipennis (Say)

This is by far the most common species of *Anopheles* in the District of Columbia, and one of the most common of all species of mosquitoes here. The larvae breed in a great variety of habitats including nearly all types of ponds and streams, from sunlit ponds to woodland streams. The adults of this species are very commonly found biting out of doors in the evening.

Anopheles quadrimaculatus Say

The common malaria mosquito is present in small numbers throughout the District of Columbia in lily ponds, old borrow pits and other quiet, sunlit pools, especially those with floating aquatic vegetation, but is not very numerous at any place. A breeding place in the water chestnut of Oxon Creek was eliminated by cutting in early 1943 and breeding in the old C. & O. canal during the summer of 1943 has been eliminated by the repairing and restoration of the canal. The main breeding areas at present are a number of large ornamental pools in Kenilworth and in the National Arboretum, in all of which breeding is kept in check by large numbers of top minnows, *Gambusia* sp.

Anopheles walkeri Theob.

Adults of *A. walkeri* have been taken in rather large numbers in light traps at Kenilworth and at Blue Plains, and in smaller numbers elsewhere. Larvae have not been taken but undoubtedly do breed in the swampy areas near Kenilworth and Blue Plains.

Culex apicalis Adams

Larvae of *C. apicalis* are found commonly throughout the District of Columbia in various types of ponds and small creeks.

Culex erraticus D. & K.

Although *C. erraticus* is a common species in the District of Columbia it never previously has been reported here. The larvae breed in lily ponds and other quiet, sunlit ponds with floating aquatic plants, frequently being found associated with *A. quadrimaculatus* and *Uranotaenia sapphirina.* C. & O. Canal near Chain Bridge, (L), 2, July 16, 1942; Oxon Creek in water chestnuts, 2 Sept. 2, 1942; North of National Arboretum, 4, Sept. 22, 1942, in large pond; Gallinger Hosp., (T), 1 ♀, Sept. 19, 1943.

Culex pipiens L.

The northern house mosquito is the most abundant species of mosquito in the District of Columbia. It breeds almost anywhere that water stands, whether in ponds, sluggish streams, or artificial containers. It is especially numerous in catch basins, stagnant ponds, and in other places where the water is slightly polluted, and, except in rainy seasons, is the cause of more annoyance than any other species.

Culex quinquefasciatus Say

The southern house mosquito is fairly common in the District of Columbia as is shown by approximately one hundred specimens in the U. S. National Museum. In collections made by Malaria Control in War Areas personnel, *C. quinquefasciatus* was not separated from *C. pipiens* after it had been determined that *C. pipiens* was much the more common species.

Culex restuans Theob.

The white-dotted *Culex* is very common although not as common as *C. pipiens.* It breeds in much the same type, and in almost as great a variety of habitats as *C. pipiens* but is not nearly as common in street catch basins.

Culex salinarius Coq.

This species is found in moderate numbers breeding in ponds of various types.

Culiseta inornata (Will.)

This species has been taken occasionally throughout the District of Columbia. The larvae occur in small semipermanent ponds, rain-water ponds, and hoof prints. Langdon Park, (L), 1, Sept. 4, 1942, pool in small stream, Hains Point, 13, March 19, 1945, in old borrow pits.

Culiseta melanura (Coq.)

Only one District of Columbia specimen of *C. melanura* is available: Gallinger Hosp., (T), 1 ♀, May 19, 1943.

Mansonia perturbans (Walk.)

Taken in light traps in moderate numbers throughout the District of Columbia, particularly at the Kenilworth aquatic gardens. No serious attempt has been made to collect the larvae.

Megarhinus septentrionalis D. & K.

Specimens from the District of Columbia formed part of Dyar and Knab's type series but there were no definite records of larvae collected until 1944. Larvae and pupae were collected in tree holes in Rock Creek Park, usually associated with either *Aedes triseriatus* or *Anopheles barberi*, from June 2 through September 1944 by Army Medical Center personnel, and from August 12 to October 7, 1944 by N. E. Good. Rock Creek Park, (L), 1, Aug. 12, 1944: 2, Aug. 26, 1944; (R), 1 ♂, Aug. 23, 1944; 1 ♀, Sept. 15, 1944, N. E. Good, all collected as larvae in tree holes.

Orthopodomyia alba Baker

Dist. Col.: 1 ♂, July 20, 1901, N. Banks (originally determined as *O. signifera*); (T), 14th & R. I. Ave., N. E., 1 ♂, Sept. 4, 1942; 1 ♀, Aug. 20, 1943; National Arboretum, 1 ♀, Sept. 18–25, 1943.

Orthopodomyia signifera (Coq.)

The District of Columbia is the type locality for *O. signifera* but it is rather rare here nevertheless. The following larval specimens have been taken: (L), 1, July 1904, H. G. Dyar; Soldiers Home, 10, Sept. 11, 1942, in unused metal horse trough.

Psorophora ciliata (F.)

Taken occasionally in light traps, particularly in the southeastern part of the District of Columbia. Larvae have been taken only twice in the District of Columbia. Chain Bridge, (R), 1 ♀, Aug. 9, 1908; Blue Plains, between Home for Aged and Oxon Creek, (L), 6, Aug. 19, 1942, in shallow temporary ponds.

Psorophora confinnis (Arrib.)

Taken commonly throughout the District of Columbia in light traps, but especially at Camp Simms and at St. Elizabeth Hospital. The larvae live in shallow ponds, puddles, and road ruts.

Psorophora discolor (Coq.)

There are only two records of *P. discolor* in the District of Columbia. In both cases the specimens were taken as larvae and reared. Data on these specimens in the U. S. National Museum is as follows: 1 ♀, "Raised from larva coll, at Mt. Pleasant, D. C., on Sept. 8, 01, Iss. Sept. 9, 01, Kotinsky"; 1 ♂, 1 ♀, "Washington, D. C., Iss. V–24, H. G. Dyar".

Psorophora ferox (Humb.)

Taken occasionally throughout the District of Columbia by all methods of collection. On a few occasions it has been observed to be numerous and a persistent biter in swampy, wooded places during the day. The larvae breed in swampy ponds, woodland pools, and small marshy creeks.

Psorophora horrida (D. & K.)

Our only records, in addition to published records, consist of four specimens in the U. S. National Museum with data as follows: 2 ♀ ♀, "Catholic Univ., D. C., VII–05, T. Pergande"; 1 ♀, "Washington, D. C., 5–VII–08, F. Knab"; 1 ♀, "Chain Bridge, D. C., July 21, 09".

Psorophora howardii (Coq.)

One male in the U. S. National Museum collection is labeled "Chain Bridge, D. C., Iss., Aug. 2, 08, T. Pergande". We have one additional record: Roosevelt Island, (B), 6 ♀ ♀, Aug. 26, 1942.

Uranotaenia sapphirina (O.S.)

Taken rather commonly throughout the District of Columbia in light traps and in larval collections. It is particularly numerous at the Kenilworth aquatic gardens. The larvae breed in the same habitats and in company with *Anopheles quadrimaculatus*. They are common in ornamental pools, ponds with floating aquatic vegetation, and among water chestnut in Oxon Creek.

Wyeomyia smithii (Coq.)

The single record of this species has been discussed on page 2.

The following table lists the indicated abundance of each species, the earliest and latest known seasonal collection records, and the oldest existing District of Columbia specimen of each species. These records are based in each instance on specimens now deposited in the U. S. National Museum and determined by Dr. Alan Stone.

Explanation of Symbols Used in Table.

Abundance Column.

1—Very abundant (breeds throughout season in a variety of habitats throughout District of Columbia).

2—Common.

3—Scarce to fairly common.

4—Rare.

a—present only in the spring.

b—breeds only in restricted habitats and the adults are of local distribution.

c—no recent records.

Recorded seasonal occurrence columns.

Source or records:

a—collections of M.C.W.A., 1942–1944.

b—specimens in U. S. National Museum.

c—other collections or unpublished records.

d—published records, for which specimens are not available.

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RECORDS OF THE SPECIES OF MOSQUITOES COLLECTED IN THE DISTRICT OF COLUMBIA

SPECIES	Abundance	Oldest Existing D. C. Specimen			Recorded Seasonal Occurrence in D. C.		
					Adults		Larvae and Pupae
		Stage & Sex	Date	Collector	Males	Females	
Aedes aegypti (L.)	4c	m.	7-3-1901	Dr. J. Carroll	7/3 b	8/28 b	....
" *atlanticus* D. & K.	4	f.	9-29-1906	T. Pergande	8/21-8/24 a	8/21-9/29 ab	6/14 a
" *atropalpus* (Coq.)	3b	m.f.	5-20-1903	M. V. Warner	4/10-10/4 ab	4/10-10/7 ab	4/10-11/2 a
" *canadensis* (Theob.)	2a	f.	8-?-1905	T. Pergande	4/18-6/1 ab	4/25/8/? ab	2/27-6/21 a
" *cinereus* Meig.	4a	L.	4-16-1943	MCWA (J. E. Porter)	....	5/9-6/9 a	4/16 a
" *mitchellae* (Dyar)	4	f.	5-13-1944	MCWA(T.)	5/11	5/13-10/7 a	....
" *sollicitans* (Walk.)	3	f.	10-4-1906	T. Pergande	7/28-9/20 a	5/27-10/4 ab	8/17-8/22 a
" *sticticus* (Meig.)	4	m.	5-18-1914	F. Knab	5-18 b	5/16 c	....
" *taeniorhynchus* (Wied.)	4	L.	9-?-1902	J. Kotinsky	....	6/12-9/16 ab	9/?-10/22 ab
" *triseriatus* (Say)	2b	f.	9-4-1901	W. E. Hinds	6/14-9/18 ab	5/23-11/12 ab	4/9-9/11 ab
" *trivittatus* (Coq.)	3	f.	8-31-1904	T. Pergande	7/3-9/30 a	6/16-10/17 ab	8/12-9/3 a
" *vexans* (Meig.)	1	R.m.f.	7-25-1900	J. Kotinsky	5/2-11/9 ab	5/8-11/8 ab	4/9-10/30 ab
Anopheles barberi Coq.	4b	f.	7-2-1943	MCWA (C. W. Travis)	7/3-8/27 a	7/2-8/27 a	8/1-9/8 ac
" *crucians* Wied.	3	f.	4-27-1893	(T. Pergande)?	5/27-9/28 a	4/10-11/27 ab	4/28-11/25 a
" *punctipennis* (Say)	1	R.f.	9-?-1901	J. Kotinsky	4/10-11/10 ab	each month ab	3/29-11/27 ab
" *quadrimaculatus* Say	2	f.	9-27-1893	?	5/11-10/23 ab	5/11-(1/29) ab	5/25-11/18 a
" *walkeri* Theob.	2b.	f.	10-15-1906	T. Pergande	5/30-10/3 a	4/21-10/10 ab	....
Culex apicalis Adams	2	R.m.	5-6-1903	W. V. Warner	4/14-10/16 ab	4/14-10/23 ab	4/10-11/27 ab
" *erraticus* D. & K.	2	L.	7-16-1942	MCWA(C.W. Travis)	6/18-9/18 a	5/15-10/21 a	4/27-10/15 a
" *pipiens* L.	1	f.	11-23-1895	?	5/4-12/31 ab	each month ab	4/13-12/16 ab
" *quinquefasciatus* Say	3(?)	m.	10-20-1896	?	5/?-11/29 b	8/14-(1/8) b	8/12-11/5 ab
" *restuans* Theob.	1	m.f.	6-23-1903	T. Pergande	5/13-10/23 a	3/23-11/19 ab	3/31-12/5 a
" *salinarius* Coq.	3	L.	6-27-1904	A. N. Caudell	5/26-10/23 a	5/25-11/10 ab	4/28-11/25 ab
Culiseta inornata (Will.)	3	f.	4-23-1903	W. V. Warner	4/4-10-7 a	3/13-10/7 ab	3/19-10/7 a
" *melanura* (Coq.)	4	f.	5-19-1943	MCWA (T.)	....	5/19-7/24 a	....
Mansonia perturbans (Walk.)	3b	f.	6-11-1901	?	6/12-9/9 ab	5/15-9/11 ab	....
Megarhinus septentrionalis D. & K.	4b	f.	9-8-1901	J. Kotinsky	8/23-10/21 a	8/28-10/23 ab	6/2-10/7 ac
Orthopodomyia alba Baker	4	m.	7-20-1901	N. Banks	7/20-9/25 ab	6/26-10/22 a	....
" *signifera* (Coq.)	4	f.	6-?-1896	D. W. Coquillett	5/27-10/12 ab	5/25-10/12 ab	6/25-9/11 ab
Psorophora ciliata (F.)	4	f.	9-?-1905	T. Pergande	6/5-8/18 ab	6/5-9/24 ab	8/9-8/19 ab
" *confinnis* (Arrib.)	2	m.f.	7-24-1900	?	5/25-9/18 ab	5/24-10/2 ab	5/19-10/23 a
" *discolor* (Coq.)	4c	R.f.	9-9-1901	J. Kotinsky	5/24 b	5/24-9/9 b	5/24-9/8 b
" *ferox* (Humb.)	3	f.	9-5-1901	W. E. Hinds	8/9-8/22 ab	7/20-10/17 ab	8/2-10/22 ab
" *horrida* (D. & K.)	4c	f.	7-?-1905	T. Pergande	....	7/5-7/21 b	....
" *howardii* (Coq.)	4	R.m.	8-2-1908	T. Pergande	7/13-8/2 ab	7/28-8/26 ab	8/2 b
Uranotaenia sapphirina (O.S.)	2	f.	9-8-1901	J. Kotinsky	5/15-10/14 ab	5/13-10/16 ab	5/23-10/25 a
Wyeomyia smithii (Coq.)	4c	L.	1901-1912	E. G. Mitchell	....	....	6/16(?) bd

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THE NORTH AMERICAN SPECIES OF THE GENUS ISOCHAETOTHRIPS MOULTON (Thysanoptera, Thripidae)

By J. C. Crawford, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture*

To this genus must be assigned *Dictyothrips reticulatus* D. L. Crawford; and as I find no characters in the description of *Isochaetothrips dampfi* Priesner by which these two can be separated, the latter is omitted from the key.

With the exception of *davidsoni* Moulton, where the sculpture is not mentioned, all the described North American species have the head and prothorax above with very fine and close, transverse, anastomosing striae, well illustrated in Crawford's original description of *reticulatus*.

Key to Females

1. Body yellow, with a median, longitudinal brown stripe............... *gardeniae*, new species.
   Body entirely brown.. 2
2. Wings brown, clear basally......................*reticulatus* (Crawford).
   Wings brown, without a basal hyaline band........................ 3
3. Pronotum with 5 pairs of posterior marginal setae, of which the second and fourth are longer............................*davidsoni* Moulton.
   Pronotum with 3 pairs of posterior marginal setae, the inner pair longest *striatus* Hood.

Isochaetothrips reticulatus (Crawford)

Dictyothrips reticulatus Crawford, 1910, Pomona Col. Journ. Ent. 2: 156, Fig. 64A.

Described from Guadalajara, Mexico.

The collection of the United States National Museum contains a number of specimens from Mexico taken at Brownsville, Tex., by plant quarantine inspectors, mostly on *Gardenia*.

Isochaetothrips davidsoni Moulton

Isochaetothrips davidsoni Moulton, 1936, Brooklyn Ent. Soc. Bul. 31 (2): 64.

Described from Idaho.

The apparent lack of close striae on head and thorax and the five pairs of prothoracic posterior marginal setae, with the second and fourth longest, are very suggestive of a *Frankliniella* of the *minuta* (Moulton) series.

Isochaetothrips striatus Hood

Isochaetothrips striatus Hood, 1935, N. Y. Ent. Soc. Jour. 43: 166, pl. XII, Figs. 1–4.

Described from Panama.

Isochaetothrips dampfi Priesner

Isochaetothrips dampfi Priesner, 1933, Wien. Ent. Ztg. 50: 51.

Described from Cordoba, Mexico.

As no authentic material is at hand, this species, as stated above, cannot be placed, nor can it be definitely put as a synonym of *reticulatus* (Crawford).

Isochaetothrips gardeniae, new species

Female holotype (macropterous).—Length 1.33 mm. Yellow, deeper in thorax where slightly washed with brownish; with a distinct median brown stripe extending from back of eyes to and including tergum VIII, on head the brown extending laterad about to middle of eyes, narrowing to base of head, on thorax narrower than at base of head, on abdomen consisting of an almost semicircular mark basad on each tergum, the straight margin cephalad, the marks almost of equal size on terga II–VI, where they are wider than the thoracic mark and successively smaller on VII and VIII, that on tergum I the smallest; ocellar crescents dark crimson; antenna dark brown, darkest on segments I–II, V apically, and VI–VIII, antenna III with pedicel whitish, very lightly tinged with brownish, base of segment whitish, very gradually shading to brown at circlet of major setae where darkest, thence lighter and whitish very lightly tinged brownish beyond trichome; IV similarly colored but darker and beyond trichome light brown; V whitish basally, the pedicel slightly darker;

forewing dark brown, distinctly lighter at extreme tip, hyaline at extreme base and with the anterior margin in front of main vein subhyaline as far distad as insertion of basal seta on hind vein, the outer half of this subhyaline area extending well back of main vein; anal lobe brown, darkest distad; legs clear light yellow.

Head almost as long as wide, eyes somewhat protruding, cheeks about evenly convex to eyes and base of head, behind ocelli with transverse anastomosing striae, distinctly farther apart than are those on pronotum, in front of ocelli with similar but finer and closer, rather indistinct striae; eyes pilose; interocellar setae inserted on each side of median ocellus, about 30 μ long; inner postocular seta directly back of lateral ocellus, about as long as, but much more slender than, interocellars; ocelli in a close triangle, the posterior pair 28 μ apart, 16 μ in diameter, 12 μ from eye, and 16 μ from the somewhat smaller median ocellus; frontal costa notched medially; antenna slender, with segments III and IV vasiform; trichomes on III and IV long, sense cone on inner side of VI extending well beyond apex of VII.

Thorax with the pronotal striae even, about 2–3 μ apart, mostly broken rather than anastomosing; setae brown, with the inner posterior angular and the inner posterior marginal setae distinctly darker and the outer posterior angular almost hyaline; three pairs of posterior marginal setae, the inner much longer and stronger than the others; mesoscutum as closely transversely striate as s pronotum, metascutum also as closely but longitudinally striate, its median pair of setae remote from base, 40 μ apart, both pairs brown; fore vein of anterior wing with 3 (+2 minute) basal setae followed by a row of 14–17 setae (interrupted when only 14); hind vein with 13–14 setae, these all brown as are wing fringes.

Abdomen not distinctly sculptured; comb on tergum VIII complete, of long, slender teeth, 20–22 μ medially; setae hyaline with those on VIII–X brown; tergum X not split open above.

Measurements (in microns): Head, median length 140, width across eyes 152, greatest width across cheeks 148, least width at back of eyes 140, least basal width 136; pronotum, median length 132, greatest 180; pterothorax, median length 208, greatest width 236; setae, prothoracic posterior angulars, inner 64, outer 52, inner posterior marginal 28; on tergum IX, median 98, lateral 100, ventrolateral 84; on X, inner 88, outer 84.

Antenna	1	2	3	4	5	6	7	8
Length	28	40	66	58	38	52	10	16
Width	32	28	22	20	18	20	8	6

Male allotype (macropterous).—Length 1.2 mm. Very similar to the female but the median brown stripe extending only onto tergum VI, with mark on I obsolete; apices of antennal segments III and IV light brown (in most paratypes, however, fully as light colored as in females), forewing not so dark as in female and becoming lighter in color from about middle of wing to apex; basal group of 5 setae on fore vein all well developed, beyond them 14–15 setae, hind vein with 12.

Antenna	1	2	3	4	5	6	7	8
	24	34	54	45	32	42	9	14

Type locality.—Mexico.

Additional locality.—Chicacao, Guatemala.

The holotype bears the date December 29, 1937, the allotype, February 8, 1941.

Type Catalog No. 57233, United States National Museum.

Described from 25 female and 6 male specimens, taken at Brownsville, Tex., by various plant quarantine inspectors, on flowers from Mexico, on various dates throughout the year. All are from flowers of *Gardenia* with the exception of one female on roses, and three females and the allotype, in which the host, *Gardenia*, is queried.

The material from Guatemala consists of two females taken in January 1945 with numerous nymphs on seedlings of *Cinchona* sp. to which it is said to do considerable injury.

MINUTES OF THE 553d REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON MARCH 1, 1945

The 553d regular meeting of the Society was held at 8 P. M., Thursday, March 1, 1945, in Room 43 of the National Museum with President Poos presiding. There were 42 members and 19 visitors present. The minutes of the previous meeting were read, corrected, and approved.

New members were elected as follows:

Mary J. Edmands, Editorial Office, Bur. Ent. & Plant Quar.
Dr. Linsley J. Gressitt, 3732A Keokuk St., St. Louis, 16, Mo.
Dr. Eugene C. Holst, Div. of Bee Culture, Bur. Ent. & Plant Quar.
Dr. Tsai-Yu Hsiao, 3048 S. Abingdon St., Arlington, Va.
Mrs. Grace W. Martin, Editorial Office, Bur. Ent. & Plant Quar.
Alice V. Renk, Editorial Office, Bur. Ent. & Plant Quar.
Dr. Donald F. Starr, Div. of Insecticide Investigations, Bur. Ent. and and Plant Quar.

Mr. C. M. Gjullin gave an account of experimental work with DDT against deer flies, *Chrysops discalis* in Summer Lake Valley, Oregon. His paper will be published in the Proceedings of the Society.

Dr. Townes asked if the work had thrown any light on the food habits of Chrysops larvae and Mr. Gjullin replied in the negative.

Dr. E. A. Back exhibited specimens of *Prostephanus punctatus* and *Tetrastichus carpatus*. He supplied the following notes:

Prostephanus punctatus Say is here reported for the first time as a pest of economic importance. During December, 1943, infested cane syrup barrel staves were received from Cairo, Ga., badly damaged by the burrows of the insect. Much loss of syrup was reported taking place, both on the farm where the barrels are filled by the cane grower and in the warehouse at the factory where the syrup is blended and otherwise processed for packaging in tin or glass. An investigation of the damage being done at Cairo, during August, 1944, indicates that the insect actually breeds generation after generation in the damp syrup barrels, all stages of the insect, including eggs, being found at that time. It would appear that most of the damage is caused during the long, warm, summer period while the barrels are stored empty, with both heads in place, after having served as a medium for syrup storage on the farm and for transportation from farm to the factory warehouse. The insect was found damaging barrels made of oak, gum, and cypress. Several establishments in Georgia are said to have lost practically all their barrels during 1943. Under normal conditions barrels are used year after year.

Tetrastichus carpatus. This parasite of the webbing clothes moth, *Tineola bisselliella*, was not observed during the inspections of Defense Supplies Corporation wool stored in various New England storages during 1942 and 1943 but was found during 1944 in certain warehouses in New Bedford, Boston, and Gilbertville, Mass., and in Manchester, N. H., in large numbers. The parasites were so aboundant in New Bedford during the summer and fall of 1944 that persons living near the warehouse complained to the local health department, from which inspectors were sent to the neighborhood. The caretaker was kept busy sweeping the parasites from the aisles of the warehouse and reported carrying them out by" the bushel" and burning them. On October 17, an examination showed the parasites still abundant, crawling on the window panes of nearby houses. On the window sills on the north side of the fourth floor of the warehouse, an estimated 2,903,600 *Tetrastichus carpatus* adults were collected on September 29. One window sill, 20 feet long by 4½ inches wide, on the 3rd floor yielded an estimated 4,839,900 *Tetrastichus* adults. One quart of *Tetrastichus* adults contains an estimated 14,069,200 specimens. As many as 15 *Tetrastichus* can develop in one *Tineola* larva. The parasite is beyond doubt primary, as *Tineola* larvae have been parasitized in the laboratory at the Beltsville Research Laboratory.

The first paper on the regular program was given by N. B. Tindale, Squadron Leader, Royal Australian Air Force: The Hepialidae, or Ghost Moths.

The Hepialidae is one of several families of ancient origin which together form the suborder Homoneura. The venation of both fore and hind wings is similar, and five radial veins are present. Adults primitively possessed jaws instead of a haustellum, and although it is a universal habit of present-day forms to fast during adult life, the ancestral jaws are still developed in a few primitive species. Fore and hind wings are jugate. Most species fly at dusk or after dark. The eggs are laid in periods of high humidity, under either high or low temperatures. Since the eggs contain only a limited amount of nutrient material, the larvae emerge after a brief period of time. Larval habits vary. There are timber borers, external root borers, grass root borers, grass blade feeders, and even feeders on fallen leaves of the rainjungle floor. Mr. Tindale stressed the intolerance of the group for dry conditions. The entire life cycle must be passed in conditions of moderate to high humidity, and the distribution of most species is strongly governed by climatic conditions. The hepialid faunas of the World are confined either to warm, moist, tropics or to temperate and cold-temperate, moist, areas. They are even present in the damp, cold, subarctic zones of both hemispheres. Hepialids are typically absent from hot deserts and from the dry lands of temperate latitudes. In Australia, the hepialid line is sharply demarcated, falling approximately at the point where the year-long ratio of the rainfall precipitation as against evaporation is greater than one-half (i. e. $P/E>0.5$ for 12 out of 12 months). More than 150 species may occur within this zone, whereas there is only one species outside it. The latter desert-frequenting species, *Trictena argentata*, spends a larval period of from one to two years in a deep burrow (sometimes reaching 6 feet) feeding on the roots of red river gum, a species of Eucalyptus. The pupae have the ability to work their way to the top of the burrows, and the adults emerge during seasons of heavy rainfall to fly and mate within an hour or so. A large *Trictena* may lay 45,000 eggs, scattering them as she flies. Death occurs within 24 to 48 hours after emergence. The fierce energy displayed by the adults is derived from the fats stored in their bodies, these fats being burned at such a rate during flight that a *Trictena* is actually warm to the touch. The aboriginal Australians rely on the grubs as a source of "Butter-fat" in their diet. Mr. Tindale discussed the hepialid zones of the world, stating that Australia has the greatest number of known species. Many species remain to be described and the Indo-Malayan region, which contains some of the most archaic forms, may prove to be almost as rich. The larval stages of many species are almost unknown; adults do not often come to lights and must usually be sought for; the emergence period is very brief; the species are variable in color and markings. Wing venation, antennal form, and mouthparts, are used for generic separations; structure of the genitalia must be studied for the best clues to specific speacations. Only when the range of forms and markings is fully understood can the species be correctly identified. A recent discovery of fossil wings from the Triassic may throw some light on the ancestry of the Hepialidae. A description of this fossil will soon be published in the Proceedings of the Royal Society of Queensland (v. 56, 1945). Mr. Tindale is currently engaged in a study of the various North American species as a part of a world-wide survey of the genera and species [1]. His remarks were illustrated by a series of slides showing the geographical range and life histories of several species. (Secretary's Abstract from Author's MS.)

A brief discussion followed during which Mr. Tindale stated that not much has been done on the internal anatomy of the Hepialidae. He, himself, has unpublished notes on the subject.

The second paper, also illustrated by lantern slides, was presented by Mr. R. P. Currie: An Entomologist—Editor Looks Back Over a Half-Century In the Federal Service. This paper will be published in a later number of the Society's Proceedings. Mr. Currie closed his talk by introducing to the Society Mrs. Ellen M. Dittmeyer, daughter of Martin L. Linell, and also Mr. Rosham W. Dyar, son of Dr. H. G. Dyar.

The meeting adjourned at 10:20 P. M.

INA L. HAWES,
Recording Secretary.

[1] Tindale, N. B. 5 parts in Records of the South Australian Museum, v. 4–7, 1932–1942.

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BIONOMICS OF THE ROSE SEED CHALCID, MEGASTIGMUS NIGROVARIEGATUS ASHM. (Hymenoptera, Callimomidae)[1]

By W. V. BALDUF, *University of Illinois*

HISTORY

Megastigmus nigrovariegatus was first described by W. H. Ashmead in 1890 "from specimens collected at Greely, Colorado, and Vancouver Island" by H. F. Wickham. All the original types were females. In his paper on certain seed-infesting chalcids, Crosby (1909) confused this species with *M. aculeatus* Swed., an error he corrected in 1913 in his revision of the North American species of this genus. In this revisional paper, Crosby also indicated his belief that *nigrovariegatus* is native to America, while *aculeatus* was introduced "recently" from abroad.

Cockerell (1894) discovered females of *nigrovariegatus* "on the fruits of roses in Mr. Boyle's garden" in Santa Fe, New Mexico, and remarked "it is extremely probable that the species breeds in rose fruits, though until now nothing was known of its habits". Crosby (1909) observed it "ovipositing on the rose-hips during June and July", described the seed-inhabiting larva, found that the overwintered larvae pupate in the spring, and emphasized the variations in size and color of the adult males and females. In 1922, Gahan published his valuable list of the known seed chalcids, including *M. nigrovariegatus*, with references to the literature. The present study was made largely in east central Illinois.

ACKNOWLEDGMENTS

My colleague in botany, Professor George N. Jones, kindly identified the roses concerned here. He has my hearty thanks for this indispensible service. I am indebted also to Professor Stanley Hall and Mr. James S. Hutchinson in the Department of Floriculture for valuable aid.

DISTRIBUTION

Published records show *nigrovariegatus* has been collected or

[1] Contribution No. 244 from the Entomological Laboratories of the University of Illinois.

reared from rose seeds taken at White Church, Wellsville and Ithaca, New York; Durham, New Hampshire; Boston Massachusetts; Newark, Delaware; Falls Church, Virginia; Waukegan, Illinois; Madison, Wisconsin; and Provo, Utah (Crosby, 1913); Santa Fe, New Mexico (Cockerell); Greely, Colorado, and Vancouver Island, British Columbia (Ashmead).

I found it rare to plentiful on various kinds of roses on the campus of the University of Illinois, and reared it from hips grown at Sidney, Illinois. Achenes taken at Sidney and along railroads at Gibson City, Illinois, and Madison Wisconsin, and along wooded roads in St. Louis County, Minnesota, contained larvae which are probably *nigrovariegatus*.

DESCRIPTION OF THE HIP

Fanciers of roses employ the names "hip" or "fruit" to designate the elongate to subspherical structures or "apples" that develop on the branches of roses after the flowers fall. The hypanthium or external cover of the hip envelopes a variable number of true fruits or achenes. The wall or pericarp of the achene varies in texture from corky to bony among the several species of roses. Within each achene lies a single seed composed of two cotyledons and a surrounding seed coat or testa that is soft and fleshy until maturity when it, like the cotyledons, becomes firm. The deposited egg, the larva and the pupa of *nigrovariegatus* inhabit the seed, or the seed cavity after the seed is consumed by the larva.

HOSTS

So far as known, the rose seed chalcid inhabits the achenes of no other plants but the genus *Rosa*, including both wild and cultivated forms. The specimens sent to Crosby (1909) by J. G. Sanders from Madison, Wisconsin, were reared from *Rosa rugosa*, but other published host records that I have seen are not specific concerning the source.

To date, I have reared it from the following species in Champaign County, Illinois: *Rosa carolina* L., the common wild rose of this area; *R. rugosa* Thunb.; *R. eglanteria* L., the sweet brier rose; *R. spinosissima* L., *R. virginiana* Mill. and *R. palustris* Marsh., the swamp rose. In addition, the presence of exit holes made by the adult chalcid in the hypanthium and achenes of the hip of *R. xanthina.* Lindl. indicates it also developes in this rose. In the course of observations extending over several weeks in June, 1944, one female was found ovipositing in a hip of *R. canina* L.; but old hips of 1943 bore no emergence holes and new achenes of 1944 contained no larvae. Dissections of achenes revealed larvae, presumably of this chalcid, in the hips of *R.* near *virginiana* cultivated at Sidney and in those of *R.*

acicularis Lindl. taken in St. Louis County, Minnesota, and of *R. carolina* growing wild along a railroad west of Madison, Wisconsin. *Rosa carolina*, like some other species, has two forms of hips, one subspherical, the other turnip-shaped with both ends flattened. Three hips of the latter type contained no larvae, whereas two of four hips of the former were inhabited.

On the other hand, there was no evidence, either in the form of oviposition, larvae, pupae or the exit holes of adults, to indicate that the chalcid utilises *R. setigera* Michx., *R. hugonis* Hemsl. or a variety of the rambler, *R. multiflora* Thunb.

RELATIVE SUITABILITY OF ROSE SPECIES

As a group, the roses named above exhibit extensive variation in their availability as hosts of *M. nigrovariegatus*. This fact is forcibly demonstrated by the range of percentages, —00.00 to 67.96, shown in table 1. Suitability or availability of rose hips for occupation by this chalcid seems, from preliminary studies, to be affected by such factors as (1) time of blooming or development of the hip with reference to the period of oviposition of the seed chalcid, (2) diameter of the hip and, accordingly, the availability of the contained achenes to the ovipositor, (3) the thickness and texture of the hypanthium and the pericarp, or penetrability by the ovipositor of the female and the mandibles of the emerging adult, and (4) the size of the seed which serves as an index of the amount of food available to the larva and of the size and vigor of the resulting adults.

In the light of these factors, the hips and achenes of *R. rugosa* and *R. virginiana* seem to afford the conditions most nearly ideal for the success of *nigrovariegatus*. Both roses produce many achenes and hips in favorable weather and their periods of bloom are approximately simultaneous, which permits alternation of the ovipositing females between two favorable species of hosts during the time the insect is at its reproductive peak. The hypanthium of both is fairly thin, favoring penetration of the ovipositor to the underlying achenes. But beyond these common characteristics, these roses have distinct advantages and also disadvatages. It seems probable that the larger population in *virginiana*, namely 67.96 compared with 53.67 per cent in *rugosa*, is made possible by the smaller diameter of its hips, which permits the ovipositor to reach a larger proportion of the achenes. On the other hand, the larger average diameter of *rugosa* enables the ovipositor to introduce eggs chiefly only into the achenes that lie against the inner wall of the hypanthium. The latter achenes are somewhat three-faced, with the broadest and moderately convex facet lying in contact with the hypanthium. It is the more or less elongate oval achenes, which lie in the central part of the hip cavity, that largely lack larvae, particularly in the case of the Marger hips, this fact indicating they lie beyond the reach of the ovipositor. Again, the achenes of *rugosa* are soft when immature and corky when mature, hence favorable to oviposition and the issuance of the young adult, whereas those of *virginiana* are semi-bony, and therefore slightly less penetrable by ovipositor and mandibles, yet not enough so to constitute a major obstacle. But the food supply afforded by the seeds of *rugosa* is considerably larger than that of *virginiana*, with the result that the imaginal individuals developing in the former are so much bigger they can usually be distinguished from others without magnification as they appear on the plants in nature. However, both hosts yield vigorous and highly-productive adults if the size of the populations in the hips may be taken as an indicator.

Like *rugosa* and *virginiana*, *R. palustris* provides a good number of readily penetrated achenes, and a consequent large population that averaged 57.54 percent. But the food supply stored in them represents the approximate minimum quantity on which adults of sufficient size and vigor necessary to reproduction can develop. This is shown not only by the very small size of individuals that become sexually mature adults but also by a considerable minority that dies as larvae, whose physical state, as explained later, indicates the food supply was inadequate to mature them; in other instances, the individuals die as pupae, or as adults too puny to be able to chew an exit hole in the pericarp and the hypanthium. While the population produced in *palustris* therefore seems to be precariously self sustaining, it was augmented somewhat by the more vigorous but late surviving minority of females that migrated from more favorable and earlier-blooming hosts growing in the vicinity.

The hips of *R. eglanteria* and *R. canina* are in what seems to be a condition suitable for oviposition and larval feeding at the same time as *rugosa* and *virginiana*. While all of the four species produce a good number of hips, the percentage of achenes populated was but 6.06 and 00.00 in *eglanteria* and *canina*, respectively. The pericarp is fairly thick-walled and bony in both species, but these qualities seem not to constitute the inhibiting factors if any significance may be attached to the fact that 53.55 percent of the achenes of *R.* near *virginiana* were inhabited despite very thick and bony-hard walls. The fact that ovipositing females are rare to subcommon on these roses indicates some external feature of the hip, if not of the plant as a whole, may be responsible for the failure of the chalcid to use *canina* at all and *eglanteria* but rarely.

One additional couple of species throws some light on the identity of host selection factors. *R. spinosissima* and *R. hugonis* are very similar in habitus, in having large, bony-walled achenes, and in earliness of blooming. The percent of megastigmatised achenes was 00.00 in *hugonis* and 16.76 in *spinossissima*, the numbers being based on dissections of achenes that grew very close to well-populated *rugosa* and *virginiana*. The most likely explanation for the low percents in *hugonis* and *spinosissima* is that these roses seem to tolerate a low average temperature in the spring season, hence bloom early, whereas the development of *Megastigmus* requires warmer weather, with the result that the plants or hips have largely passed a state attractive to ovipositing females before a considerable number of the insect has become adult.

SEASONAL DEVELOPMENT AND ACTIVITIES

Wintering Stage. All but a few individuals were found to be in the mature larval state during the winter. The small exceptional number of submature larvae occurred in the small and more or less inadequate achenes of *R. palustris*. The larvae lie in the cavity formed in the achene by their ingestion of the entire seed. The fecal pellets remain in the digestive tract, their black color contrasting sharply with the white body.

Pupal Life. In the prepupal phase the larval body becomes shorter, thicker and irregular in form. Ecdysis follows soon after this form is attained, exposing the white pupa. The black fecal pellets, eliminated before the last larval molt, lie on the venter of the constriction that joins the thorax and abdomen of the pupa. From the initial solid white, the body progresses through several changes in color until the pattern of the adult form is reached. Early in this series of changes the eyes become pale pink, then deep pink, the rest of the body remaining white or grayish. Very gradually the black and yellowish colors of the adult then appear. Like the mature larvae, the pupae lie in the seed cavity, with the cephalic end directed toward the periphery of the hip.

Data obtained by periodic dissection of achenes and by rearing adults from hips in April and May indicate that *nigrovariegatus* began its pupal phase during the last 10 days of April, 1943 and 1944; attained the numerical pupal peak between May 8 and 22, and concluded this stage with emergence of the adults, which extended from the last week of May to June 20. These dates pertain largely to normally vigorous individuals such as develop in the achenes of *R. rugosa* and *R. virginiana*. If records from *R. palustris* are admitted, the period of pupation is lengthened by about two weeks. Such tardy transformation is traceable in part to the normal late-blooming habit of this rose, and possibly in part to the undernourished condition of some larvae. Not a few underfed larvae persisted at least until July 22, but since these were then shrinking, dessicating and dying, and therefore did not attain the pupal stage, they may not be considered in fixing the time limits of the pupal period. It is probable that this subnormalcy is the effect of the inadequacy of the food available in the small achenes of *palustris*.

The widely applicable principle of insect life that pupation of individuals requires less time than the pupation of the generation which they constitute is illustrated in *Megastigmus* by a series of instances from the records of 1943. These pertain to *R. rugosa*. On April 24, only one pupa occurred among the larvae of the sample obtained; on May 1, two larvae still retained their fecal pellets, while 55 had eliminated them and 15 had pupated; on May 8, the sample consisted of two larvae and 64 pupae; on May 12, 16 and 22, all the 135 individuals dissected from achenes were pupae, mostly in the advanced phase; and on June 1, only one pupa remained, the rest having already molted to adults, and these had emerged from the hips by this time.

Variation from the normal time of pupation in April and May appears to be rare, but five such exceptional off-season instances came to my attention in the course of dissecting fresh achenes on November 28, 1942 and on July 16, 21, 28, and 29, 1944. One of the pupae obtained in 1944 was still white and the rest were already browned indicating that adulthood was imminent. Both sexes occurred in the series, all had developed in the achenes of *R. rugosa* and all were large and vigorous in appearance. I have not learned the fate of such pupae.

Adult Life. The pupal exuviae are cast in the seed cavity where they remain more or less fragmented. The adult young gnaws a single circular hole straight through the pericarp of the achene and the hypanthium directly above. The exits are invariably made in the broadly rounded larger surface that lies contiguous with the inner face of the hypanthium, and mostly in the equatorial and basal parts of the hip. A small number of individuals, presumably such as develop from under-nourished larvae in the smaller achenes of *R. palustris*, either fail to exuviate or to prepare an emergence hole, and die within the achene or the partly prepared exit.

In 1943 the first adults made their appearance on *R. rugosa* in nature on June 3, and in 1944, the first were seen on May 25. The emergence of adults from hips was completed on or about June 20, 1944. The over-all period of issuance was therefore three to four weeks long. Males were found alive on the simultaneously developing *rugosa* and *virginiana* over a period of 21 days in 1943 and 22 days in 1944; and females occurred 21 and 19 days respectively in these years. Males were seen infrequently after the last females had issued from the hips.

The rose seed chalcid is slightly yet definitely protandrous. The occurrence and nature of protandry was learned by rearing adults from caged hips and by frequent checks on plants in the field. The following record represents the emergence over a period of eight successive days from a series of *rugosa* hips isolated in cages: 26 ♂♂, 3 ♀♀; 23 ♂♂, 7 ♀♀; 20 ♂♂, 10 ♀♀; 13 ♂♂, 26 ♀♀; 6 ♂♂, 28 ♀♀; 2 ♂♂, 10 ♀♀; 3 ♂♂, 0 ♀; 1 ♂, 0 ♀. Field work in 1943 showed only males were present on June 3 and the early afternoon of June 4; by 6:00 p. m., June 4, the first females had appeared. Males still predominated on June 5. However, on June 9 the ratio favored the females by 15 to one, and on June 13 it had become 35 to one. From June 15 to 19, no males were found, whereas females numbering 82, 60, 62, 50 and 38 were present on the five successive days of that period. Excepting one present on June 24, males were not seen again on this *rugosa* planting in 1943.

Likewise in 1944, all the adults found May 26 on *rugosa* and *virginiana*, the two roses most favorable to the chalcid, were males. Still on May 28 only males had appeared. Two females were seen on May 29; and on May 30, the ratio of males to females was 34 to one, and males still predominated on June 6. But by June 10, the females exceeded the males 6 to 1 on *virginiana*, while no males remained on *rugosa*. On June 16 and 17, males ceased to occur on both these hosts, also on *eglanteria*. A few persisted until June 23 on *palustris*, the late-blooming, small-seeded rose.

Accordingly the first males appear one to three days before the first females. The emergence records from caged hips indicate the sexes coexist throughout life, but the males attain peak numbers in the first and second days, and diminish sharply in the next few days, while the females are few at the beginning of the emergence period and build up in the following five days. After this time adults of both sexes continue to issue but in small and diminishing numbers.

Sex Ratio. Data pertaining to the relative numbers of males and females in *nigrovariegatus* were obtained by dissecting achenes during the pupal period, when females are recognizable by the dorsally-carried ovipositor; also by rearing adults from hips before the normal time for emergence. Of 776 individuals secured in these ways, 369 or 47.53% were males, and 407 or 52.47% females.

Mating. The behavior of the emerged male adults was observed in three years and invariably proved to follow a single pattern. So long as even a single female, or perhaps male, inhabits such hips, the emerged males attend individual hips in numbers varying from one to 15 at a time. Their activities are various. They rest quietly on the old hip, run excitedly over it and the adjacent branches and leaves, make short quick flights here and yon but return again, and commonly one or more pursue others as if patrolling the environs to drive them away and, in doing so, may elevate and lower their wings in the manner of resting butterflies. The mating impulse appears to be strong at this time, for the eager males pursue newly issued males as well as females; but having advanced from behind over the dorsum and bitten the head of such newly issued individuals, the pursuer obviously recognizes his error, for he retires at once.

That coition between the waiting males and the newly emerging females takes place on or very near the old hip is indicated by several observations. The males concentrate on certain old hips while disregarding entirely others already completely evacuated. Sometimes much of the male population of a bush was concentrated upon one or several hips, whereas none frequented dozens of others within a radius of about a yard. I observed the outcome of such congregations in two cases. On May 30, 1944, 12 males hovered about one old hip. One adult female came from it within the next hour. Dissection of the contained 49 achenes showed this adult to be the last chalcid in the hip. She proved to be the sole attraction of the 12 males. Again, on June 3, 1944, I witnessed 15 males gathered around one old hip. Within three minutes after I picked the hip for examination, three females emerged from it. As a fourth came out soon thereafter, I maneuvered one of the remaining males onto the hip, and coition followed at once. The fifth female issued 75 minutes later. This proved to be the last chalcid in the hip.

The almost simultaneous emergence of the first four females in the latter instance shows they had almost completed the exits at the time I picked the hip. It is therefore probable their heads were already partly exposed to the outside. It is possible the males recognized the presence of their prospective mates by sight of the heads, by tapping the heads with their antennae, or by vibrations set up by the female jaws chewing on the hip.

In the precopulatory phase of mating, the male crawls upon the back of the female, usually advancing from behind, and vigorously vibrates his abdomen and antennae dorso-ventrally. If the female attempts to crawl forward, the male advances on her back and taps the vertex of her head with his own and thereby brings her to a stop again. From this dorsal position the male steps backward and directs his abdomen ventrad along the abdomen of the mate and finally recurves its tip dorsad to reach the genital aperture at the base of the ovipositor. Not only the larger individuals, but the small ones that developed in the normally small achenes of *R. palustris* were seen to mate. However, it seems probable that some adults from the latter source are so impoverished that the urge to mate may be lacking.

The repeatedly observed segregation of the males and the females suggests any one female is inseminated only once. Not only do the males confine themselves quite definitely to the old hips, but the females restrict their movements equally to the new hips into which they lay their eggs. Thus the two sexes seem to intermingle only at the moment the females issue from the old hips that are the focal points of the males. I have not seen any behavior to date that indicates males seek the females after the latter have left the hips in which they developed.

Migration, or Change of Hosts. The type of migration concerned here is characterised by a fairly sudden and complete disappearance of adult females from a species of rose on which they had been common, to a contiguous rose on which they had not previously occurred or were few. Two instances of this kind were discovered in 1944. In one case, the movement proceeded from *R. rugosa*,—one of the favorable host species, to *eglanteria*, a secondary host; in the other, from *R. virginiana* to *palustris*, a late-blooming species. I can only surmise that maturing hips, hardened to the extent that the hypanthium and achenes had become impenetrable to the ovipositor, stimulated these changes of hosts. But the two cases presumably differed in regard to the fate of the chalcids; the hips of *eglanteria* were largely past the optimum state for oviposition and the chalcids remained here only a few days, whereas the hips of the late-blooming *palustris* were still coming into the optimum state at the time, hence the migrated ovipositing chalcids persisted a relatively long time on this rose.

Oviposition. Oviposition follows soon after emergence from the old hips and insemination. In 1943, egg-laying was observed on June 4, the day the first females were found, but in 1944, an interval of five days transpired between these two events of May 29 and June 3. The effect of late-blooming hosts on the time of oviposition is indicated by the fact that it was first observed on *palustris* on June 16, 1944. Some of the females on this host had come from the intermingling *virginiana;* the large size of the females indicated this: while others originated in hips of *palustris*, as was indicated by the very small size of the adults. The contiguity of two host species characterised by successive blooming times seems to enable the females to express their reproductive capacity to a larger degree than a single host, unless its blooming period is extremely protracted, as in the case of *rugosa*.

The activity of oviposition terminated about July 21 to 23 in 1943 and June 17 to 24 in 1944. Hence eggs are known to have been laid during a period of at least 17 to 19 days in the first year, and 15 to 20 days in the second year. The discovery of four dead females on July 7 and one on July 14, 1944, with the ovipositors inserted in the hypanthia of *palustris* indicates the chalcid persists in reproduction to the very end of its life.

Oviposition is in progress when the hypanthium and pericarps are still soft and the seeds remain in a semiliquid pulpy state. The position of eggs and larvae in the first instar show the ovipositor penetrates to the tests of the seed or to the outer end of the seed itself to deliver the egg. In an estimated 95 percent of the inhabited achenes dissected, the ovipositor entered fruits that lay contiguous with the inner surface of the hypanthium, piercing the outer and usually broadly-rounded face. The remaining eggs were inserted in the more or less ovate form of achene that lies in the central portion of the hip, indicating the ovipositor cannot reach them excepting in the case of hips of small diameter. In other words, the ovipositor appears to bore mostly only through the hypanthium of the hip and the cortex of the achene to place the egg in the seed substance. The performance of ovipositional movements does not invariably signify development of progeny. On July 4, 1944, I observed a female engaged in the movements of egg-laying. The hip involved proved to contain only undeveloped achenes. Accordingly, larval survival was impossible even though eggs may be presumed to have been laid.

When ovipositing, the female stands at some point of the exposed equatorial zone of the hip, with legs spread to hold her to the surface. The abdomen is then raised sharply, the long sheath and the contained ovipositor are brought ventro-cephalad from their dorso-caudal resting position until they stand perpendicular to the hip and their tips contact the surface. The sheath is released, presumably when the ovipositor has superficially pierced the hypanthium, and flips backward to rest in a caudo-ventral position during the remainder of the ovipositional process. The ovipositor then drills into the hip by a series of alternating thrusts and partial withdrawals aided by a pulsating downward pressure of the abdomen. In some cases the ovipositor sinks into the hip to its base. The work of inserting this instrument required from 80 seconds to 9 minutes. A short period of quiet followed the insertion during which the egg is presumed to pass into the seed. The ovipositor is withdrawn in one quick steady pull and at once snaps back into the sheath which then resumes the original resting posture. The entire process of oviposition required from 100 seconds to about 10 minutes in a number of cases observed.

Both incidental and thrice daily counts on well populated plantings of *R. rugosa* showed that oviposition, also locomotor activities, are certainly influenced by atmospheric temperatures. Examples follow. On June 17, 1943, 60 females were counted in the morning while the rose was shaded, but only 43 in the warmth of early afternoon, and 62 when evening shades again cooled the spot. Likewise the counts were 50, 20, and 41 on the 18th, and 18, 5, and 13 on the 20th. In the morning and evening the chalcids moved about in full view on the new hips or leaves close by, and a number invariably worked at oviposition, whereas in midday they had resorted to the underside of leaves, and eggs were being laid only by such individuals as dwelt in shade. The extent of the activities varied from day to day with the degree of heat prevailing at the time.

Larval Life. Of several thousand inhabited achenes dissected, none contained more than one larva of *nigrovariegatus*. The young larva is conical in form and lies in the outer end of the seed, either in the testa or in the cotyledons. As it grows, it becomes hymenopteriform and eats out an increasingly larger cavity in the soft seed, eventually ingesting both testa and cotyledons, excepting small particles that are dry and brown at the time the larva is almost mature. These particles then lie scattered throughout the seed cavity and over the body of the insect. Subsequently the larva, probably incidental to its writhing movements, pushes this frass to the caudal and cephalic ends of the seed cavity, where it becomes compacted to form two brown concave caps shaped to the ends of the body and the seed cavity.

Submature and mature larvae are distinguishable by their general appearance. In the former, the alimentary canal is filled with dark reddish to purple food and fecal matter, hence distends to occupy most of the body cavity, giving the larva a dark color. Moreover, the larva is now plump and fills the seed cavity snugly. By contrast, the mature larva has a comparatively reduced volume of material in the tract, a whiter color and a somewhat shrunken body that fills the seed cavity loosely. But while most of the dark matter had disappeared from the tract when the larva seems to have attained maturity, the process of reducing the alimentary substance to its smallest size still goes on in mid-October at least, when the purplish black matter is still thick soupy. By April, *i. e.* shortly before pupation, only a cluster of small black solidifying fecal pellets remain in the tract. With this exception, the body is now white.

These observations on the superficial changes in color and content of the maturing larva doubtlessly have a deeper physiological significance. The purplish distended condition of the tract in the submature larva suggests the process of ingestion is rapid and short, while the process of digestion and assimilation is slow and continued through several months after the body has attained its maximum size. The progressive shrinkage in bodily volume during this period of gradual maturing seems to be due to the depletion of the food bulk by assimilation and the concurrent evaporation of moisture through the cuticle and the respiratory system.

That embryonic development and hatching follow oviposition at once is known from the occurrence of first instar larvae in mid-June, *i. e.* 11 to 12 days after the first eggs were laid. Dissections of achenes from *R. rugosa* at intervals during June and July provided a chronological picture of larval development. The records for 1943 and 1944 were very similar in respect to the time and rate of growth.

In mid-June, the larvae in the oldest hips of the season were still conical and about 0.4 mm. long. All lay within the end of the seed nearest to the periphery of the hip. On June 30, the larvae varied from conical and 0.7 mm. long to hymenopteriform and 1.7 mm. long, the mature larvae of the species ranging from 2.0 to 2.5 mm. in length. This extreme variation in size and type on the latter date probably coincides with the fact that oviposition continues over two weeks or more. By July 7 the larvae had advanced either to the reddish-purple color phase indicative of submaturity, while a few appeared to have become mature. The seeds were still fairly fluid and pulpy, that is, apparently favorable to ingestion. A week later, the achenes contained larvae of mature size, but the alimentary substance had not yet been entirely assimilated and extremely contracted to the axis of the body. The over-all development from hatching to approximate maturity therefore required from mid-June to late July in these years.

From the latter part of July until late April or early May of the ensuing year, a period of approximately nine months, the mature or maturing larvae lie dormant in the seed cavity of the achene in the hips attached to the stems of the host rose. A second generation does not develop in the latter half of the summer, unless a very small partial second may be produced by adults that may develop from such pupae as were observed to occur off-season in July, 1944. However, it is doubtful whether rose seeds are suitable for larval feeding in late July and August.

Larval Population. Table 1 gives data on the extent to which *M. nigrovariegatus* utilises the several rose hosts investigated. The data were secured by dissecting all the developed achenes in the sample hips taken. Since other species of chalcids may inhabit rose seeds, there is a possible but minor and negligible error in the numbers given, but my rearings of adults show that more than 99% of the larvae present are *nigrovariegatus*. An alternate method, in which I counted the exit holes made by the emerging adults in the achenes and hypanthium, proved to be unreliable for the reason that a considerable number of larvae, pupae or adults died within the seed cavity, hence made no exit holes.

TABLE 1.—POPULATIONS OF MEGASTIGMUS IN ROSES

Species of rose	Hips Examined	Number of Suitable Achenes	Number of *Megastigmus* Present	Percentage of Achenes Populated
R. virginiana	13	306	208	67.96
R. palustris	30	608	350	57.54
R. rugosa	63	3957	2124	53.67
R. near *virginiana*	9	56	30	53.55
R. spinosissima	2	24	4	16.67
R. acicularis	9	125	19	15.20
R. carolina	27	505	44	8.71
R. eglanteria	14	165	10	6.06
R. hugonis	10	145	0	0.00
R. canina	9	124	0	0.00
R. setigera	10	17	0	0.00
R. multiflora	20	32	0	0.00

In calculating percentage, two classes of achenes were cast out: First, those which had not developed, through failure of pollination, or some embryonic mishap, and second, such as had attained more or less mature size but contained seeds so immature or shrunken that larvae had no chance to develop even though eggs may have been laid. Again a varying yet considerable number of achenes and seeds, and doubtlessly also larvae of the chalcid, were consumed by the feeding of the adult and larva of the rose snout beetle, *Rhynchites bicolor* Fabr. All such chewed achenes were included in the base figure even though this decision prejudiced the percentages against the chalcid. Such injury was more or less extensive in the hips of *R. rugosa*, but negligible in the other host species.

Enemies of Megastigmus. A second instar nymph of the reduviid bug, *Sinea diadema* (Fabr.) was seen on May 29, 1944, holding an adult male *Megastigmus* with the grasping fore legs. Several other nymphs of this species occurred on the same rose on June 3.

A number of achenes of *R. rugosa* containing larvae of *Megastigmus* were found to have holes gnawed more or less through the pericarps by the grubs of the rose snout beetle. The grubs would obviously soon have penetrated the pericarps and then very probably have destroyed the chalcid larvae. It is likely that this grub incidentally kills and possibly ingests a considerable number of the growing and mature larvae of *Megastigmus*. This belief is based on several facts: First, the larval development of the two species is largely concurrent; second, the larvae of *Rhynchites* infest a good number of the hips in some years, particularly those of *R. rugosa;* third, 53.67 percent of the achenes of this species dissected contained larvae of *Megastigmus* and fourth, observations to date show a single grub of *Rhynchites* pulverizes or ingests 7 to 10 achenes in the course of its growth.

The larvae of *Megastigmus* may also be killed by a species of mold. For example, all the 44 larvae found in one hip of *rugosa* on December 9, 1942, and 51 percent of those from another dissected the next day were dead and dried. The core of fecal matter remained, the segmentation was exaggerated by a slight inflation of the body, and a pinkish mold lightly covered the entire surface of the body. Also several lesser instances of this disease were noticed in the same reason.

Two conditions may exist in the hips of roses that do not constitute positive aggressive enemies yet adversely affect the population of the rose seed chalcid. In the first condition, the hips, achenes and seeds remain in the incipient state existing at flowering; this state seems largely to prohibit oviposition, for only once did I observe a female that had the ovipositor inserted in a hip of this type. Such incipient seeds appeared particularly on *R. rugosa* in 1944, and occurred in no less than 90 percent of the hips. Accordingly *Megastigmus* had only about one tenth the maximum possibilities for establishing its progeny in this host. The population of 1945 will, therefore, be unusually small on *rugosa*.

In the second condition, the seeds advanced to various states of development but dried and shrivelled before they became mature. The nutritional content of the large majority is consequently inadequate to enable the chalcid larvae to develop. Particularly *rugosa*, *virginiana* and *palustris* suffered this condition, which affected from 25% to 80% of the seeds. Failure of roses to produce seeds was therefore much more detrimental to the seed chalcid than diseases and entomophagous insects.

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THE OCCURRENCE OF CULEX (MELANOCONION) ELEVATOR DYAR AND KNAB IN FLORIDA, WITH KEYS TO THE MELANOCONIONS OF THE UNITED STATES (Diptera, Culicidae)

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Introduction

Matheson (1944) lists five species of the subgenus *Melanoconion* occurring in America north of Mexico: *Culex erraticus* (D. & K.), *C. peccator* D. & K., *C. pilosus* (D. & K.), *C. abominator* D. & K., and *C. atratus* Theob. Of these species, *C. erraticus* is the most common *Melanoconion* in the Southern States, occurring as far north and west as Nebraska and Iowa. *C. peccator* and *C. pilosus*, though less common, have been reported from throughout the Southeastern States. *C. abominator*, recognized as distinct from *erraticus* by King and Bradley (1937), has been recorded only from Texas, where the larva was recently described by Eads (1943). *C. atratus* has been reported by Roth and Young (1944) from Boca Chica Key, Florida.

A sixth recorded species of *Melanoconion*, *C. anips* Dyar, has been taken only once, in 1916, at San Diego, California by Dyar who described it from males and females reared from pupae. An intensive search by Freeborn (1926) in 1918 at the type locality for additional material was unsuccessful. A study of the male genitalia of the type of *anips* in the U. S. National Museum by the writer shows it to be distinct from *peccator* and *abominator*, to which it is most closely related, by the characters of the male genitalia aptly used by King and Bradley (1937) in their synoptic table. These characters are included in the key to the males in this paper.

As stated above, Roth and Young recorded a male of *C. atratus* taken in a light trap in December, 1943, at Boca Chica Key, near Key West, Florida. The writer has examined three larvae of this species from a lot collected on Elliot's Key, Dade County, Florida, on January 14, 1943, by L. T. Woosley, F. H. Stutz, and J. G. Kennedy. The larvae were taken from an abandoned fish pool in the garden of an estate at about the center of the Key, and were associated with larvae of *Culex bahamensis* D. & K. One larva from this collection has been deposited in the U. S. National Museum. Its identity has been verified by Dr. Alan Stone.

On September 22, 1944, D. G. Denning and the writer collected larvae and pupae of *Culex opisthopus* Komp from crab holes at Fort Lauderdale, Florida, from which adult males and females were reared. A detailed report of this collection together with the description of the larva is being prepared in a separate paper by H. D. Pratt, D. G. Denning, and the writer.

Culex elevator D. & K. in Florida

The first known record of the occurrence of *C. elevator* D. & K. in the United States was made by the writer based on collections on Key Largo, Florida, on April 23 and 28, 1944. Five larvae and four pupae were taken from a brackish pot hole in the rocks in the longitudinal center of the Key, on high ground (el. 3-5 ft.) but adjacent to an arm of the mangrove swamp extending from Card Sound. The pool was about 10 by 15 feet in size with a water depth up to 18 inches. The sides of the pool were oölitic limestone but the bottom was of rich, black muck. The dense thorny, shrubby, hammock vegetation characteristic of the "upper" Florida Keys provided dense shade. A small number of *Aedes taeniorhynchus* (Wied.), *Culex bahamensis* D. & K., and *Deinocerites cancer* Theob. larvae were also taken from this pool in the April collections.

In an attempt to find more material of *elevator*, regular trips were made to this location, and a search was made for similar pot holes on Key Largo. Due to the dry season no other breeding places were found, although dozens of dry pot holes were seen. It was discovered during these trips that the water level in the pool where the *elevator* larvae were found remained fairly constant, but fluctuated several inches from month to month corresponding to the monthly high and low tides. The salinity also varied slightly with the tidal fluctuation; at the time the larvae were collected in April the chloride content measured 8,150 parts per million, about half as concentrated as in sea water.

C. elevator was not collected again until July 23, 1944, when ten additional larvae and pupae were taken in the pool where they were first discovered. Associated with them at this time were hundreds of small *C. bahamensis* larvae and also a small number of larvae of *Anopheles atropos* D. & K. Regular visits to this location were continued until October, 1944, but no further mosquito breeding was observed. No adults of *elevator* were collected in the field. From the April and July collections a total of seven female and three male *elevator* adults were reared. Adults and associated larval skins are in the collections of the U. S. National Museum and of the writer.

Keys to the Melanoconions of the United States

The eight *Melanoconions* known to occur in the continental United States are included in the keys given in Dyar's "Mosquitoes of the Americas" (1928). The characters given for separation have proved somewhat difficult to use, however, and later workers in this group, notably King and Bradley (1937), Roth (1943), Roth and Young (1944), and Matheson (1944) have contributed greatly to the selection and use of improved diagnostic characters. Since Dyar's keys include many species from outside the United States, and the latter authors treated at the most five of the eight species at one time, it is believed that new keys to include all the known United States species will prove very useful to the many workers in this country. It is likely that with the increased collecting of mosquitoes during the current war period together with careful identification of larvae and males, the rarer species of this group may be found to be much more widely distributed and of commoner occurrence.

Adults of the subgenus *Melanoconion* may be separated from other United States *Culex* (subgenera *Culex* and *Neoculex*) by the following characters: 1) wings with the outstanding scales broadened, especially on the branches of veins 2 and 4; 2) some broad, appressed, flat scales on the occiput; the male genitalia with 3) sub-apical lobe of basistyle divided, generally into two distinct parts; and 4) tenth sternites with a row of blunt spines at the tip, forming a transverse comb. The larvae of *C.* (*Melanoconion*) species usually have the lower head hairs single and pecten spines with a fine lateral fringe, while *C.* (*Culex*) larvae have lower head hairs at least triple, and *C.* (*Neoculex*) *apicalis* Adams has pecten spines with coarse lateral teeth. Edwards (1932) places *C. pilosus* in the subgenus *Mochlostyrax* on the basis of larval characters, but following Matheson (1944) and King, Bradley, and McNeel (1944), this species is here treated as a *Melanoconion*, since the characters separating the two subgenera do not seem very definite.

It is assumed that before using the keys the user will have become familiar with the morphological terminology involved; for reference Matheson's "Handbook of Mosquitoes" (1944) is suggested. In the characters of the male genitalia the writer prefers to follow Freeborn (1924), rather than Dyar or Matheson, in using the terms *basistyle* for sidepiece, *dististyle* for clasper, and *phallosome* for mesosome, in order to promote the more correct morphological usage. As the terminal abdominal segments of the male undergo a 180° torsion shortly after emergence from the pupa, the ventral structures become apparently dorsal and *vice versa*. In this paper the terms *dorsal* and *ventral* are used in their true morphological sense.

In the selection and description of diagnostic characters the writer has drawn freely on the keys and descriptions of various authors. In preparing the keys, specimens of each species from the U. S. National Museum have been examined, through the courtesy of Dr. E. A. Chapin, Curator of Insects, and Dr. Alan Stone, in charge of Culicidae, at the Museum.

KEY TO LARVA

1. Air tube long, at least 4:1; basal hair tufts arising beyond the pecten; head without tracheal gill 2

Air tube short, about 3:1; two basal pairs of tufts arising within the pecten; a stalked ovoid tracheal gill at base of antennae. (Head hairs usually short, single, upper occasionally double; comb of 8 to 15 long pointed scales (Fig. 4) in a curved or irregular row; air tube curved, with about 8 pairs of very long ventral tufts, those decreasing in length apically, and 2 pairs of small sub-dorsal tufts; dorso-apical recurved hooks of air tube prominent; integument of thorax and anal segment sparsely spicular-pilose, abdomen glabrous; pecten tooth as in Fig. 9.) (Southeastern United States) .... *pilosus* (D. & K.)

2. Comb of many (30 to 40) fine scales in a triangular patch; integument of thorax sparsely spicular-pilose or glabrous 3

Comb of about 20 large scales in an irregular single or double row; integument of entire body densely spicular-pilose. (Lower head hairs long and single, upper half as long and multiple; comb scale with a long terminal spine and fringed only on basal half (Fig. 5); air tube about 5 or 6:1, with 5 or 6 pairs of long multiple ventral tufts, apical tufts progressively shorter, and 2 pairs of slight subdorsal tufts; pecten tooth as in Figure 8.) (Eastern United States) ...... *erraticus* (D. & K.)

3. Air tube with basal tufts long (at least twice the width of air tube at point of insertion), rest progressively shorter 4

Air tube with all tufts short (length about equal to width of air tube at point of insertion). (Lower head hairs long and single, upper generally 5-branched, one-half to three-fourths the length of the lower hairs; individual comb scale long, apical one-fourth broadly expanded and evenly fringed at tip (Fig. 1); air tube generally 10:1, with 4 pairs of short 2- to 4-branched ventral tufts and 1 pair of slight apical subdorsal tufts; single pecten tooth with blunt basal spine as well as fringe extending to tip (Fig. 11); integument of thorax and anal segment sparsely spicular, abdomen glabrous.) (Fort Lauderdale, Florida) .. *opisthopus* Komp

4. Individual comb scale long and narrow, free portion at least as long as base (Figs. 2, 3, 7) 5

Individual comb scale short, broad, free portion less than half as long as base, and evenly fringed with long hairs (Fig. 6). (Lower head hairs long and single, upper half as long and single or double, rarely triple; air tube about 4 or 5:1, with 5 pairs of long multiple ventral tufts and 2 pairs of slight subdorsal tufts; pecten tooth as in Fig. 8; integument of thorax and abdomen sparsely spicular-pilose, anal segment spiculate, especially dorso-apically.) (Texas) .... *abominator* D. & K.

5. Sclerotic plate of anal segment with scattered fine spinules dorso-apically; hair tufts of air tube long, basal tuft 2 to 3 times the width of tube at point of insertion 6

Sclerotic plate of anal segment with a group of blunt heavy spines at extreme dorso-apex; hair tufts of air tube short, basal tuft twice the width of tube at point of insertion or less. (Lower head hairs long and single, upper multiple and about one-fourth to one-third as long; individual comb scale long, gradually expanded, evenly fringed on apex (Fig. 3); air tube 8 to 10:1, with 4 pairs of short 3- to 6-branched ventral tufts and 2 or 3 pairs of minute subdorsal tufts; pecten tooth as in Fig. 10; integument of thorax finely spicular-pilose, abdomen less so.) (Florida Keys) . . . . *atratus* Theob.

6. Upper head hairs 2- to 5-branched, one-fourth to one-half as long as lower head hairs; comb scale heavily fringed from base to apex (Fig. 7). (Lower head hairs single, air tube 4 to 7:1, with 5 pairs of long multiple ventral tufts and 2 pairs of slight subdorsal tufts, often with a wide dark-pigmented band at about half the length; pecten tooth as in Fig. 10; integument of thorax and abdomen sparsely spicular.) (Southeastern United States) . . . . *peccator* D. & K.

   Upper head hairs single or double, one-half to three-fourths as long as lower head hairs; comb scale long and gradually expanded with heavy fringe apically, only slightly fringed at base (Fig. 2). (Lower head hairs long and single; air tube 6 to 8:1, with 5 pairs of long multiple ventral tufts and 2 pairs of slight subdorsal tufts; pecten tooth as in Fig. 10; integument of thorax and abdomen sparsely spicular.) (Key Largo, Florida) . . . . *elevator* D. & K.

The larva of *C. anips* Dyar is unknown.

Key to Male Genitalia

1. Dististyle with apical half enlarged, snout-shaped, or otherwise modified (Figs. 15, 16, 18–22) 2

   Dististyle simple, tapering from base, the apical half not enlarged or otherwise modified (Fig. 17). (Basal division of subapical lobe columnar with a short apical rod-like filament and a small weak filament from a tubercle near the base; apical division partially fused to basistyle and curved from base of basal division, bearing a broad-ribbed leaf, a rod, and 2 spines; 2 to 4 flattened setae arise from dististyle between basal and distal divisions; dististyle slender, uniform except base slightly enlarged, with subterminal appendage small and clavate; lobe of ninth tergite broad at base with an elongate tip curved outwardly, base with 10 to 12 long barbed hairs (Fig. 30); inner plate of phallosome a stout curved simple blade, with long basal hook.) (Florida Keys) . . . . *atratus* Theob.

2. Apical division of subapical lobe of basistyle with a distinct broad leaf . . 3

   Apical division of subapical lobe without expanded leaflet 6

3. Dististyle with apical half abruptly and angularly expanded, bearing prominent processes and a very prominent crest in addition to subterminal appendage (Figs. 16, 18, 19) 4

   Dististyle with apical half snout-shaped but not abruptly and angularly expanded, bearing only a slight outer crest, a small terminal claw, and a small subterminal appendage (Fig. 20). (Basal division of subapical lobe with two arms subequal, each bearing a long crooked, capitate filament; apical division with a broad irregular fan-shaped leaf, a long flattened hook-tipped filament, and 4 or 5 smaller filaments; lobes of ninth tergite oblong, prominent, covered with numerous long hairs (Fig. 23); inner plate of phallosome irregular, with a long basal hook, 2 sharp distal teeth, and a blunt lateral tooth.) (Eastern United States) *erraticus* (D. & K.)

4. Basistyle with a long dense patch of fine hairs on inner (dorsal) surface; anterior crest of dististyle without a prominent solid fused horn (Figs. 18, 19); subterminal appendage of dististyle short, not reaching tip of terminal claw (Figs. 18, 19).. 5

Basistyle with only a few long scattered hairs on inner surface; anterior crest of dististyle with a prominent solid fused horn (Fig. 16); subterminal appendage of dististyle long, extending beyond tip of terminal claw (Fig. 16). (Basal division of subapical lobe bearing a stout hooked filament from a long arm and a slender capitate filament from a tubercle near the base; apical division with a distorted irregular fan-shaped leaf, 2 short flattened spinose filaments, a fine seta, and a long recurved filament with a narrow attached membrane; apex of dististyle below the appendage forming an obtuse angle; lobes of ninth tergite extended triangularly, with a prominent inner basal patch of fine hairs and one long hair at apex (Fig. 29); inner plate of phallosome long and narrow, terminating in 2 stout curved teeth, one apical, the other one-fourth way from apex.) (Texas)......................*abominator* D. & K.

5. Apex of dististyle below the claw forming an acute point; basal portion of dististyle with a thorn-like point about midway of inner margin (Fig. 18). (Basal division of subapical lobe nearing a stout hooked filament from a long arm and a slender filament from a tubercle near the base; apical division with a very large fan-shaped leaf, a large hooked filament, and 3 small filaments; anterior crest of dististyle consisting of a distal group of short appressed spines, scattered short appressed spines basad, with short fine hairs between, subterminal appendage setose (Fig. 18); lobes of ninth tergite set close together, triangular, with long fine hairs scattered along outer border and in a group at inner basal corner (Fig. 25); inner plate of phallosome long and narrow, with short curved basal hook, and terminating in 2 stout curved teeth). (Southeastern United States)................................*peccator* D. & K.

Apex of dististyle below the claw broadly rounded; basal portion of dististyle without a thorn-like point, at most a rounded shoulder on inner margin (Fig. 19). (Basal division of subapical lobe unequally divided, with a short inner arm bearing a slender pointed filament arising at the basal third of the long outer limb which bears an expanded hooked filament; apical division with a distorted irregular fan-shaped leaf, 3 irregularly-placed filaments and a short spine; anterior crest of dististyle consisting of a distal patch of short appressed spines and a basal patch of long fine hairs, subterminal appendage clavate (Fig. 19); lobes of ninth tergite irregularly ovate with about a dozen long hairs scattered over the rounded apex (Fig. 26); inner plate of phallosome long and narrow, terminating in two bluntly pointed, curved teeth (Fig. 14).) (San Diego, California)........................*anips* Dyar

6. Basal division of subapical lobe not apparently divided, or if so, the cleft slight and the arms unequal in size.. 7

Basal division cleft to the basistyle so that the subapical lobe is apparently in 3 divisions. (The arms of the basal division subequal in size, each with a single broad hook-tipped filament; apical division with a long hooked filament and several shorter filaments and small spines irregularly borne at apex; dististyle with a broad, abruptly tapering, cap-like expansion at the apex, bearing a row of fine setae on outer margin and a small subterminal appendage on inner angle (Fig. 22); lobes of ninth tergite fingerlike projections from the corners of a broad spicular plate which has a central ovate lacuna, 1 or 2 setae on each lobe and a few on posterior corners of plate (Fig. 28); inner plate of phallosome with a long curved basal hook, a sharp hooked ventro-lateral tooth and 1 long ventral and 2 short dorsal distal teeth). (Southeastern United States) *pilosus* (D. & K.)

7. Basal division of subapical lobe short and columnar, undivided, and bearing two sub-equal long crooked hook-tipped filaments apically, the inner filament markedly curved and flattened; apical division columnar with 4 to 6 filaments unequally inserted at apex; lobes of ninth tergite rugose and finger-shaped with ovate wrinkled tips bearing a few short hairs, these lobes about 4:1 and arising from sparsely setose connected triangular bases (Fig. 24). (Dististyle narrowly snout-shaped, slightly crested on outer margin, with a groove, terminal claw, and thickened subterminal appendage (Fig. 15); inner plate of phallosome broad and evenly rounded distally, with a point at each angle, concave laterally, and with a long basal hook (Fig. 13).) (Fort Lauderdale, Florida)............................*opisthopus* Komp

Basal division (Fig. 21) unequally divided, consisting of a very short inner arm sessile at the basal third of the long outer limb, each bearing a long crooked-tipped filament; apical division with an inner arm continuing the shaft bearing a long and a short filament, 1 or 2 large middle filaments approximated to an outer group of three bent, somewhat flattened filaments; lobes of ninth tergite rather menbranous, irregularly elliptical, with long scattered hairs (Fig. 27). (Dististyle with a prominent snout, bearing a groove, a terminal claw, and thickened subterminal appendage (Fig. 21); inner plate of phallosome broadly rounded distally, the tip minutely serrate, a long lateral tooth about one-third way from tip, basal hook long and curled (Fig. 12).) (Key Largo, Florida)........................*elevator* D. & K.

Summary

1. *Culex elevator* D. & K. is reported for the first time in the United States from material collected by the writer in the summer of 1944 on Key Largo, Florida. A brief description of the habitat is given.

2. The finding of larvae of *Culex atratus* Theob. on Elliot's Key, Florida, is reported. This constitutes the first United States breeding record for this species.

3. Eight species of *Culex* (*Melanoconion*) are now known from the United States: *erraticus* from the Eastern States, *peccator* and *pilosus* from the Southeastern States, *abominator* from Texas, *anips* from California, and *atratus*, *opisthopus*, and *elevator* from southern Florida. Keys are given to separate the males by genitalia and the larvae (except *anips*, larva unknown).

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The writer wishes to thank Dr. Alan Stone, Division of Insect Identification, U. S. Department of Agriculture, for his very helpful advice and assistance. Acknowledgment is also gratefully extended to Senior Entomologist (R) G. H. Bradley, U. S. Public Health Service, for many valuable criticisms and suggestions, and to the staff of the U. S. Quarantine Station, Miami Beach, Florida, for their interest in the field work. Mr. Fred H. Stutz and Mr. Joseph G. Kennedy of the Dade County Florida Anti-Mosquito District kindly loaned specimens of *Culex atratus* from Elliot's Key and supplied the accompanying data.

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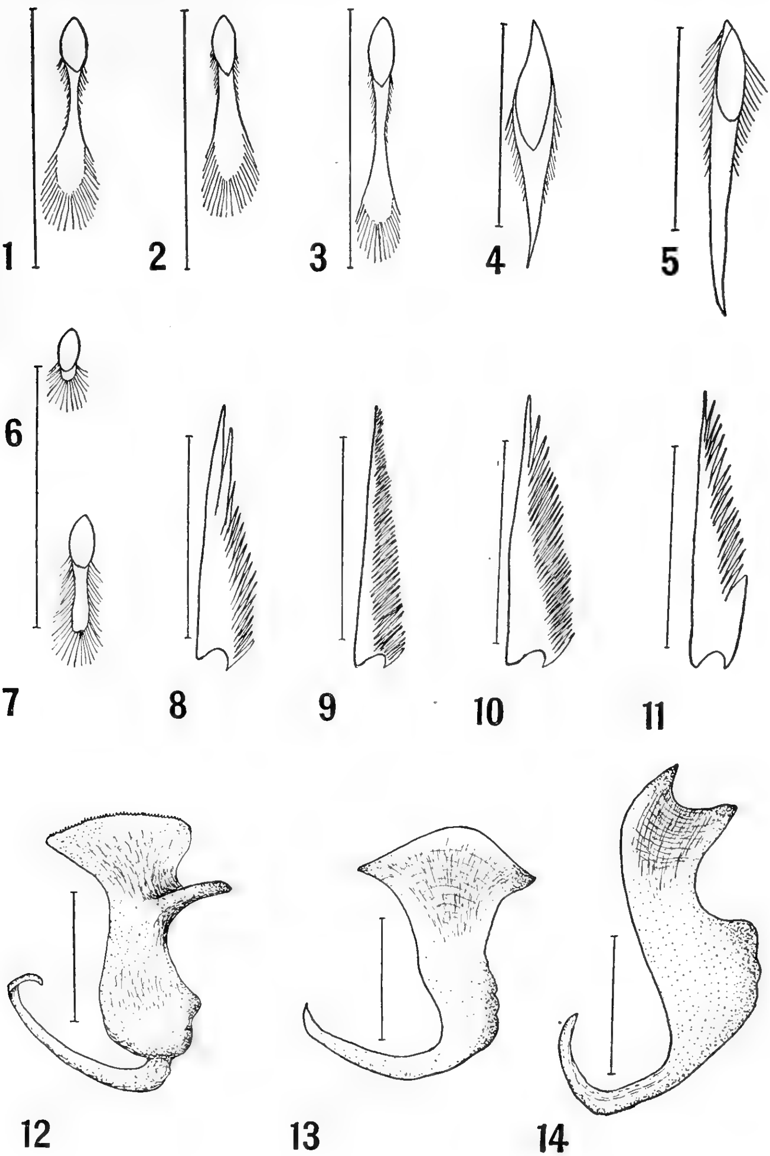
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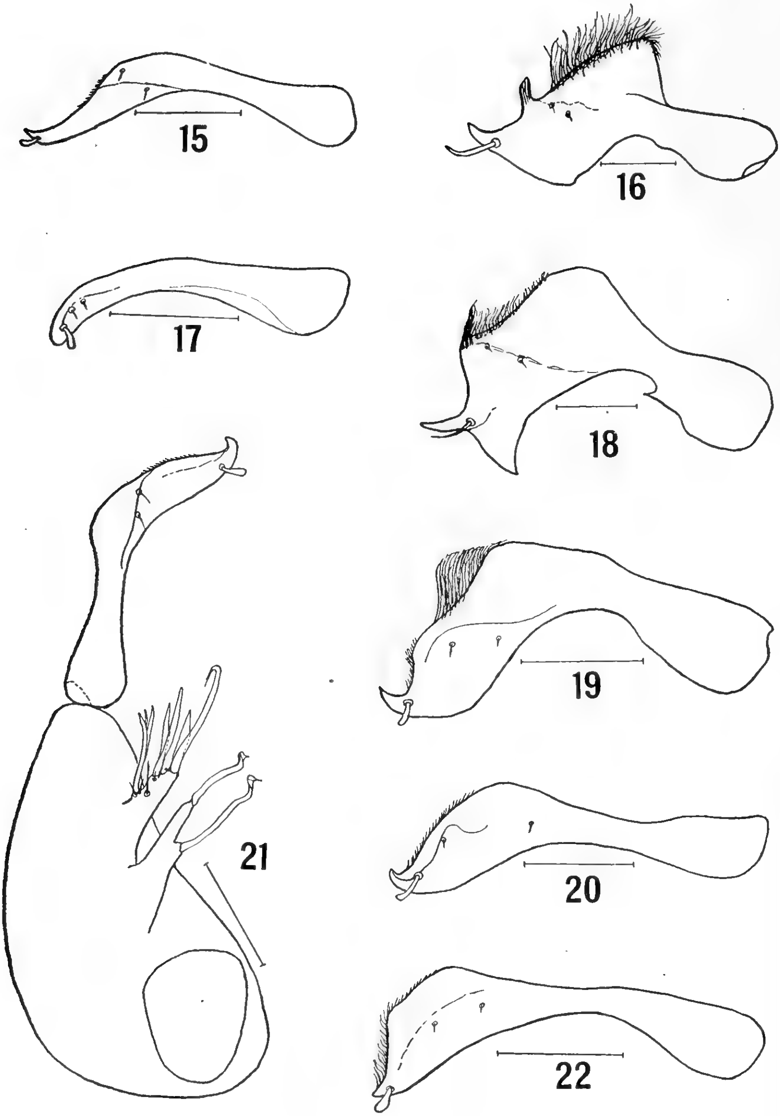
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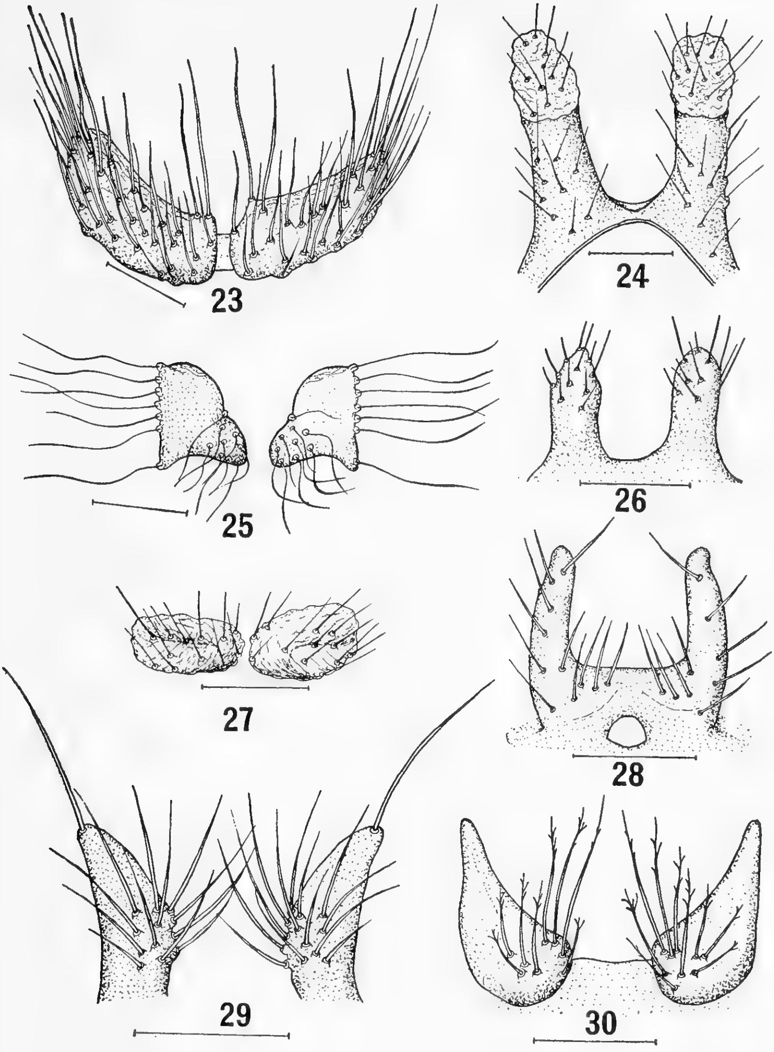
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EXPLANATION OF FIGURES

Figs. 1–7, Comb scale of larva (scale from center of posterior row figured): 1. *C. opisthopus.* 2. *C. elevator.* 3. *C. atratus.* 4. *C. pilosus.* 5. *C. erraticus.* 6. *C. abominator.* 7. *C. peccator.*

Figs. 8–11, pecten tooth of larva (subapical tooth of pecten figured): 8. *C. erraticus* (*C. abominator* similar). 9. *C. pilosus.* 10. *C. peccator* (*C. atratus*, *C. elevator* similar). 11. *C. opisthopus.*

Figs. 12–14, inner plate of phallosome, lateral aspect: 12. *C. elevator.* 13. *C. opisthopus.* 14. *C. anips.*

Figs. 15–22, dististyle; Fig. 21 includes basistyle (lateral view of inner surface) to show condition of subapical lobe of *C. elevator;* 15. *C. opisthopus.* 16. *C. abominator.* 17. *C. atratus.* 18. *C. peccator.* 19. *C. anips.* 20. *C. erraticus.* 21. *C. elevator.* 22. *C. pilosus.*

Figs. 23–30, lobes of ninth tergite, ventral view: 23. *C. erraticus.* 24. *C. opisthopus.* 25. *C. peccator.* 26. *C. anips.* 27. *C. elevator.* 28. *C. pilosus.* 29. *C. abominator.* 30. *C. atratus.*

(Scale: In each figure the adjacent line equals .05 mm.)

THE BIOMETRICS BULLETIN

A new journal, the Biometrics Bulletin, is being launched this year by the American Statistical Association for its Biometrics Section. It is to appear six times a year, to contain a first 12 or 16 pages, and to include news, queries, abstracts, and a few short articles of general interest. Subscription is $3.00 (or $2.00 to Section members, who need not be members of the general association). Applications should be sent to the American Statistical Association, 1603 K St. N. W., Washington, D. C. The editorial staff is a strong one, and the quality of the first numbers is gratifying. It is hoped that entomologists and other workers in biology and agriculture, will support and use this little journal.—F. M. WADLEY, *Statistical Consultant, Bureau of Entomology and Plant Quarantine.*

A NEW BRACHYMETRA FROM PERU WITH A LIST OF KNOWN SPECIES (Hemiptera, Gerridae)

By H. M. Harris and C. J. Drake

The following described water strider brings the known number of species of *Brachymetra* to six, *B. vittata* Shaw being referable to the genus *Eobates* Drake & Harris.[1] The types of the new species are in the collection of the authors.

Brachymetra mera, new species

Brachypterous form: Elongate-ovate, brown, pale beneath, opaque, the middle and hind acetabula usually with silvery spot. Antennae dark fuscous, segments I and II slightly enlarged distally, the former pale beneath, its length subequal to width of head across eyes (92); proportions—I, 90; II, 45; III, 68; IV, 50. Eyes large, as viewed from above with about one-third of their total length projecting back behind base of head. Anterior legs moderately stout, dark fuscous, the femora within, and the coxae and trochanters yellowish, the femur as long as pronotum (170), the second tarsal segment nearly one-half longer than first. Middle and hind legs very long, slender, dark fuscous, paler beneath, the length of middle femora subequal to that of body, the posterior ones a little longer. Rostrum extending a little behind prosternum, yellowish brown, the last segment blackish. Venter plump, the last segment nearly twice as long as preceding. Head without markings, the vertex about one-fourth wider than the diameter of an eye. Pronotum long, the anterior lobe distinctly impressed on disc, the posterior lobe about three times as long as front lobe, broadly rounded behind (a little more sharply so in female). First abdominal segment above with hind margin deeply, roundly emarginate. Connexiva wide, concolorous. Male with first genital segment above slightly emarginate at apex. Clasper moderately long and narrow, somewhat bowed within.

Winged form: Hind triangular part of pronotum more obtusely narrowed and appearing shorter than in *B. kleopatra* Kirkaldy, its median length subequal to width across humeri, the apex obtuse, reaching posterior to hind margin of meso-acetabula. Hemelytra dark brown, longer than abdomen, the veins yellowish, the outer marginal nervure very broad, finely hairy.

Length, 8.85 mm; *width*, 3.25 mm. Winged form nearly 10 mm. long.

Holotype (male), *allotype* (female) and 1 *paratype* (all apterous), Maria, Peru, Sept. 16, 1944, taken by E. J. Hambleton; 4 winged paratypes, bearing same labels as type.

Probably most nearly like *B. kleopatra* Kirkaldy but readily recognized by its larger size, darker color, obtuse apex of hind lobe of pronotum, and differently shaped clasper. This is the largest member of the genus.

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[1] *Eobates vittata* (Shaw) 1934 (=*E. morrisoni* D & H, 1934).

List of Species

Genus *Brachymetra* Mayr, 1865

1. *albinerva* (Amyot & Serville), 1843..............Panama; Brazil; Colombia; Venezuela; Peru; Central America; British West Indies
   var. *incisa* Shaw, 1934.....................................Bolivia; Brazil
2. *anduzeei* Drake & Harris, 1942.....................................Venezuela
3. *kleopatra* Kirkaldy, 1899.................................Peru; Trinidad, B.W.I.
4. *lata* Shaw, 1934...Brazil
5. *mera* Harris and Drake, n. sp...Peru
6. *unca* Shaw, 1934...Trinidad, B.W.I.

IDENTITY OF TETYRA LATERALIS FABRICIUS (Heteroptera, Pentatomidae)

By W. L. McAtee and J. R. Malloch

Reece I. Sailer's complimentary remarks (Proc. Ent. Soc. Wash., 47(5), May 1945, p. 129) upon our Revision of the Thyreocorinae are appreciated but his optimism as to the identifiability of certain earlier described species is not shared.

Even if we should accept all of Sailer's suggestions as to interpretation of the original description, we still think that *Tetyra lateralis* Fabricius is not definitely identifiable. A point which Sailer apparently did not consider is that there probably is more than one species of approximately the same size and coloration to be reckoned with. As the Fabrician type is not extant and was never precisely described or figured, we do not see how choice can be made between *Allocoris g. gillettei* Van Duzee (N. Y. and N. Dak., south to Fla. and Tex.), *A. harti* Malloch (N. Y. to Miss.), and possibly *A. agrella* McAtee (Md., Va.), species that may occur in the type locality, "Carolina." As the specimen was from the Bosc collection, this probably should be interpreted as Charleston, S. C., where Bosc spent some time.

With only one species as a possibility, its identification with *lateralis* might be acceptable, but with two and possibly more of very similar stature and coloration to choose from, the advisability of making a choice is surely debatable. There are no stauncher advocates of priority rights in generic and specific names than the present writers, but they would not strain a point to save an old name of insufficient description when the type is not available or its characters have not been satisfactorily described or depicted by a later author. Preserving such names means little anyway as when forms of the same complex have later been described, little or none of the preceding usage can be safely interpreted.

As to *Eucoria marginipennis* Mulsant and Rey, described from Marseilles, France (where a waif), the basis for identifying it with an American species seems not to have improved since 1933. One point remains, namely, applying the rule of priority among supergeneric names. The issue is complex as noted by McAtee (Journ. Wash. Acad. Sci., 11(10), May 1921, pp. 230-235) and the term *Eucoriens* of Mulsant and Rey which Sailer proposes to modify and adopt as *Eucoriinae* is a good illustration of one of them. It is a vernacular, not a scientific, term and is representative of a large class, distinctions among which as to availability or nonavailability for technical nomenclature are in many cases impracticable.

MINUTES OF THE 554TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, APRIL 5, 1945

The 554th regular meeting of the Society was held at 8 P. M., Thursday, April 5, 1945, in Room 43 of the National Museum. President Poos presided and there were 34 members and 17 visitors present. The minutes of the previous meeting were read by H. K. Townes, acting as Recording Secretary, and approved as read.

President Poos announced the death of Raymond Shannon on March 7, 1945, in Trinidad and appointed Mr. S. A. Rohwer, Dr. F. C. Bishopp, and Mr. Herbert Barber as a committee to prepare a necrological notice.

The following new members were elected:

Dr. Robert E. Gregg, Department of Biology, University of Colorado, Boulder, Colorado.

Dr. Clarence Hoffman, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

W. J. Nolan, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The following notes were presented:

Dr. Austin Clark showed a drawer of butterflies from the Marshall Islands collected by Lt. W. H. Wagner and Lt. D. F. Grether of the Naval Air Transport Service. There are only three butterflies in this group of islands: the native *Hypolimnas bolina*, the introduced *Danaus plexippus*, and *Badamia exclamationis*, the latter a widespread asiatic skipper not before recorded from the Marshalls. The specimens exhibited included a sereis of females of the *Hypolimnas* showing a remarkable amount of color variation.

Dr. A. E. Brower, a visitor from Maine who has been studying sawflies and microlepidoptera in the National Museum, told of the status of the spruce budworm (*Archips fumiferana*) in Maine. Twenty-five to 30 years ago this species fell in Bar Harbor in such numbers as to cover acres of water. From 1931 to 1941, no specimens were found in Maine by anyone. In each of the years 1941, 1942, 1943, and 1944 scattered specimens were caught. The present outbreak in Canada has been moving eastward year by year and is now near the Maine border.

The first scheduled speaker of the evening was Captain W. D. Reed, In Charge Insect and Rodent Control Unit, Office of the Chief of Engineers Insect and Rodent Control in the Corps of Engineers.

The Corps of Engineers serve as the operations agency for the Army Medical Department in the continental United States for the execution of control measures for insects and rodents. This includes pests that affect the health and morale of Army personnel and that destroy Army supplies and property. Insects and rodents most often encountered in this control work includes mosquitoes, flies, bedbugs, fleas, ants, termites, rats, pests of subsistence supplies, and insect pests of grassed areas. The work is carried out in accordance with the recommendations of the Medical Department and under such Medical Department technical supervision as is necessary for its accomplishment.

The organization in the Corps of Engineers for the control work consists of an Entomologist in charge of the Insect and Rodent Control Unit in the Office of The Chief of Engineers and men similarly trained to handle the work in the nine Service Commands. The purpose of the organization is to provide funds for the work, to make the program more effective, to assist the preventive medicine service of the Army Medical Department in reducing the danger of outbreaks of insect and rodent-borne diseases, and to control other pests that destroy Army supplies and property.

Programs of training schools were held in 1943 and 1944 in Service Commands for insect and rodent control. The schools were conducted cooperatively by the Service Command Surgeon and the Service Command Engineer and served to effect a Medical-Engineer team for insect and rodent control.

The Corps of Engineers develop and supply some types of sprayers and dusters for use in insect and rodent control. These include the knapsack sprayer, the skid mounted power spray unit, and the rotary hand operated duster. They procure specialized supplies including chemicals, insecticides, and apparatus used by Engineers for the accomplishment of recommended insect and rodent control measures. (Author's Abstract.)

Questions by Mr. S. A. Rohwer received replies from Captain Reed to the following effect: The Insect and Rodent Control Unit of the Corps of Engineers under Capt. Reed's direction does much less fumigation than in 1943. There are plans for using vacuum fumigation in larger depots. At present there are few calls for warehouse fumigation, but during salvage operations after the war, an increase in calls is expected. In many situations use of DDT takes the place of fumigation. The Army Corps of Engineers started using DDT as soon as a supply was available. Small quantities were received in May, 1944, and by September of that year the supply was adequate. For fumigation of subsistance items and clothing, the Army Corps of Engineers uses HCN rather than methyl bromide because the latter is sometimes objectionable. Almost no pyrethrum is used because there is almost none available. On cockroaches, the Army Corps of Engineers used a 10 percent DDT dust, which it finds as effective as sodium fluoride. For spraying DDT, an Army model of a knapsack sprayer, holding 3 gallons, is now on procurement for replacement and authorized supply. Most spraying is done by civilian crews. So far there is no record of DDT injury to spray crews. One crew that has been working with DDT for over 1½ years has shown no effects. Insect-borne diseases are now at their lowest ebb in the history of the U. S. Army.

The second paper was presented by Dr. M. C. Goldsworthy of the U. S. Bureau of Plant Industry: New Developments in Fungicides.

For a number of years bordeaux mixture and liquid lime-sulfur have been considered the standard fungicides. In the early stages of the growth of our fruit and vegetable industries quality had not reached the high standards considered essential in the present day and age. Because of this, some of the undesirable characteristics of bordeaux mixture and lime-sulfur were tolerated. As emphasis on quality increased, however, it became necessary to search for chemicals that caused less injury to the sprayed plants. This research led to the introduction of a number of finely ground sulfur materials and a variety of copper compounds; all of which, while not as efficient as lime-sulfur or bordeaux mixture, found specific uses. At a later stage of this research, investigations were conducted with various organic chemical compounds as plant protectants. This led to the development and experimental use of the dithiocarbamates, thiuram disulfides, quinones, phenyl mercuric derivatives, and a large series of quaternary compounds. The use of these organic materials as fungicides is quite limited at this stage of their development and a great deal of research is necessary before the public will accept selections from this group or other groups with the same degree of confidence that has, in the past, been accorded to liquid lime-sulfur and bordeaux mixture. (Author's Abstract.)

Questions by Mr. S. A. Rohwer and others brought answers from Dr. Goldsworthy that fungicides act differently on different species of fungi, just as insecticides act differently on different insects; the fungi used for most field tests by Plant Industry are brown spot of peaches and bitter rot of apples; mercury compounds come as near as any to being effective against all fungi, but these are too dangerous for general use; most fungicides kill through some oxydizing reaction; DDT is of no value as a fungicide; though most of the work on development of certain new fungicides was done by Plant Industry, they are patented by private companies.

President Poos asked for the introduction of visitors, after which he requested Dr. V. B. Wigglesworth, a visitor from England, to address the Society. Dr. Wigglesworth gave the following description of his findings on the fate of hemoglobin in *Rhodnius prolixus*, a South American blood-sucking reduviid: The bug takes a large meal of blood which goes into the dilatable anterior portion of the midgut, where it is stored. It may be stored there for weeks, and there the hemoglobin changes to methemoglobin. From time to time a little blood is let into the narrower part of the midgut where it quickly darkens, is digested, and the residue passes out as black excreta composed largely of hematin. In the blood of the insect is a faint red pigment which spectroscopic examination shows to be parahematin. Hemoglobin injected into the body cavity is soon altered to parahematin. The salivary glands are a bright cherry red which spectroscopic examination shows to be caused by a substance similar to hemalbumin. The inference is that some hemoglobin escapes from the anterior part of the midgut, is altered in the body cavity to parahemoglobin, and then in the salivary glands to the hemalbuminlike substance. The pericardial cells are colored brilliant green, being filled with biliverdin. If hemoblogin is injected into the body cavity, the pericardial cells become loaded with brown hematin which is then converted into biliverdin. When overloaded, these cells, too, lose biliverdin into the blood and this is then excreted by the Malpighian tubules and may be seen as droplets in their lumina. The posterior part of the gut also becomes loaded with hematin, which is altered to biliverdin, discharged into the intestine, and passed out with the excreta. The Prussian blue test shows traces of free iron in the heart and a heavy accumulation of it in the cells of the gut. Parahematin occurs also in the ovarian egg and is found in the yolk residue in the gut of the newly hatched nymph. From the gut this pink coloration can be traced to the salivary glands, from which it may be injected into the host at the time of the first meal.

The Society adjourned at 9:45 P. M.

H. K. TOWNES,
Acting Recording Secretary.

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THE

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Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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PROCEEDINGS OF THE
ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 47 NOVEMBER, 1945 No. 8

THE EXTERNAL MALE GENITALIA OF FULGOROIDEA (Homoptera)

By R. G. Fennah

The external genitalia of the male in Fulgoroidea develop in association with the posterior margin of the ninth abdominal segment and comprise a tubular intromittent organ, or *phallus* (Fig. 1, *ph*) and a pair of claspers, genital styles or *harpagones* (*hrp*), all emerging through the conjunctival membrane between the sterna of the ninth and tenth segments. The ninth abdominal segment is ring-like and on its inner walls are attached all but one pair of the muscles of the genitalia.

On the posterior ventral margin of this segment there is frequently developed a median process (Fig. 9, *mvp*), usually simple (Cixiidae, most Derbidae), but sometimes forked (*Malaxa:* Delphacidae), or paired (*Burnilia*, *Perkinsiella*, *Pissonotus:* Delphacidae), or showing evidence of having been formed by the fusion of paired immovable processes (many Achilidae): this structure has been considered homologous with the more prominent *subgenital plates* of the Cicadoid superfamilies. Functionally it wedges the first and second valvulae of the ovipositor between the bases of the harpagones during coitus. The harpagones are free from the ventral surface of the ninth segment and are invariably inter-connected near their internal (basal) extremities by a transverse bar (Fig. 4, *tvs. st*)—the "basal plates" of Singh-Pruthi—from the mid-point of which a vertical sclerotised rod passes upward to a sclerotised ring surrounding the apex of the *ejaculatory duct* (Fig. 13, *ejd*) where it joins the *endophallus* (*enp*) or innermost lining of the phallus. The latter consists of a *phallobase* (*phb*), which is suspended from the posterior margin of the tergum of segment IX on each side of the insertion of segment X and passes distally into a tubular aedeagus (*aed*) which is invaginated at its apex, the invaginated portion passing anteriorly as the endophallus to join the ejaculatory duct. The sclerotised arms which suspend the phallobase from the tergum are in some families fused for part of their length, and assume the shape of a Y, but their points of attachment remain constant.

The musculature of these organs comprises four elements: (1) paired protractor and retractor muscles of the phallus; (2) a pair of muscles from the transverse strut between the harpagones to the anterior ventral margin of the pygofer; (3) a pair from the basal ends of the harpagones to the phallobase and (4) a pair from the harpagones to the ventrolateral walls of the pygofer. There is in addition a small pair of muscles attached to the posterolateral wall of the ninth segment close to the points of insertion of the suspensorial arms of the phallobase and attached dorsally to the tergum. In Jassoidea and Cercopoidea there is an unpaired transverse zygomatic abductor muscle joining the basal ends of the harpagones: no counterpart of this has been found in Fulgoroidea.

(1) The protractor muscles of the aedeagus are attached to the dorsal surface of the sclerotised roof over the apex of the ejaculatory duct and pass obliquely to the lateral margins of the pygofer where they are broadly inserted and invariably reach the posterior margin (Fig. 1, 1). The retractor muscles (Fig. 1, 2) are inserted on the anterior margin or on the ventrolateral surface of the sclerite which bears the protractors and pass to a lip on the anterior ventral or ventrolateral margin of the pygofer. (2) The muscles which connect the transverse strut of the harpagones to the anterior margin of the pygofer (Fig. 1, 3) are always paired and apparently serve to retract the harpagones; they are often attached along the major portion of the strut, but sometimes converge from the anterior margin to lie immediately at each side of the base of the vertical apodeme. (3) The muscles directly associated with the phallobase (Fig. 1, 4) are attached ventrolaterally to a slight flange at its junction with the conjunctival membrane; proximally they join the inner faces of the basal arms of the harpagones and serve as abductors and depressors of the latter. (4) The muscles attaching the harpagones to the pygofer are antagonistic to the last mentioned and are inserted on the outer surface of their basal arms whence they pass laterally to unite broadly with the ventrolateral wall (Fig. 1, 5).

The above arrangement of the genital musculature occurs in almost all families of Fulgoroidea: it is accordingly of interest to find it strikingly modified in the families Derbidae and Achilidae. In both it is the phallic musculature which is involved, and in both the base of the aedeagus is withdrawn into the body—excessively so in Achilidae—but whereas in the latter the median apodeme from the transverse strut of the harpagones is greatly elongated, in the Derbidae it is absent. The condition found in Achilidae is shown in fig. 7. Here the retractor muscles of the aedeagus are absent, otherwise the musculature is normal (though it may be noted that the dorsal muscles near the insertion of the phallobase on the tergal margin are unusually well developed). It is presumed that in such an arrangement retraction of the aedeagus is brought about by the median apodeme to the harpagones becoming flexed when the protractor muscles are contracted and pulling antagonistically as their tension is reduced. In the Derbidae also it is the paired retractors of the aedeagus which are aborted, but here their function appears to have been assumed by the muscles which pass from the phallobase to the harpagones. These muscles in Derbidae are exceptionally large (Fig. 8, 4), and the basal arms of the harpagones on which they are inserted extend deeply into the abdomen with the result that the muscles pull antagonistically to the aedeagal protractors.

The ninth segment, or pygofer, is normally ring-like. In Derbidae its tergal region is reduced to a narrow rim firmly attached to the basal margin of the tenth segment (*Cedusa*, *Phaciocephalus*) or almost indistinguishably incorporated into the tenth tergite (*Neocenchrea* (Fig. 8), *Zeugma*). In this family the eighth and sometimes the seventh abdominal sternite may also be suppressed.

Kershaw and Muir (1922) and Muir (1925) considered the medioventral process of the pygofer in Fulgoroidea and the closely similar subgenital plates in other Auchenorhyncha to be homologous with the first valvulae of the Hemipterous ovipositor: they postulated a movement of the posterior (coxopodite) area of the eighth sternite in the male, on which they believed genital appendages (gonapophyses) subsequently to develop, to a position below the ninth tergum and fusion with it to form the pygofer, and justified this view by citing the example of the female in which the valvifer, or coxopodite of the eighth sternite, with its gonapophysis (the first valvula) during nymphal development becomes attached to the ninth tergum. Muir's contention, as he pointed out, rests on a claim that the ninth abdominal sternite has not been demonstrated in the homopterous male either in the nymphal or adult form. This claim, however, is no longer tenable: the writer has examined all stages of the delphacid *Peregrinus maidis* (Ashm.) and has found this sternite initially present in both sexes, and in the male continuously so during development (Figs. 14, 15). There is no trace of posterior drift of any portion of the eighth sternite in the male (compare figs. 14–17 and 21–26). Moreover, the first valvulae of the ovipositor, notwithstanding their migration, still retain their original muscular relation with the coxopodite of the eighth segment (the valvifer), while the muscles of the second valvulae are restricted to the ninth segment, of which these valvulae are the gonapophyses. An inevitable corollary of Muir's view of the nature of the ventral portion of the pygofer is that the paired muscles which pass from the transverse strut between the harpagones to the anterior ventral margin of the pygofer, the adductor muscles of the harpagones and the retractor muscles of the aedeagus all connect appendages of the ninth segment with the coxopodite area of the eighth, a condition at variance with that in the female with which homology is claimed. Muir found it difficult to accept what he considered to be the alternative to his interpretation, namely that the subgenital plates of Homoptera are "new processes not represented in the other sex or in other insects". Such apodemes of the sternite of the ninth segment, however, have arisen by parallel development in the males of certain Mecoptera (e. g. *Panorpa*). In contrast to Muir, Singh-Pruthi (1924:71) interpreted the sub-genital plates as "coxites" (of the ninth segment) "and therefore homologous to the lateral pair of ovipositor-lobes" (third valvulae). In *Peregrinus* the third valvulae of the ovipositor arise in the membrane behind the posterior margin of segment IX laterad of the second valvulae (Fig. 26a): buds arising in a corresponding position in the male nymph (i. e. laterad of the median phallogenic area of the membrane behind segment IX) (Fig. 18) develop into the harpagones, as may readily be seen by dissecting teneral fifth instars and adults from their respective fourth and fifth instar cuticulae. Subgenital plates are not developed in *Peregrinus*, but if fourth and fifth instars of the Jassoid *Entogonia* be examined it may be seen that the subgenital plates arise posteriorly on each side of the middle line of the ninth sternum and represent an outpushing of the sternal margin itself. Above them, in the membrane, are developed the buds of the harpagones and phallus exactly as seen in *Peregrinus*. The ontogeny of the subgenital plates thus shows them to be adventitious apodemes of the ventral margin of the ninth segment: this conclusion is corroborated by their anatomy, since they are at no stage provided with muscles.

It is appropriate at this point to draw attention to a pair of processes prominently developed in all nymphal stages of *Peregrinus maidis* (Ashm.) on the dorsolateral hind margin of the pygofer at the level of a line through the middle of the tenth segment (Fig. 15, *dlp*). Similar processes are of widespread occurrence in nymphal Fulgoroidea and may prove to be universal in the superfamily: as far as has been ascertained these have not previously been mentioned in the literature on this group. In *Peregrinus* each process is unsegmented, devoid of musculature, subquadrate and rugose-verrunculate; in the Dictyopharidae *Hyalodictyon* and *Toropa* and the Flatidae *Antillormenis* and *Ilesia* it is lanceolate and smooth. Their position on the ninth segment indicates that, resemblances notwithstanding, they cannot be cerci: their condition remains unchanged throughout nymphal life but in the adult, if present at all, they appear in rudimentary form as a slight inwardly-directed lobe on the hind margin of the pygofer. In *Peregrinus* this eminence is feeble and minutely granular. In adult Fulgoroidea various immovable apodemes may be developed on the posterolateral margins of the pygofer, sometimes asymmetrically (as in the Kinnarid *Quilessa*), while in certain Delphacidae (e. g. *Burnilia*) they may form a comparatively elaborate armature.

The harpagones, the development of which is considered along with that of the aedeagus below, are symmetrical, rod-like or triangularly or subquadrately spatulate, and are always interconnected by the transverse strut. In *Tettigometra* they are styliform, while in *Euphyonarthex* they are fused in a broad plate resting on the coxosternum of the pygofer. Union of the apposed ventral margins of the harpagones is not common but is of wide occurrence in Acanaloniidae.

The phallus varies considerably in shape but its morphological composition is far more uniform. The different arrangements of the phallobasic and aedeagal elements are shown diagrammatically in fig. 29; these diagrams are self-explanatory and comment may accordingly be restricted to a few of the more interesting points. The phallus of Tettigometridae is generally considered to represent one of the most primitive types; the phallobase is well developed, with paired suspensorial arms, and passes distally into a simple tubular aedeagus which is apically membranous and devoid of accessory processes. In the Asiracinae, the least specialised subfamily of the Delphacidae, the phallus closely resembles that of the pintaliine Cixiidae, and comprises a phallobase and an exserted aedeagus (Fig. 13): in the tribe Delphacini the aedeagus has become largely withdrawn into a crypt (Fig. 12), and the phallobase, still recognisable by the attachment of the harpagonal depressor muscles, is formed dorsally by the median sclerotised suspensorial arm passing upward to the tergum and ventrally by a sclerotised and usually pigmented plate lying transversely across the conjunctival membrane; this is the "diaphragm" (Fig. 11, *dpm*) of systematic terminology. Kershaw and Muir (1922:209) homologised "a small ring at the base of the aedeagus" with their "periandrium" (phallobase): their view was questioned by Singh Pruthi (1925:228), who considered the delphacine aedeagus to correspond to the phallobase of Cixiidae. If this contention were correct it would be necessary to look for the attachment of the harpagonal depressors ventrally at the base of the aedeagus: they do not, however, occur in this position, but as indicated above, on the sclerotised transverse plate across the conjunctival membrane. Singh-Pruthi's interpretation accordingly leaves unexplained both the presence of the "diaphragm" and its relation to the dorsal insertion of the harpagonal depressor muscles. In the kinnarid genus *Bytrois* (Fig. 10) only the phallobase is present, and assumes the form of a wide tube produced distally to form a *theca;* the gonopore opens medially at its base. Muir's figure of the Old World genus *Kinnara* (1923:236) indicates that in this family the aedeagus may be fully developed within the theca; other genera (*Quilessa*, *Prosotropis*, and *Atopocixius*) appear to occupy an intermediate position between these two forms. As in Kinnaridae the phallus in Meenoplidae shows considerable variation: in *Nisia* and *Robigalia* the phallobase appears to combine with the aedeagus in a short tube which is traversed by the endophallus; in *Phaconeura* the aedeagus itself forms a tube and is surrounded basally and roofed over for most of its length by the extended phallobase. No adequate account has yet been given of the phallus in Achilixiidae: it is possible that it may be found to be similar to that of *Bytrois* as in *Achilixius* the phallus is simple and is attached to a transverse bar across the conjunctival membrane. In Acanaloniidae the phallus consists in some species merely of a thecal extension of the phallobase in the shape of a spinose bag decurved laterally to form an incomplete tube, while the aedeagus is represented by a small triangular lip medially at its base. In the ricanioid group of families with which the Acanaloniidae are generally associated the aedeagus proper is reduced to a short tube with the phallotreme, or external opening of the endophallus (Fig. 13, *pt*), occupying the dorsal, apical or ventral surfaces; the condition of the aedeagus in Acanaloniidae merely represents a reduction of this type.

Suggestions have been put forward (Kershaw and Muir 1922:208, Muir 1923:245, Singh-Pruthi 1925:232) for a phylogenetic arrangement of the families of Fulgoroidea in which the form of the phallus is treated as the paramount character, the principle division of the superfamily being considered as occuring between groups in which the phallotreme is situated proximally, when the aedeagus is usually surrounded by a theca, and others in which the phallotreme is situated distally, when the aedeagus is exserted well beyond the phallobase. If this distinction be employed rigorously as a criterion of natural relationship through common ancestry then it would appear that the small family Meenoplidae, which embraces both types, is not of monophyletic origin; moreover it is to be suspected that with the examination of the genitalia of many more species other families would come to be regarded as being in a similar condition. The writer is not prepared to endorse such an extreme view, and while he is provisionally disposed to recognise a community of origin between the Cixiidae and Delphacidae, the Dictyopharidae and Fulgoridae, and members of the ricanioid complex respectively, does so on the basis of characters which are not necessarily subordinate to that of phallic structure. Between families other than those indicated above considerable latitude must be allowed for local modifications and for parallel trends of development, and evidence of natural relationship must be accumulated from their ontogeny, anatomy and biology.

The phallus in *Peregrinus* and *Toropa* arises medially in the membrane behind segment IX and between the harpagonal buds (Fig. 18 *ph*). A T-shaped sclerotisation of the membrane, with the transverse arm composed of two layers and the vertical strut occupying the middle line of the body, advances into the body cavity. In *Peregrinus* (Figs. 19, 19a, 19b) two invaginations of the membrane are thus developed, the first forming a flattened pocket between the upper and lower surfaces of the cross-bar of the T-shaped sclerite which in the adult forms the crypt in which the aedeagus lies, the second lying below the preceding between the posterior margin of the sternum and the buds of the harpagones and persisting in the adult as the chamber in which the medio-basal portion of the harpagones is contained. The latter develop from small buds by rapid proliferation during the fifth nymphal stage. The transverse strut which connects the harpagones together develops in the membrane below them and from the first is in contact with the lower end of the T-shaped sclerite. In Achilidae, Flatidae and possibly in other families the vertical apodeme of this sclerite may lose its mesal connection with the conjunctival membrane in the adult though in such cases it retains its normal attachments at each end. In *Peregrinus* the dorsal plate of the cross-bar of the T-shaped sclerite, which forms the roof of the aedeagal crypt, becomes more strongly sclerotised at its posterior lateral angles to form the suspensorial arms of the phallobase; from the outset of its development it is in contact with the laterodorsal hind margin of the tergite. These sclerotised arms in some families may be developed throughout their length as separate elements passing to each side of the phallobase, or as in *Peregrinus* they may unite mesally to form a short vertical bar in the middle line of the membrane. The ventral plate of the cross-bar of the T-shaped sclerite forms the floor of the aedeagal crypt and distally provides the areas of insertion of the dorsal ends of the harpagonal depressor muscles. The roof-like sclerite over the distal extremity of the ejaculatory duct is formed during the basad extension of the point of union of the dorsal and vertical elements of the T-shaped sclerite.

Singh-Pruthi (1924) on the basis of a study of late instars of two species of the jassoid *Idiocerus* by means of transverse sections concluded that in these species the aedeagus arises as a paired organ formed during division of what he regarded as an initial (and phylogenetically primitive) pair of common phallic-harpagonal buds. His figures 2e and 2f of the third instar and 3a and 3b of the fourth indicate that incipient aedeagal development in *Idiocerus* occurs as reconstructed diagrammatically in fig. 28. He expanded his account of phallic and periphallic differentiation in this genus into a general statement embracing both auchenorhynchous and sternorhynchous Homoptera (pp. 87, 88) and claimed that the phallus and harpagones in members of this Suborder are conjointly homologous with the second valvulae of the ovipositor (p. 71).

While it may be accepted that in Auchenorhyncha differentiation of the phallus, its associated basal sclerites, and its musculature occurs symmetrically about the axial line of the body, observational evidence that the phallus is formed by the union of two appendages developed independently in each half of the ninth segment is still lacking. It must not be overlooked that in *Idiocerus* the ectoderm of the middle line from the earliest stage of development differentiates to form the dorsal surface of the phallus throughout its length and at all times is in broad continuity with the flanges which grow downward on each side, forming with them a single steeply tectiform plate, of which the ventral margins finally become united. The implication that the bilaterally symmetrical development of the phallus in this genus may be taken as evidence of the presence of a pair of gonapophyses, one on each side of the gonopore, in ancestral forms of Homoptera must be evaluated in the light of possible alternatives. In *Peregrinus* there appear to be grounds for considering the harpagones as homologous with the third valvulae of the ovipositor: both arise as buds in close association with the lateral portion of the hind margin of the ninth segment and occupy a morphologically similar position in the adult; both are provided with muscles which are inserted on elements of the ninth segment. The relation of these appendages in *Idiocerus* as illustrated in Singh-Pruthi's figures 3a and 6 is quite consistent with this interpretation. On this presumption, if the aedeagus in Auchenorhyncha be regarded as a morphologically paired organ with a counterpart in the female, it can only be homologised with the second valvulae of the ovipositor. In view of the variability in the male genitalia of Auchenorhyncha and of the unprecedented appearance or suppression of muscles in different groups the writer considers that the evidence in favour of such homology in this Series is still too inconclusive to secure its general acceptance.

Divergent views have been expressed on the question whether the accessory sclerites of the base of the aedeagus are homologous in Heteroptera and auchenorhynchous Homoptera (Singh-Pruthi 1925: 135, 136; Muir 1926:328). No one has yet attempted to homologise them with structures in the female genitalia and it would seem not inappropriate here to anticipate speculation on this point. If it be supposed that the aedeagus in Auchenorhyncha is of paired composition and is homologous with the second valvulae, and if it be assumed that the median (though distally paired) vertical sclerites above and below the aedeagus were also primitively paired throughout their length, it will be noted that each sclerite so formed includes a limb to a gonapophysis (one half of the aedeagus), a limb to a style (one of the harpagones) and a third limb to the posterior margin of the ninth tergum. A similar series of relationships is found in the valvifer of the ninth segment in the female. If these structures were considered homologous it would be expected that the muscles of the style would be inserted on the coxopodite from which it primitively arose: one such muscle, it may be claimed, exists in that which joins each of the harpagones to the phallobase; of the four remaining muscles of the genitalia on each side of the body, however, only one, the protractor of the aedeagus, has the anatomical relations of a muscle of the valvifer. Moreover on ontogenic grounds it is to be supposed that the coxosternal area from which the gonapophyses originate is embodied in the ventral half of the pygofer. Such a hypothesis, therefore, does not consistently account for the relations with the pygofer of all elements of the genitalia. In the opinion of the writer it is more satisfactory to regard the sclerites supporting the male genital appendages in Auchenorhyncha as having recently arisen (perhaps by local sclerotisation of a basal and primitively segmental element in the conjunctival membrane) in adaptation to the functional requirements of a changing copulatory mechanism than to seek in them the modified remains of structures supposedly omnipresent in the earliest evolutionary stages of the Rhynchota.

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Explanation of Figures

Fig. 1. *Petrusa marginata* (L.) (Flatidae), lateral view of male genitalia with muscles and clasper of left side removed.

Fig. 2. Do., posterior view of male genitalia, slightly diagrammatic, left side showing muscles hidden by those on right.

Fig. 3. Do., dorsal view of male genitalia, slightly diagrammatic, aedeagal protractor muscle of right side removed.

Fig. 4. Do., ventral view showing harpagonal muscles of left side.

Fig. 5. *Toropa ferrifera* (Wlk.) (Dictyopharidae), lateral view of male genitalia, harpagonal muscles omitted.

Fig. 6. Do., lateral view of harpagonal muscles.

Fig. 7. *Catonia* sp. (Achilidae), lateral view of male genitalia.

Fig. 8. *Neocenchrea gregaria* Fenn. (Derbidae), lateral view of male genitalia.

Fig. 9. Do., harpagonal muscles with posterior process of segt. IX shown dotted.

Fig. 10. *Bytrois nemoralis* Fenn., (Kinnaridae), lateral view of male genitalia.

Fig. 11. *Peregrinus maidis* (Ashm.) (Delphacidae: Delphacini), posterior view of male genitalia, right clasper removed, its phallobasic attachment seen by transparency.

Fig. 12. Do., lateral view of male genitalia.

Fig. 13. *Punana portoricensis* Muir (Delphacidae: Asiracinae), lateral view of phallus.

Figs. 14-20. Stages in development of male genitalia of *Peregrinus maidis* (Ashm.).

Fig. 14. *Peregrinus maidis* (Ashm.), ventral view of posterior segments of first instar.

Fig. 15. Do., lateral view of same.

Fig. 16. Do., ventral view of IXth sternite of third instar; (a) lateral view.

Fig. 17. Do., posterolateral view of IXth and Xth abdominal segments, fourth instar.

Fig. 18. Do., anterior view of harpagonal buds and phallogenic area, fourth instar.

Fig. 19. Do., as above, fifth instar; (a) lateral view, (b) dorsal view.

Fig. 20. Do., lateral view of phallus and clasper of teneral adult.

Figs. 21–26a. Stages in the development of the female genitalia of *Peregrinus maidis* (Ashm.).

Fig. 21. Do., ventral view of posterior segments of second instar of female.

Fig. 22. Do., ventral view of IXth sternite of second instar of female; (a) lateral view.

Fig. 23. Do., as above, third instar of female.

Fig. 24. Do., as above, fourth instar of female.

Fig. 25. Do., ventral view of genital appendages of fifth instar of female.

Fig. 26. Do., posterior view of abdominal segments IX and X of fifth instar of female; (a) ventro-posterior view of genital buds.

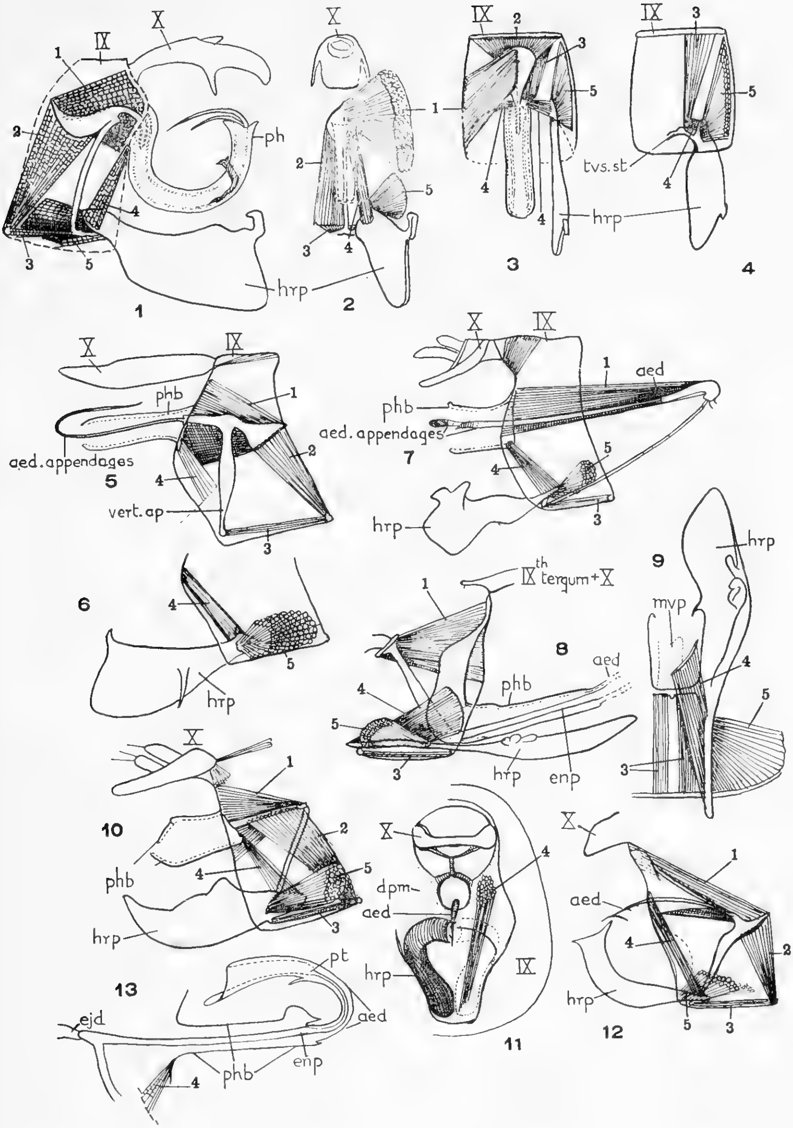
Fig. 27. Do., genital appendages of left side of IXth segment of adult female.

Fig. 28. Diagrammatic reconstruction of incipient phallus-formation in *Idiocerus* (Jassoidea) from sectional figures given by Singh-Pruthi (1924).

Fig. 29. Diagrams showing composition of phallus in various groups of Fulgoroidea.

Explanation of Lettering

aed, aedeagus; *dlp*, dorsolateral process of IXth segment; *dpm*, diaphragm (phallobase of Delphacini); *ejd*, ejaculatory duct; *enp*, endophallus; *hrp*, one of harpagones; *mvp*, medioventral process of pygofer; *ph*, phallus; *phb*, phallobase; *pht*, phallotreme; *tvs. st.*, transverse sclerotised strut interconnecting the harpagones; *valv*, valvula of ovipositor; *vert. ap.*, vertical apodeme from transverse strut of harpagones to base of aedeagus.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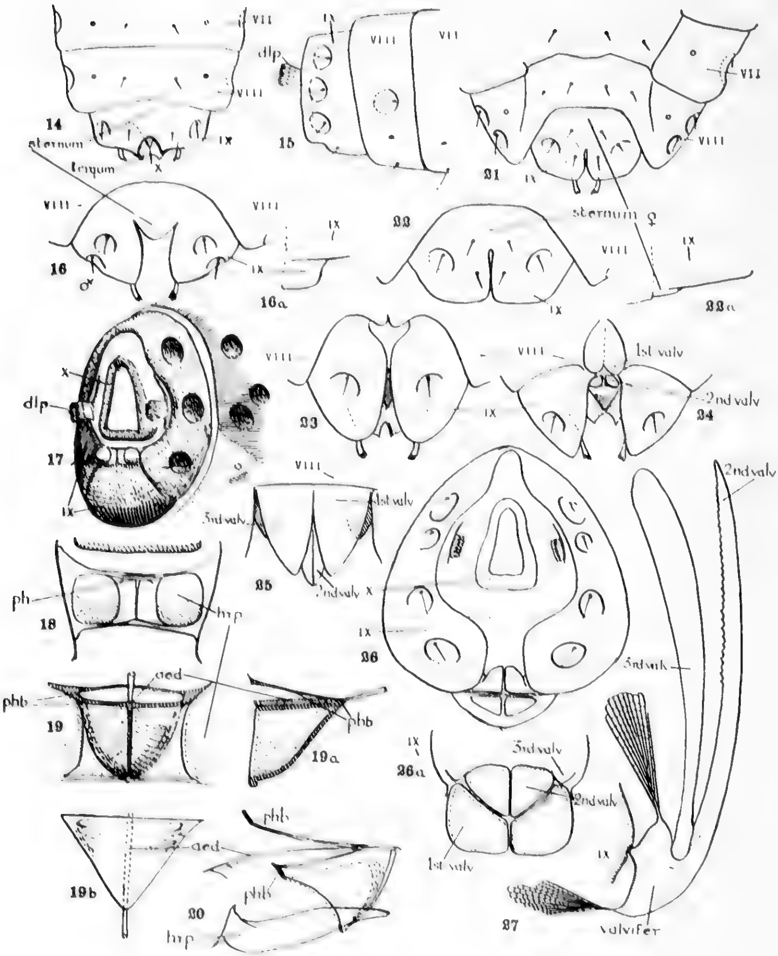
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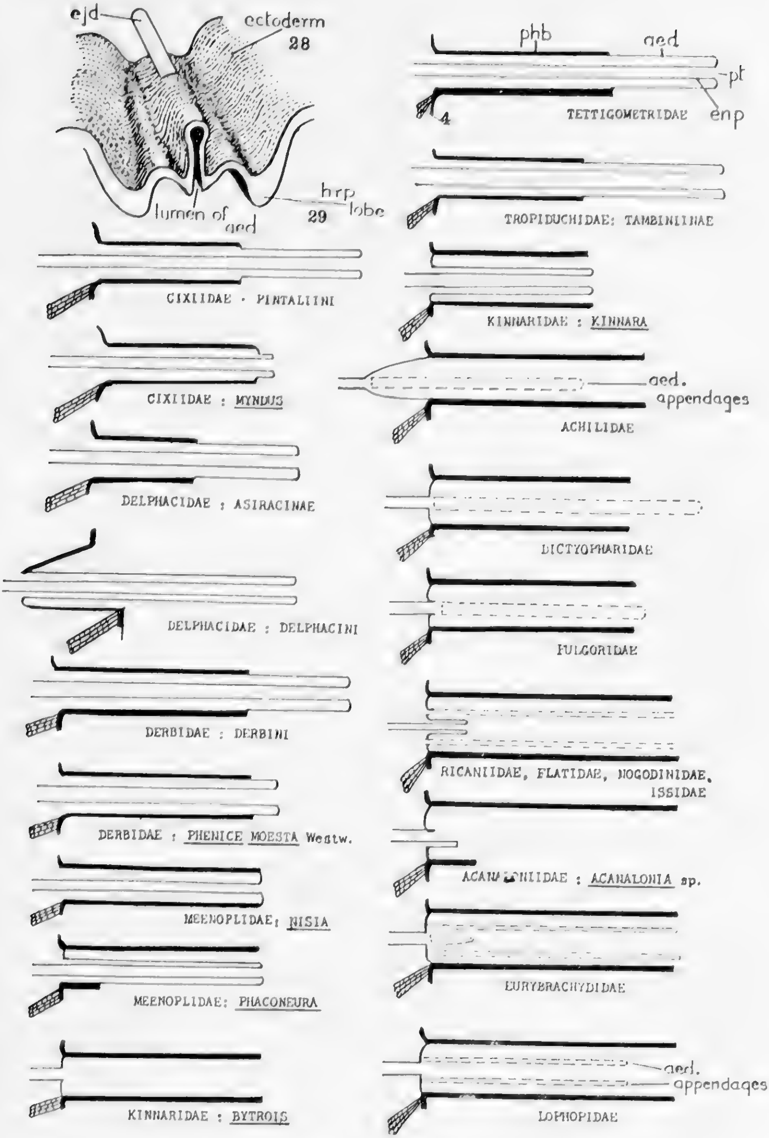


Footnote: For "Eurybrachydidae" above, read "Eurybrachyidae"

WILLIAM THOMPSON DAVIS
1862–1945

William Thompson Davis, American naturalist, historian, antiquarian, man of affairs, and member of the Entomological Society of Washington for 36 years, since December 2, 1909, was born at New Brighton (now Saint George), Staten Island, New York, on October 12th, 1862. He was son of George B. and Elizabeth (Thomson) Davis. Their ancestors had settled first in Massachusetts, and later generations had removed to Staten Island. While as yet only a child be became interested in the study of natural history, and particularly in making observations on and collections of insects, birds and plants. Educated in private schools, he entered early upon a business career and for some time was with a New York mercantile establishment. However, in 1883, at the age of 21, he became connected with the New York Produce Exchange, where he was associated for 26 years. At the age of 38 he was married on November 7, 1900 to Bertha Mary Fillingham of Livingston, Staten Island. After slightly over a year of married life, she died on December 7, 1901. In 1909 at the age of 47 he retired from active business and devoted the remaining 36 years of his life to care of his property interests and to natural history, historical and antiquarian research. He died at Staten Island Hospital, Saint George, Staten Island, on January 22, 1945, age 82 years, 2 months, and 10 days. The remains were interred in Moravian cemetery, New Dorp, Staten Island.

He first appears to have become really interested in insects when he was a lad of only 15, and that these chanced to be cicadas, was stimulated by the fact that it was during that season that the 1877 brood of the so called "Seventeen Year Locusts" emerged from the soil. By a curious coincidence, another person who later became famous as a nature writer, Henry David Thoreau, had made observations 34 years before of the 1843 brood of these same insects there on Staten Island. In the decades that followed, the studies by William T. Davis of the cicadas gradually increased in range and scope until, eventually with the passing of the years, he became one of the foremost world authorities on this fascinating group of insects.

Edwin Way Teale, in an appreciation in 1942 of William T. Davis, comments on his entomological work as follows: "Out of approximately 170 cicadas from North America known to science, William T. Davis has named and described more than 100. The oldest fossil cicada ever found has been named in his honor. Oxford University and other venerable institutions of learning abroad have sent him specimens to study and identify. His cicada collection at the Staten Island Museum is one of the most complete in the country. On trips afield with entomological friends, he has collected cicadas high on mountainsides and, at the opposite extremes, more than 200 feet below sea level near the Salton sea in California. Here, he found a new species." In one of his latest papers Mr. Davis made this characteristic acknowledgement of their value to him: "Old man Davis wishes to express his gratitude to the beautiful sweet singing family Cicadidae for helping him reach old age pleasantly 'mid the perplexities of this mysterious world."

Aside from his special work with cicadas, his insect collection was rather general in scope, including particularly those forms occurring on Staten Island. He was also deeply interested in the Orthoptera, to which he devoted much attention along with his studies of the cicadas. He was fortunate in having a very keen ear for insect sounds and was able to identify many insects from hearing their music.

Perhaps the most important and certainly one of the most interesting of his popular nature writings is the little volume entitled: "Days Afield on Staten Island," (12mo., cloth, 132 pp.), published by the author for private circulation in 1892, when he was 30 years old. Charmingly written, its chapters comprise a series of loosely related essays or poems bearing such titles as: "First signs of spring," "After the snow," "The benison of Spring," "South beach," "By the rippling sea," "The old stone house," "The deserted farm house," "Native brooks," "The pond-meadow," "The turnpike road," and "In memory." After remaining out of print for many years, a second revised edition (8vo., cloth, 122 pp.,) was published in 1937, under the auspices of the Staten Island Historical Society, 45 years after publication of the original first edition.

Other non-technical books written by him, of historical or antiquarian interest, are "The Church of Saint Andrew, Richmond, Staten Island," (8vo., cloth, 266 pp., illus.). This was written in collaboration with his life long friend Charles W. Leng, and another friend Royden Woodward Vosburgh, and also was published under the Society's auspices in 1925. Another volume, "Legends, Stories, and Folklore of Old Staten Island, The North Shore," (8vo., paper, 140 pp., illus.) likewise was published by the Society the same year, and a volume entitled "The Conference or Billopp House," (8vo., cloth, 203 pp., illus.) was published by the Society in 1926.

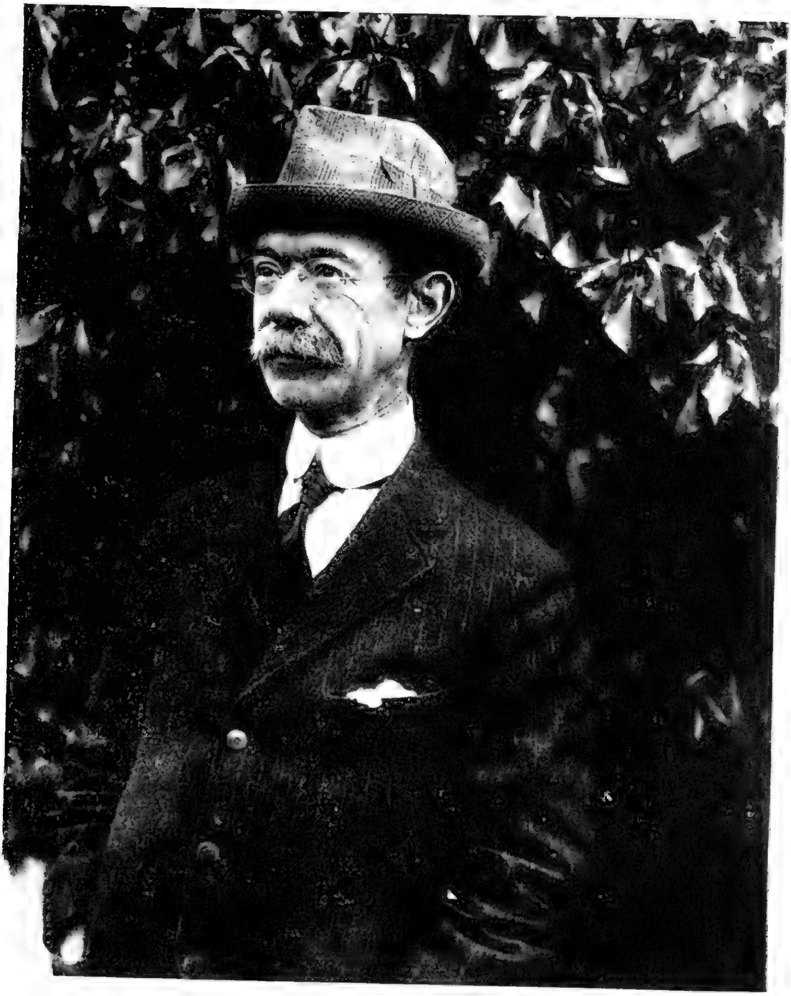
Doubtless the most important single work published by these two men is that entitled "Staten Island and Its People: A History 1609 to 1929", which comprises four large quarto volumes, with numerous plates, maps, etc., and was issued from the press in 1930, when Leng, its senior author was 71, and Davis, its junior author, was 68, years old. Only those who have used these ponderous tomes can realize the enormous patience and persistence, the long continued toil and pains entailed in their preparation. Indeed the production of one of these might well be considered a life time task for an average worker.

It will be noted that long before his retirement from active business he had already built up in his spare time a very fine library and natural history collection and a most enviable mental foundation and background for scholarly pursuits in the fields in which he was most interested. Thus, when more favorable opportunity came, he was enabled to continue his studies under environmental conditions of affluence, scholarship and leisure of a sort to make him at once the envy and the despair of thousands of other students everywhere who have experienced life-long desire for like freedom and similar opportunities. For years thereafter much of his time was spent in occasional travel, in outdoor rambles and collecting, these varied at convenient intervals with prolonged periods of intensive study and writing. A passionate lover of books, he gradually accumulated a large and increasingly valuable library, which became particularly strong in complete sets of scientific and historical periodicals, bulletin sets, and in entomological rarities. These were augmented by several hundred bound quarto volumes of his own personal notes and records, comprising original source material, accumulated with great toil and pains over the decades, and drawn upon from time to time as needed in preparation of his historical and other writings—a veritable mine of information.

Worthy of special mention also was the beautiful friendship which existed for over sixty years between William T. Davis and Charles W. Leng, author of "A Catalogue of North American Coleoptera North of Mexico," and himself a most unusual individual. These two men—"Billie" and "Charlie" to each other—were close personal friends until separated by death. Together they worked and rambled, together they pursued their hobbies, and together they spent every possible moment. During their young manhood, Davis at 19 and Leng at 21, they had prominent part in forming in 1881 the Staten Island Institute of Arts and Sciences, an organization that has grown from 14 charter members to a present membership of over a thousand.

The two comrades also had prominent part in the founding and development of the Staten Island Museum, an outgrowth of the Institute. On this Davis lavished thought, time and money, until now it has over a hundred thousand specimens in its collections of scientific, historical or artistic value, a library of over 7,000 volumes, and its Proceedings, containing much material of great local value, now covers more than sixty years of continuous publication.

His memberships in scientific and other societies included the Linnean Society of New York, the Academy of Natural Science of Philadelphia, the Boston Society of Natural History, and life membership in New York Historical Society. His very considerable activity in organizations of this kind is evidenced by the fact that he was president of the Staten Island Historical



Society for 16 years from 1922 to 1938 and thereafter was president emeritus; he was president of the Brooklyn Entomological Society from 1912 to 1916 and from 1920 thereafter. He was treasurer of the New York Entomological Society for a quarter of a century from 1904 to 1929, was its president in 1929 and 1930, was a member of its Executive Committee 1931–38, inc., and was elected its Honorary President from 1940 thereafter. He was president for 11 years of the Staten Island Bird Club. He was made a fellow of the New York Academy of Science in 1910, a fellow in the Entomological Society of America in 1917, and an Honorary Fellow in that Society in 1943, an honor which comes to few entomologists. Further, The Park Association of the City of New York conferred upon him an Official Citation in 1941 for his interest in and assistance in the development of parks and nature recreation centers on Staten Island.

Singularly gifted in making and retaining friendships, the range and the versatility of these not only was noteworthy but was remarkable. Having built up over the years a wide acquaintance among scientific and historical workers, throughout the world, and being a prolific letter-writer, he kept in touch by highly valued correspondence with many faraway friends, infrequently seen, and otherwise out of contact. The veneration and affection in which he was held by his immediate contemporaries was evidenced by the dedication to him of the October 1942 issue of the Bulletin of the Brooklyn Entomological Society in honor of his eightieth birthday. In it were published papers in appreciation of him by J. R. de la Torre-Bueno, Edwin Way Teale, Howard Cleaves, and J. Bequaert. Grateful acknowledgement is gladly made to these authors for data from these papers included in this notice.

Any sketch, however brief, of William T. Davis would be ncomplete that did not at least make mention of his gentleness, his helpfulness, his tactfulness, the inimitable charm of his personality, and—manifested over and over again in countless unrecorded acts of kindness and beneficence—the simple goodness of the man.

Also, it is a matter of difficulty for old friends, such as were the authors of this notice, who have long held him in affectionate regard, to attempt to evaluate impersonally the career of this unusual man. Doubtless they could appropriately apply to him in paraphrase the words of Ralph Waldo Emerson in appreciation of Henry David Thoreau, when he said: "The country knows not yet . . . how great a son it has lost." Perhaps the subject of this notice may be longest remembered for his historical and antiquarian work, but, definitely, American Entomology, by the example of his life and achievements, has been left enriched in inspiration to research and endeavor.

J. S. WADE and H. G. BARBER.

NOTES ON THE BIOLOGY AND CONTROL OF CHRYSOPS DISCALIS WILLISTON (Diptera, Tabanidae)

By C. M. GJULLIN, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture and* DON C. MOTE, *Department of Entomology, Oregon Agricultural Experiment Station*[1]

INTRODUCTION

The deer fly *Chrysops discalis* was named by Williston (*5*) in 1880 from specimens collected in Wyoming. It has since been taken in Oregon, Washington, Idaho, California, Nevada, Colorado, Utah, Montana, North Dakota, Minnesota, and Nebraska. Hearle (*4*) states that in Canada it is "especially common in the Dry Belt of British Columbia and extends as far east as Manitoba . . ." In 1921 Francis (*3*) proved that this species was the carrier of tularaemia, and reported a number of cases of the disease in Utah. In 1937 Francis (*2*) reported the seasonal and geographical distribution of 67 cases of tularaemia that had been transmitted by this fly in the United States from 1924 to 1935. Thirty-eight of these cases occurred in Utah. Cameron (*1*) obtained the larvae of *C. discalis* "on 29th June 1925 amongst decaying vegetable matter washed up on the shore by the strongly alkaline waters of Baldur Lake in Southern Manitoba." He found that the larvae did not feed on each other and could be reared in soil containing considerable organic material.

In Oregon *Chrysops discalis* has been taken in Lake County in the vicinity of Summer Lake and Abert Lake, and in Warner Valley. Specimens have also been taken in Klamath County near Klamath Falls, in Harney County near Frenchglen, and in Jefferson County near Warm Springs.

Chrysops discalis (fig. 1) is a severe pest of cattle, horses, and humans on dairy and cattle ranches bordering Summer Lake. In the more heavily infested areas 25 or more flies swarm continuously around the heads of the men working in the hayfields. Large numbers swarm around the cattle and horses and feed on them. Live-stock in this area is also attacked by *Tabanus productus* Hine, *T. sonomensis phaenops* O. S., and *T. punctifer* O. S., but these species are less numerous than the deer flies.

Summer Lake is about 16 miles long by 6 miles wide, and lies in a valley about 25 miles long by 15 miles wide, which is almost entirely surrounded by hills. Deer flies are present in the

[1] The writers wish to thank the following members of the Oregon State College and the Agricultural Experiment Station: H. A. Scullen for assistance in the later stages of this investigation, H. M. Gilkey for identification of sedge plants, R. H. Robinson for analysis of mud and water samples from Summer Lake, Oreg., and E. C. Anderson for bibliographical records. Published as Technical Paper No. 465 with the approval of the Director of the Oregon Agricultural Experiment Station; constribution of the Department of Entomology.

valley from the middle of June to the first part of September. They have been found to be fairly numerous from 4 to 5 miles from their breeding places.

A number of cases of tularaemia occur in the valley almost every year. The first case was reported to have occurred 28 years ago. There were six cases in 1943, and none in 1944. Rabbits, which are reservoirs of the disease and normally numerous in the valley, were nearly all destroyed by an epizootic in 1943. In 1921 Francis (*3*) reported the coexistence of human cases and a fatal epizootic in rabbits in Utah, both of which were caused by (*Bacterium*) *Pasteurella tularensis*, the causative organism of tularaemia. The destruction of the rabbits in the Summer Lake area was undoubtedly also caused by tularaemia, and the absence of human cases in this area in 1944 was apparently due to the reduction in the number of rabbits.

Tests to determine whether sprays containing DDT (1-trichloro-2, 2-bis (p-chlorophenyl) ethane) might be effective in protecting cattle in this area from *Chrysops discalis* were made during the summer of 1944. A few tests on the effect of this insecticide against newly hatched larvae were also made in the laboratory. Information on the biology of the species was also obtained during the summer.

NOTES ON BIOLOGY

The water in Summer Lake is maintained by a river arising from large springs about 4 miles from its northern end. A dam has been built across this river to provide water for irrigation in the valley. Rest Lake and several ponds are scattered around the flat areas bordering the northern half of the lake. Summer Lake has no outlet, and is shallow over most of its area. It is approximately 2 feet deep in the deepest place.[2] During the summer months the water level falls several inches, and alkali flats from a quarter of a mile to a mile or more in width are exposed. Grass and sagebrush border these alkali flats.

The waters of Rest Lake and Summer Lake are highly alkaline. A sample of water from Summer Lake having 21,730 parts per million (p. p. m.) of total solids was found to contain about 67 percent of sodium carbonate, 18 percent of sodium chloride, 13 percent of sodium sulfate, and about 2 percent of other salts. Mud from Rest Lake had a pH of 8.8 and that from Summer Lake a pH of 9.6. Mud samples from both lakes contained large amounts of hydrogen sulfide. The concentration was somewhat higher in the Summer Lake sample. The

[2] The contours of the Summer Lake bottom were mapped by the U. S. Geological Survey in 1941. In June of that year, when the water level was estimated to be slightly below normal, the water was 1.5 feet deep in the deepest place across from Hunters Point.

hydrogen sulfide apparently comes from the spring water, which flows into the lake.

In the Summer Lake area larvae of *Chrysops discalis* were first obtained on July 18 from a small pond near the northern end of the lake. The larvae were recovered from mud samples taken at intervals from a point 25 feet out in the pond to the shore, under water from 1 to 2 feet deep and from 2 to 4 inches under the surface of the mud. They were obtained by washing the mud through a 16-mesh sieve. These larvae were from 13 to 17 millimeters long.

Larvae were also obtained from Rest Lake at this time. An average of two larvae per pint dipper of mud were found 100 feet from shore, where the water was about 6 inches deep. Closer to the shore the larvae were more numerous. They were of the same size as those found at Summer Lake, and were taken at the same depth in the mud.

The shore of Rest Lake slopes upward gradually for a distance of 3 to 10 feet to a grassy bank about a foot high. Pupae and pupal cases were found in large numbers just below the edge of this bank, where the soil was comparatively dry. The cases protruded about three-eighths of an inch above the soil, and averaged 3 or more per square inch in emergence beds of considerable size. It was estimated that 90 percent of the flies had emerged from this area by July 22. The emerging flies pushed out of their pupal cases and rested on top of them or on the ground while their wings hardened. Pupal cases left by *Chrysops discalis* emerging from this area are shown in figure 2.

Larvae, pupae, and cast skins were also found in several places around the southern end of Summer Lake. In most instances both the larvae and the pupae were from 50 feet to several hundred yards from the water, and from 50 yards to half a mile or more from any type of vegetation. These areas had apparently been under water earlier in the season, but had been gradually exposed as the water level fell.

A large number of larvae from Rest Lake were brought to the laboratory and confined in individual containers, where seven of them pupated and emerged. The length of the pupal stage ranged from 5 to 9 days.

Several *Chrysops discalis* larvae about 6 millimeters long were found floating on the surface of Rest Lake, when this area was visited again on August 25. These larvae were found near the shore.

Chrysops discalis egg masses were also found at this time on the stems of *Scirpus americanus* Pers., a sedge which grows in small patches along the shore of Rest Lake. The eggs, which are cemented to the stems and to each other, are shown in figure 3. They were concentrated on small clumps of sedge growing near the water line of the lake. The number of eggs in each of 5

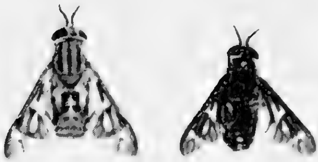


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Fig. 1. The deerfly *Chrysops discalis* Williston; female at left and male at right. X 1.4.

Fig. 2. Pupal cases of *Chrysops discalis Williston* projecting from soil on shore of Rest Lake, Ore., where this species emerged in large numbers.

Fig. 3. Eggs of *Chrysops discalis* Williston laid on stems of *Scirpus americanus* Pers. Egg mass on left, X 4.7; egg masses on right, X 0.7.

different egg masses ranged from 179 to 500, the average being 356. Many stems had 25 or more such egg masses, or a total of 9,000 or more eggs per stem. Only occasionally were egg masses found that had hatched.

One female was observed while laying eggs on a *Scirpus americanus* stem. She was facing downward on the stem, and had laid approximately 450 eggs. A considerable number of the eggs were still grayish white, and they did not turn black until about 18 hours later. All the eggs hatched 5½ days after they were laid.

All the larvae from one egg mass usually hatched in 2 to 10 minutes after hatching began. Newly hatched larvae that were placed on water over mud remained on the surface of the water part of the time. The larvae passed through their first molt about an hour after they had hatched.

The northern half of Summer Lake is overgrown with *Scirpus paludosus* A. Nels. Small areas of *S. americanus* grow along the borders of this sedge. In all the examinations made *Chrysops discalis* egg masses were found only on *S. americanus.* In the southern end of Summer Lake no vegetation is present, and there appears to be no place for large numbers of flies found in that section to lay their eggs, unless they lay them on the mud or water or fly to the nearest clumps of sedge.

All egg masses found on *Scirpus americanus* plants in August had hatched when the Summer Lake area was visited again on October 18. The larvae were from 3 to 9 millimeters in length. They were obtained by placing mud samples on a piece of cheesecloth, gathering up the edges to form a bag, and agitating this bag in water until the fine mud was washed out. The larvae could be seen in the coarse residue that remained.

Larvae from eggs laid in 1943, as well as in 1944, were found in Rest Lake. Only a few large larvae were found. These would probably require 2 years to complete their life cycle, since they were still some distance out in the mud of the lake. Small larvae were present in samples taken from within 25 feet of the shore of this lake. In Summer Lake small larvae were found in the mud near the water and out as far as 30 feet. Larvae are probably also present farther out in these lakes. The larvae were taken 1 to 3 inches beneath the surface of the mud under 2 to 6 inches of water. In one area that was sampled for larvae in Summer Lake, the nearest vegetation was 400 yards from water. In another area the nearest vegetation was separated from shore by 400 yards of dry alkali flat, and the *Scirpus americanus* plants nearest the water were half a mile away.

The presence of these small larvae in areas so distant from the known areas of egg deposition, as well as the presence earlier in the summer of full-grown larvae and pupae half a mile or more from vegetation of any kind, indicates either that the flies of this species lay their eggs on the mud or water, or that the larvae are carried to these locations by waters of the lakes or ponds in which they are found. Both newly hatched larvae and larvae 6 millimeters long have been observed to float on the surface of the water. The length of time they float has not been determined, but if larvae remained floating for some time they could be readily distributed from the northern end of Summer Lake, where most of the eggs were found, to the southern end of the lake by the continuous inflow of water into the northern end and also by the strong winds that blow from the north during the evenings.

Eggs of this species might also be laid in the cracks in the mud of alkali flats, which are exposed when the lake waters recede during the summer. This would explain the presence of larvae so far from the sedge plants on which the eggs have been found. However, it seems doubtful that an insect which cements its eggs on a plant would also lay its eggs on the soil.

EFFECT OF DDT ON ADULT AND LARVAL STAGES

Tests of DDT sprays were made in Summer Lake Valley in July. Out of a total of 34 milk cows on 4 ranches, 13 cows were sprayed with DDT emulsion, 12 with 2 percent DDT and 1 with 4 percent DDT. The sprays were made up from a stock emulsion containing 25 percent of DDT, 68 percent of xylene, and 7 percent of Triton X-100 (an aralkyl polyether alcohol). The emulsion was applied as a fine spray with a 5-gallon knapsack sprayer. For application around the head and eyes a cloth was soaked in the liquid. Approximately a half-gallon of emulsion was used per cow, sufficient to wet the animal thoroughly.

The number of flies attacking the cattle ranged from almost none on 1 ranch to about 50 per animal on others. The spray was applied in the morning, after the cows had been milked, and its effect was usually observed in the forenoon and again in the afternoon. The flies swarmed around both the sprayed and unsprayed animals, and fed mostly around their heads and shoulders. There was no noticeable reduction in the number of flies alighting and feeding on the sprayed animals. Flies that were not disturbed or driven off by the animal usually remained for several minutes.

In order to observe the effect of DDT on deer flies more closely, some of the flies were captured in the sagebrush, confined for periods of 2, 5, 10, and 15 minutes in pint glass jars which had been coated with DDT, and then transferred to clean jars. The jars were coated by filling them with a 2 percent DDT emulsion, draining them, and then letting them dry thoroughly. Observations made 30 minutes after the exposure periods indicated that all the insects were unable to fly. Flies exposed for 2 and 5 minutes were dead at the end of 8 hours, and 90 percent of those exposed for 10 and 15 minutes were dead in 4 hours.

Chrysops discalis requires several minutes to obtain a full blood meal, and the legs, undersides, and mouthparts of flies feeding on sprayed animals would be in contact with DDT during this time. The tests with flies in DDT-coated jars indicate that all flies feeding on sprayed animals would eventually be killed. It is doubtful, however, that much relief would be obtained in the Summer Lake area, even if all the cattle in the valley were sprayed, for there are large areas of sagebrush that are heavily infested with flies and comparatively few cattle.

Horn flies were also present on the cattle sprayed in these tests. DDT was apparently effective against these flies, since very few were seen after the cattle were sprayed.

A few tests were also made of 2 percent DDT emulsion against first and second instars of *Chrysops discalis* larvae in tap water. This emulsion was made up from the same type of stock emulsion that was used in the previous test. The larvae were tested in 4 liters of tap water in glass jars. Results of these tests are shown in table 1. In these tests 25 larvae were used in each jar, but larvae which were first affected by the poison were apparently eaten by the remaining live larvae. This may have affected the mortality, but the tests indicate that all larvae would probably be destroyed by a 1 p. p. m. concentration of DDT, even if dead larvae were not eaten by the temporary survivors.

TABLE 1. The toxicity of 2 percent DDT emulsion to first and second instars of *C. discalis* (2 replications of 25 larvae each)

Millions of parts of water to 1 part DDT	Percent Mortality in	
	24 hours	48 hours
1	60	100
5	48	98
10	20	72
No DDT	0	0

SUMMARY

The deer fly *Chrysops discalis* Williston is a severe pest of cattle, horses, and man in the Summer Lake Valley in Oregon. Several cases of tularaemia are also caused by the bite of this fly almost every year.

The waters of Summer Lake and Rest Lake, where most of the flies breed, are highly alkaline, the pH ranging from 8.8 to 9.6,

and the mud is saturated with hydrogen sulfide. In July larvae of *Chrysops discalis* were obtained in mud samples taken as far as 100 feet from shore, under water up to 2 feet deep. The larvae were about 16 millimeters long, and were buried from 2 to 4 inches in the mud. Many larvae and pupae were present in the soil bordering the lakes, and many flies had emerged.

Large numbers of eggs were found on the stems of *Scirpus americanus* Pers. on August 25, but none were found on other plants. All these eggs had hatched by October 18, and the larvae, which were from 3 to 9 millimeters in length, were found in mud samples taken at intervals from a point near the shore to 30 feet out in the lake. Large larvae obtained in July, as well as small larvae obtained in October, were found a half mile from vegetation of any kind, and since the larvae have been found to float on the surface of the water at times, they may have been carried to these places by water currents or wave action. The eggs of *Chrysops discalis* hatch 5 or 6 days after they are laid, and the larvae molt about an hour after they have hatched. The pupal stage requires from 5 to 9 days.

Cattle were sprayed with 2- and 4-percent emulsions made from a stock emulsion containing 25 percent of DDT, 68 percent of xylene, and 7 percent of Triton X-100 (an aralkyl polyether alcohol). Application of one-half gallon per animal did not noticeably reduce the number of flies attacking the cows. In laboratory tests flies that were confined in glass jars coated with a 2 percent DDT emulsion for 2 minutes and then transferred to clean jars were killed in 8 hours, while those confined in coated jars for 10 minutes and then transferred were killed in 4 hours.

The same type of emulsion was tested against first and second instars of *Chrysops discalis* in water. In these tests 1 part of DDT to 10 million parts of water caused a mortality of 72 percent in 48 hours, and 1 part of DDT to 5 million parts of water caused a mortality of 98 percent in 48 hours.

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THE OCCURRENCE OF CULEX OPISTHOPUS KOMP IN PUERTO RICO AND FLORIDA, WITH A DESCRIPTION OF THE LARVA (Diptera, Culicidae)

By Harry D. Pratt, W. W. Wirth, and D. G. Denning, *U. S. Public Health Service*

INTRODUCTION

Culex opisthopus Komp has been known from Honduras, its type locality, from which the female and male were described in 1926 by Komp, and from Panama where it was described again under its synonym *mychonde* from a single male captured by Komp and described in Dyar's "Mosquitoes of the Americas."

The hitherto unknown larva of this species is now described from specimens taken in Puerto Rico and Florida. Notes on the biology and distribution of *opisthopus* are added, the range of which is now known to extend practically to the northeastern limit of the Neotropical region. Detailed figures of the larva, pupa, and male genitalia are given.

Acknowledgement is gratefully made to Dr. Alan Stone of the U. S. National Museum for much valuable advice and assistance and for comparing adult material with the types of *C. opisthopus* and *C. mychonde*, and to Mr. W. H. W. Komp of the U. S. Public Health Service, Ancon, Canal Zone, who confirmed the determination of the Puerto Rican specimens. Mr. G. H. Bradley and Dr. C. B. Spencer of the U. S. Public Health Service have made many helpful suggestions.

BIOLOGY

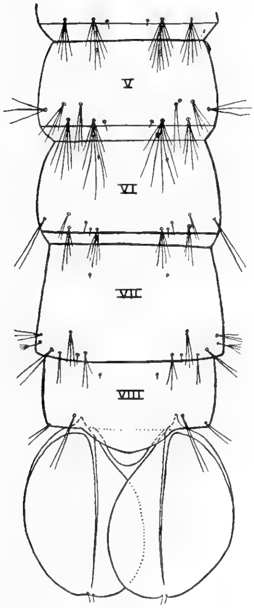
Puerto Rico. The larvae were first discovered in Puerto Rico on December 26, 1942, at Barrio Palma Catano, Puerto Rico by T. H. G. Aitken and H. D. Pratt. They occurred in small numbers in moderate to dense shade in a sluggish stream, or in pools alongside the stream, in rank vegetation such as *Persicaria* and *Leptochloa* associated with the larvae of *Uranotaenia cooki* Root, *U. lowii* Theob., *U. sapphirina* (O. S.) and *Culex erraticus* D. & K. Adult females have been collected by A. A. Weathersbee and G. E. Bohart at Ensenada Honda in horse- and calf-baited traps, and from horse- or calf-baited traps in Playade Humacao (R. E. Serfling), Carolina, Catano, and Vega Baja (H. D. Pratt). Two males have been found in light trap collections at Harvey's Dairy, Carolina, P. R. on June 10 and 15, 1943. R. E. Serfling has collected females in light traps at Humacao, P. R. in October, November, December, 1944 and January and February, 1945. The largest single catch in a horse-baited trap contained over a hundred females and was made at Carolina, P. R. in March, 1944. *Culex opisthopus* would seem to have a general distribution for some fifty miles along the northeast coast of Puerto Rico.

Females collected in a horse-baited trap at Carolina in March, 1944 were brought into the laboratory and eggs were secured. From these eggs the complete life history was worked out in the laboratory, the cycle from oviposition to newly-emerged adult being completed in 28 days. Duration of each stage was as follows: egg, 1 to 2 days; instar I, 2 to 3 days; instar II, 2 to 3 days; instar III, 3 to 4 days; instar IV, 13 to 16 days; pupal instar, 36 to 48 hours. The life cycle from egg probably is accomplished in less time in nature depending on favorability of the habitat.

Florida. On October 22, 1944, D. G. Denning and W. W. Wirth collected 28 larvae and pupae of *Culex opisthopus* from several crab holes near Fort Lauderdale, Florida. Larvae were collected in holes approximately four inches in diameter, generally under or around tree bases, and made by the land crab (*Cardisoma guanhumi* Latr.). Collections were made in a cypress and maple swamp bordering the South Fork of New River, about 300 yards from the stream. This location is approximately 3.5 miles west of Port Everglades on the east coast of Florida. Weather data from nearby Fort Lauderdale, Florida showed that a total of 4.86 inches of rain fell on October 15 to 17, 1944. Consequently this entire swamp was well flooded. A rise in the water table brought the water in the crab holes to within a few inches of the ground level and larvae were easily collected with a dipper. *Culex opisthopus* larvae were found only in the crab holes and associated with larvae of *Deinocerites cancer* Theob. Adjacent ground pools contained heavy populations of *Aedes atlanticus* D. & K., *Psorophora confinnis* (L. A.), *P. ferox* (Humb.), *Culex nigripalpus* Theob., *C. pilosus* (D. & K.), *Anopheles crucians* Wied., and *Uranotaenia lowii* Theob. However, no *C. opisthopus* larvae were taken outside the crab holes, though a particularly intensive search was made. When the crab holes were disturbed, a number of *D. cancer* adults which had been resting on the sides flew up and were collected, but no *C. opisthopus* adults were seen. Three days later subsequent collections were made in the same location but no *opisthopus* larvae, pupae, nor adults were taken; only *C. nigripalpus* and *D. cancer* larvae were taken in the crab holes. Additional visits in November and December, 1944, failed to yield any additional material; as the rainfall was scanty, the swamp was nearly dry and the water was very low in the crab holes.

From the 28 larvae and pupae collected, 4 males and 6 females were reared in the laboratory.

TRUMPET OF PUPA



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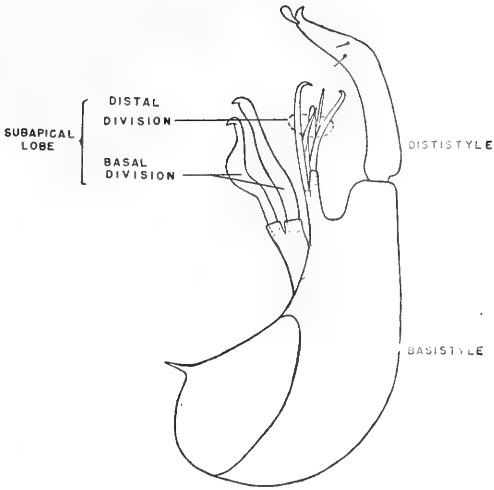

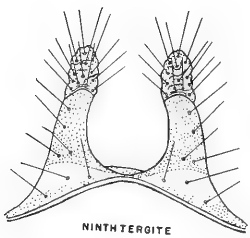

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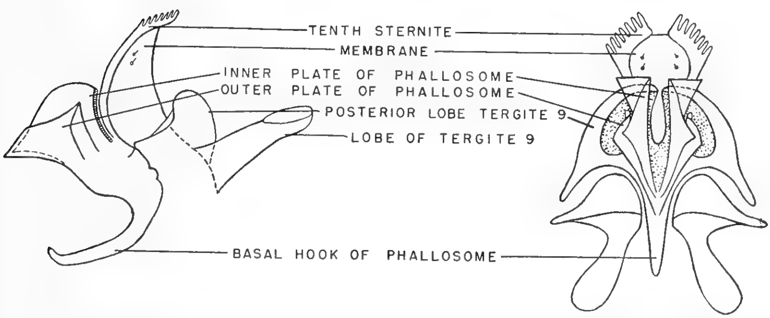


LATERAL VIEW

VENTRAL VIEW

PHALLOSOME COMPLEX

CULEX OPISTHOPUS KOMP

TAXONOMY

Culex (Melanoconion) opisthopus Komp

Culex (*Choeroporpa*) *opisthopus* Komp. Ins. Inscit. Mens., 14: 44, 1926 (male and female described; type locality—Punto Castilla, Honduras).

Culex (*Mochlostyrax*) *opisthopus* Komp: Dyar, Mosq. Amer., p. 294, 1928 (male and female redescribed, male terminalia figured); Komp, Ent. Soc. Wash. Proc., 37: 3–4, 1935 (*Culex mychonde* Komp made a synonym of *C. opisthopus* Komp).

Culex (*Mochlostyrax*) *mychonde* Komp, in Dyar, Mosq. Amer., p. 295, 1928 (male described and figured from a single specimen; type locality—Almirante, Republic of Panama, Feb. 1, 1928).

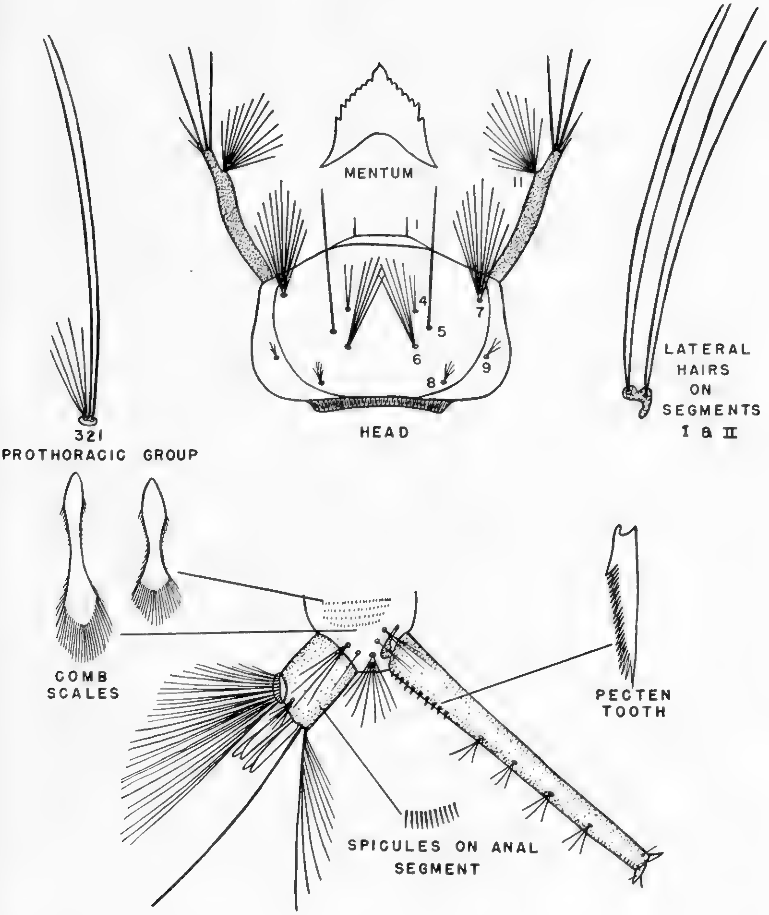
Culex (*Melanoconion*) *opisthopus* (Komp: Edwards, Dipt., Fam. Culic., in Wytsman, Gen. Insect., Fasc. 194, p. 213, 1932.

Culex (*Melanoconion*) *mychonde* Komp: Edwards, Dipt., Fam Culic., in Wytsman, Gen. Insect., Fasc. 194, p. 213, 1932. ("[?=*taeniopus*]").

Female. The only known North American *Culex* (*Melanoconion*) with white tarsal markings. These are restricted to the hind tarsi, in which the first four segments have narrow white rings basally and apically, and the last segment is almost entirely white. In some specimens there are coppery reflections at the tarsal articulations of the fore and middle legs. The occiput is covered with a few long strong, anteriorly directed bristles laterad to beyond the bases of the antennae; and with many erect black forked scales mixed with many half-depressed, twisted, long slender silvery scales. The genae bear conspicuous patches of flat, rounded, closely-appressed silvery-white scales.

Male Genitalia (Fig. 1). The ninth tergite consists of a pair of rugose, finger-shaped lobes (each with wrinkled, oval tip bearing a number of setae) nearly four times as long as wide and arising from sparsely setose connected triangular bases. Tenth sternites comb-like, each sternite with seven blunt teeth. Basistyle with subapical lobe divided. Basal division with two long thick filaments with small oblique point at tip, the lower filament curved, expanded and flattened; the upper filament less irregular and subequal in length to the lower one. Distal division thickly columnar, undivided, with 4 to 6 fine filaments of various lengths inserted apically. No leaf present. Dististyle (clasper) slightly shorter than basistyle (side piece), very slenderly snout-shaped, with a groove and two small eye-setae, a thickened subapical appendage and a terminal claw or horn. Inner plate of phallosome broad, concave laterad and evenly rounded at tip with a blunt point at dorsal and ventral angles, basal hook long and narrow.

Larva (Fig. 2). Head more or less quadrate, wider than long. Antenna curved, as long as head, spined, dark brown in color throughout; constricted at outer fourth, bearing a large many-branched tuft at constriction; with three long and one short spines at apex; constricted portion bearing fewer spines. Preclypeal hairs (No. 1) stout, peg-like; post-clypeal hairs (No. 4) short, fine, double; lower head hairs (No. 5) (inner frontal hairs) single, long, stout; upper head hairs (No. 6) (middle frontal hairs) 5- to 6-branched, the branches about one-half to three-fourths as long as the No. 5 hair; outer frontal hairs (No. 7) multiple and about as long as the No. 5 hairs; mental plate with 7 teeth on either


MENTUM
1
4
5
6
7
8
9
11
HEAD
321
PROTHORACIC GROUP
LATERAL HAIRS ON SEGMENTS I & II
COMB SCALES
PECTEN TOOTH
SPICULES ON ANAL SEGMENT

side of a strong, median tooth, the basal teeth on each side progressively stronger and more remote from the other teeth. Thoracic integument very sparsely spicular pilose. No. 3 hair of anterior submedian prothoracic group short and 5- or 6-branched, the branches about one-third or one-fourth as long as the No. 2 and No. 1 hairs. Long lateral hairs on either side of the abdomen have the following arrangement: Segment I—two long stout 2-branched hairs; Segment II—one long stout 2-branched hair; Segments III to VI—one shorter, finer, multiple (usually 4- or 5-branched) hair. Comb of eighth segment with many scales (40 to 60) arranged in a triangular patch 3 or 4 rows deep, each scale long, roundly expanded and fringed at apex. Integument of abdomen glabrous except slightly spicular pilose near comb. Air tube long, slender, tapering slightly, somewhat variable in length, ranging from 8 to 10 times as long as basal width. Pecten of 9 to 12 teeth on basal fourth of air tube, each tooth with basal spine and fringed on one side. Five pairs of very short 2- to 6-branched hair tufts on air tube; first 4 in a straight line, the branches slightly longer than the diameter of air tube at point of insertion of hair tuft, the last tuft slight, subdorsal in position. Anal segment encircled by sclerotic plate; with many transverse rows of fine spicules composed of 10 to 20 spicules each; the lateral hair many-branched. Anal gills, short, tapering, about as long as anal segment.

The larva may be easily distinguished from other North American *Culex* (*Melanoconion*) larvae by a number of characters: (A) the antennal shaft is uniformly brown or blackish, without the whitish color found in the basal portion of the antennae of other species; (B) the branches of the upper head hair (No. 6) are one-half to three-fourths the length of the lower head hair (No. 5); (C) the first abdominal segment has two stout, two-branched hairs whereas *C. pilosus* has two stout, three-branched hairs on either side, and the other species have the upper lateral hair two-branched and the lower lateral hair single on each side of the first abdominal segment; (D) the hair tufts on the air tube are very short, usually only slightly longer than the diameter of the air tube at their point of insertion; and (E) the spicules on the anal segment are arranged in many short rows of 10 to 20 spicules, whereas the spicules on other species are scattered irregularly over the air tube.

Pupa (Fig. 1). The pupa is easily distinguished from all other North American *Culex* by the very long slender respiratory trumpet. This is about seven times as long as apical width, with the tiny notch at the base of the apical truncation characteristic of the subgenus *Melanoconion*.

The larval description is based on larvae collected at Fort Lauderdale, Florida (October 22, 1944, D. G. Denning and W. W. Wirth) and Carolina, Puerto Rico (March 10, 1944, H. D. Pratt). Two larval skins with the pupal skins and associated reared female adults from Puerto Rico have been deposited in the U. S. National Museum. Two larvae and one male and one female adult from Fort Lauderdale, Florida, are also in the U. S. National Museum collection. Other larval and adult material is in the collections of the authors and the University of Minnesota.

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A CHANGE OF NAME IN CERAMBYCIDAE

By W. S. Fisher

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The generic name *Cyllene* Newman, 1840, which includes the common locust borer (*Cyllene robiniae* Forster) and hickory borer (*Cyllene caryae* Gahan), is preoccupied by *Cyllene* Gray, 1834, which was proposed by Gray (*in* Griffith's Cuvier, Animal Kingdom, vol. 12, p. 597, pl. 41, fig. 2, 1834) for *owenii* Gray, a species of mollusk from West Africa. It is regrettable that the same name was proposed by Newman (Entomologist 1: 7–8, 1840) for *spinifera*, a new species of Coleoptera from South America. Both genera are monobasic.

Casey (Memoirs Coleoptera, III, p. 348, 1912) proposed *Megacyllene* for *Cyllene antennatus* White, separating it from the other species of *Cyllene*. Hopping (Ent. Soc. Amer. Ann. 25: 531, 1932; 30: 440, 1937) placed *Megacyllene* as a synonym of *Cyllene* Newman, stating that the heavier antennae and slight difference in the slant of the mesosternum are not sufficient for separating the two genera.

Therefore, the only available name for *Cyllene* Newman 1840 (not *Cyllene* Gray 1834) is *Megacyllene* Casey 1912.

A COMPARISON OF MOSQUITOES CAPTURED WITH AVIAN BAIT AND WITH HUMAN BAIT[1]

By David E. Davis

INTRODUCTION

During the years 1942 and 1943 extensive captures of mosquitoes were made in the County of Teresópolis, State of Rio de Janeiro, as part of ecologic investigations of animals relating to jungle yellow fever (1). These captures were designed to determine changes in the abundance of mosquitoes during the year, and were made in the same places during a period of about 168 hours each month. The collections were made at three vegetational levels with avian bait, and on the ground with human bait. The aim of this paper is to compare the behavior of the various species in respect to avian and human bait. The comparison of captures at different vegetational levels has been published (2).

DESCRIPTION OF THE LOCATION OF CAPTURES

The County of Teresópolis is situated on the top of the coastal mountains between the Serra dos Orgãos and the Serra da Estrela at an altitude of approximately 800 meters. The region consists of cultivated valleys and forested hills. The climate is subtropical. The average rainfall for the years 1932 and 1943 was 1655 mm., and the average temperature was 18.8° C. The coldest and driest months are June, July, and August; the rainiest months are October, November, and December; the hottest months are January and February.

The captures were made in forests on two estates about 10 kilometers apart. The localities have the following characteristics:

Fazenda Boa Fé.—The captures were made in a second-growth forest approximately 70 years of age upon the top of a hill some 60 meters high. The trees are about 30 meters high and have some bromeliads and lianas on the branches. Under these trees the vegetation, although thick, is not impenetrable. Palms and two sizes of bamboos are present in the undergrowth. The ground is dry, without springs, but with a small stream at the base of the hill in the valley. The valley below is cultivated.

Fazenda Comarí.—The captures were made in a forest located in a small valley between some hills about 50 meters high. The forest is virgin and has tall trees and many bromeliads and lianas

[1] The work on which these observations are based was done under the auspices of the Servico de Estudos e Pesquisas Sobre a Febre Amarela (Yellow Fever Research Service) which is maintained jointly by the Ministry of Education and Health of Brazil and the International Health Division of The Rockefeller Foundation.

Although palms are common, bamboos are present only in a few places opened up by windfalls. The forest is open below, but the canopy shuts out nearly all light. The ground is moist, and there are some temporary springs which flow only in the wet season.

METHODS

Two types of captures were made. Using about 10 individuals of several avian species as bait in a "Shannon" one-compartment type of trap (3), mosquitoes were captured at three vegetation levels, indicated as A, B, and C. In addition captures with human bait without a trap were made on the ground. The captures were carried out by three men working in 8-hour shifts during all hours of the day and night. Every hour on the hour, the Shannon traps were visited to collect the mosquitoes therein. From the half hour to the hour, captures were made with human bait. The captures were interrupted only when the rainfall was very heavy and were resumed as soon as the rain stopped. Each trap contained about 10 birds of the species *Columbigallina talpacoti*, *Molothrus bonariensis*, *Sicalis flaveola*, and *Zonotrichia capensis;* as far as the supply of birds permitted, an equal number of each species was kept in each trap.

Location and conditions of the traps

Fazenda Boa Fé.—The location of the traps was on a small level area on top of the hill fairly well shaded by trees. The surrounding vegetation was disturbed as little as possible during the investigations. Trap A was placed on the ground between trees and bushes in fairly thick vegetation. There was no bamboo within 25 meters. The captures with human bait were made on the ground in vegetation similar to that near trap A. The location was covered at all times by a tarpaulin in order to give constant shade and protection from the rain.

Fazenda Comarí.—The place where the traps were placed is at the base of a hill, in an area which has several temporary springs. Trap A was placed on the ground among saplings and bushes and under a thick cover of trees. There was some bamboo about 30 meters away. The captures with human bait were made on the ground at a place slightly up hill from the location of trap A. The vegetation, though similar to that surrounding trap A, was somewhat drier and more open.

COMPARISON OF AVIAN AND HUMAN BAIT

A consideration of the number of mosquitoes captured in trap A and with human bait (H) in the two localities permits a comparison of the preferences in feeding habits. Table 1 shows the ratio between the number of individuals captured with human bait and the number captured in trap A. Species of which less than five individuals were captured in both locations are omitted. The comparison of the ratios indicates that there are great variations among the species in their preferences for bait. Some species, such as *Trichoprosopon reversus*, *Trichoprosopon pallidiventer*, *Phoniomyia pilicauda*, and *Wyeomyia bourrouli* show a marked preference for human bait. Other species such as *Culex* spp., *Trichoprosopon compressum*, *Wyeomyia brucei*, and *Psorophora discrucians* show a preference for avian bait. It is interesting to note the difference in preferences between the two species *Psorophora ferox* and *Psorophora discrucians*. The close similarity of the ratios of the species of the genus *Aedes* suggests that the species are similar in their preferences.

DISCUSSION

Comparison of the captures with human bait and with avian bait must be made with due caution. It should be noted that the captures with avian bait were made by a trap and the mosquitoes were collected every hour. It is possible, therefore, that individuals of some species habitually fly out, although the observations of Shannon (3) and of the men who made the captures indicate that the habits of the species are similar. It is known (unpublished data) that in such a trap more mosquitoes are captured at intervals of 15 minutes than at intervals of 2 hours. It will be assumed therefore that a constant proportion of each species escape from the trap. In contrast, the captures with human bait are continuous; the man captures every mosquito which alights. But the voracious aedines attack more readily than the wary sabethines, so that when aedines are abundant the sabethines are captured in proportionally lower numbers. However, it is still possible to compare aedine with aedine and sabethine with sabethine. Even more important than the difference in the method of collecting is the fact that the vegetation was not identical at both locations. Nevertheless, it is considered that the differences were not sufficient to invalidate comparison of related species among themselves.

The literature reveals that extensive investigations of bait preferences, especially those of anopheline mosquitoes, have been made. Some studies (4) show that mosquitoes are attracted by the presence of humans, since the mosquitoes are more abundant in inhabited houses than in those that are uninhabited. Other investigations (5) (6) (7) (8) compare the relative attractiveness of individuals or species to anophelines. Still other studies (5) (9), by means of precipitin tests of the blood in the females, determine the feeding habits of the anophelines. Another method in investigation (10) (11) showed

TABLE I

Ratios of Mosquitoes Captured with Avian and with Human Bait

	Fazenda Boa Fé			Fazenda Comarí		
Species	H	A	H/A	H	A	H/A
Trichoprosopon reversus	243	12	20.16	1183	33	35.82
Trichoprosopon pallidiventer	91	5	18.20	173	19	9.10
Phoniomyia pilicauda	386	28	13.78	922	29	31.79
Wyeomyia bourrouli	89	8	11.12			
Wyeomyia mystes	142	17	8.35	92	5	18.40
Trichoprosopon fluviatilis				260	16	16.25
Psorophora ferox	1390	168	8.27			
Taeniorhynchus chrysonotum	81	10	8.10			
Sabethes lutzianus	93	13	7.15			
Sabethes melanonymphe	35	5	7.00			
Wyeomyia confusa	3104	455	6.82			
Aedes serratus	2352	375	6.27			
Aedes scapularis	679	118	5.75			
Trichoprosopon digitatum	183	36	5.08			
Sabethes purpureus	26	6	4.33			
Psorophora discrucians	96	25	3.84			
Wyeomyia brucei	214	63	3.39	156	24	6.50
Trichoprosopon compressum	12	11	1.09			
Culex spp.	693	656	1.05	71	23	3.08

that the blood of different species of vertebrates differs in its effect on egg production by mosquitoes. The application of such investigations to malaria has been summarized (12). In northern Brazil (13) it was concluded that deer and aguti attracted the most *Psorophora* but that paca attracted the most *Aedes*. *Culex* choose man more than twice as often as either deer or aguti. However, since in these studies there is no consideration of environmental conditions at the times of capture, the totals are not comparable.

The data here presented suggest caution in the interpretation of the absolute abundance of species in various stations by showing that it is necessary to know something about the preference for bait. For example, *P. ferox* in comparison with *P. discrucians* prefers human bait. Captures made only with human bait, therefore, may be misleading by producing a greater number of the former. In reality *P. discrucians* might be of great abundance but appear in the captures in small numbers.

SUMMARY

Extensive captures of mosquitoes in Teresópolis, Rio de Janeiro, make possible the comparison of related species among themselves in respect to preferences for avian or human bait.

Species, even within the same genus, differ one from another in their preference for avian as compared with human bait.

ACKNOWLEDGMENTS

These investigations were made possible by the generous permission of Sir Henry Lynch and Sr. Carlos Guinle to work on their estates. Sr. Nelson Cerqueira identified the mosquitoes and made numerous helpful suggestions on the manuscript.

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ABERRATIONS AND VARIATIONS IN ANOPHELINE LARVAE OF THE SOUTHEASTERN UNITED STATES (Diptera, Culicidae)

By Louis M. Roth[1]

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Since 1942 thousands of mosquito larvae have been submitted to the Fourth Service Command Medical Laboratory for identification or confirmation. This has afforded an excellent opportunity to obtain specimens which have departed widely from the usual types. Unfortunately only a small number of the aberrations seen prior to 1944 were retained or recorded and therefore few of these can be presented in this paper. Beginning in June 1944 a careful examination was made of a large number of our common southeastern anophelines and variations were noted. Between June and August, roughly 10,074 anopheline larvae (exclusive of *A. barberi* and those anophelines not identified to species) were examined by various members of the laboratory, and most of these were checked by the writer. Some aberrations were noted after the month of August and these, too, have been recorded. The species, and roughly the number of each examined between June and August were: *A. atropos* D. and K.—26; *A. bradleyi* King—14; *A. crucians* Wied.—3,678; *A. georgianus* King—407; *A. punctipennis* (Say) —4,941; *A. quadrimaculatus* Say—1,008.

Since some of the aberrations were recorded before June and after August 1944, and since an exact count was not kept of the number of specimens actually seen by the author himself, the percentage of aberrations or variations cannot be determined. It is the purpose of this paper to describe and illustrate the variety of forms which certain taxonomic characters may assume.

[1] This work was begun at the Fourth Service Command Medical Laboratory, Fort McPherson, Georgia, and completed in the Entomological Laboratory, Med Tng Sec, ASFTC, Third Regiment, Camp Plauché, Louisiana. The author wishes to thank those men at the numerous Army Installations who collected and submitted the specimens thus making possible the accumulation of this data. Further appreciation is expressed, for their assistance, to Lt. John Wanamaker, Lt. Roy W. Chamberlain, Miss Winona Gilstrap, Miss Leonora Peeples, Mrs. Edna Roth, Miss Elaine Smith, and Mrs. Jeanne Spence, all of the Fourth Service Command Medical Laboratory.

Taxonomically, the inner and outer anterior clypeal hairs of the head of anopheline larvae are very important structures. *Anopheles crucians*, *A. quadrimaculatus*, and *A. punctipennis* normally have two simple inner clypeals and two thickly, dichotomously, branched outer clypeals. Any major variation of these hairs would make it difficult to determine the species with the aid of our present larval keys. Most of the anomalies which will be presented pertain to the inner and outer clypeals of the head. This is due to the fact that a careful check was made particularly of these conspicuous hairs. However other aberrations (i.e. palmates, frontals, etc.) were noted and described. For diagrams of anopheline larvae showing positions of the various head and abdominal hairs, the reader is referred to Ross and Roberts (1943; Part I, pp. 1.3, 1.4), Russell et al. (1943; pp. 14-16), or King et al. (1944; p. 78).

The aberrations for each species are grouped together. The date and place of collection[2] of the specimens is listed under the explanations of the figures. Collection data for similar aberrations are listed under each figure. Each date represents one specimen unless otherwise indicated. Where anomalies are described and not figured, collection data is given in the text. The drawings were first outlined with the aid of a camera lucida and then corrected for symmetry.

ABERRATIONS IN ANOPHELES QUADRIMACULATUS SAY

Inner Clypeal Hairs:—The anomalies are listed in Table 1. Either one (Figs. 2,3) or both (Figs. 4,5) clypeals may be weakly or strongly branched. Simple branching (Figs. 2-5) occurred more frequently than multiple (Figs. 6-11) branching. Russell (1925) recorded 18 specimens with one of the two inner clypeals forked and 1 specimen with both forked. Root (1922) noted the forked condition of a normally simple hair as a rare abnormality. Buren (1944) described an anomalous larva in which the inner clypeals were densely plumose, actually almost resembling outer clypeals.[3]

Ten specimens were found with only a single, medial, inner clypeal (Figs. 1, 12)[4]. One specimen had three normally shaped inner clypeals with their basal tubercles wide apart

[2] All the specimens were collected on or near army installations but only the town or county in which the post is located has been listed.

[3] The adult reared from this unusual larva was a typical female *Anopheles quadrimaculatus*.

[4] When the inner clypeals are broken off their basal tubercles generally remain on the clypeus. When the outer clypeals break off the tubercles may remain or more often the point of insertion is indicated by a scar. When a clypeal is missing and there is no indication of a basal tubercle or scar, it is assumed that the clypeal was never present.

TABLE 1.—Types of inner clypeal aberrations and the number of specimens of each type found in three species of *Anopheles*. dichot. br.—dichotomously branched.

	Type of Aberration		Species and Number of Specimens Recorded					
	Left Inner Clypeal	Right Inner Clypeal	*Anopheles crucians*	Figures	*Anopheles punctipennis*	Figures	*Anopheles quadrimaculatus*	Figures
Only one inner clypeal atypical	simple or 2-branched	2-branched or simple	67	15,16,17	28	41, 48	107	3
	simple or 3-branched	3-branched or simple	11	20, 21	1	50	12	6
	simple	small with 3 apical branches			1	47		
	simple or 4-branched	4-branched or simple			1	51	1	9
	simple	5-branched	1	25				
	6 or more branches	simple			3	54		
	thickly and dichot. br.	simple	1	27				
Both inner clypeals atypical	smaller than normal	2-branched					1	2
	2-branched	2-branched	11	18, 19	3	49	18	4, 5
	3-branched or 2-br.	2-branched or 3-branched	2	22	1	52	6	7
	3-branched	3-branched					1	8
	4-branched or 2-br.	2-branched or 4-branched	1	23			2	10
	4-branched or 3-br.	3-branched or 4-branched	1	24			1	11
	5-branched	3-branched			1	53		
	4-branched	5-branched	1	26				

and evenly spaced (Fig. 13). One specimen (FLORIDA—Tampa, X-5-44) had one inner clypeal slightly to the right of the middle, the other inserted in about the middle of the pre-clypeus. The distance between the basal tubercles is a highly constant and valid character. However one specimen (GEORGIA—Atlanta, VIII-18-44) had the bases of the inner clypeals so close together that another basal tubercle could not be inserted between them.

Outer Clypeal Hairs:—Three specimens had three outer clypeals and all of these had only a single medial inner clypeal (Fig. 1) (See Footnote 4).

Frontal Head Hairs.—One specimen (MISSISSIPPI—Grenada, VII-3-44) had hair 6 on the left side (left middle frontal hair) inserted directly in front of hair 7 (left outer frontal hair). Normally hair 6 lies between hairs 5 and 7.

Occipital Head Hairs:—The specimen with the densely plumose inner clypeal hairs described by Buren (1944) was also unusual in that an additional occipital hair was inserted behind left occipital hair nine (See Footnote 3).

Palmate Hairs:—One specimen was found having two palmate hairs on the right side of the fifth segment and one (normal) on the left side (Fig. 65).[5] One specimen (MISSISSIPPI—Greenwood, VII-5-44) had two palmate hairs on the right side of segment four and one palmate on the left. The duplicated palmate was well developed but had fewer leaflets than the normal. The normal palmate on the right was similar to the left palmate.

Antepalmate Hairs:—The antepalmates on segments IV and V are usually single and occasionally double. Root (1924) and Russell (1925) noted that in some specimens this hair is double on some segments and single or triple on others, with the branching occurring at the base, or at various distances along the hair. In the present study one specimen (MISSISSIPPI—Greenwood, VII-22-44) had one of its antepalmates four branched, two others single, and one double.

ABERRATIONS IN ANOPHELES CRUCIANS WIED.

Inner Clypeal Hairs:—The anomalies are tabulated in Table 1 with the number of specimens of each type found. Figures 16–27 show how the normally simple inner clypeals may vary from simple forking to multiple branching. Either one (Figs. 15-17, 20, 21, 25, 27) or both (Figs. 18, 19, 22-

[5] All larvae possessing an additional palmate (including those later described for *A. punctipennis*) were checked, before the specimens were mounted, by gently prodding the palmates with a needle, thus proving that the additional hair was actually inserted and had not broken off from another segment and floated to its present position. Under high mangification the tubercular insertion of both palmates could be plainly seen.

24, 26) of the hairs may be affected. The branching may be strong (Figs. 17, 19) or weak (Figs. 16, 18) and may occur at various distances along the hair. Russell (1925) recorded one larva with both inner clypeals forked.

The left inner clypeal shown in Figure 27 may possibly represent a thickly and dichotomously branched outer clypeal which has assumed an inner clypeal position. Seven specimens were found with only a single, medial inner clypeal (Fig. 28) and one specimen had a single forked inner clypeal (Fig. 29). (See Footnote 4). One specimen had three inner clypeals whose basal tubercles were close together (Fig. 30), and another had four inner clypeals, one of these hairs itself being branched at the base (Fig. 31).

Outer Clypeal Hairs:—One specimen had three normally branched outer clypeals, two of them inserted on the left side (Fig. 14). One specimen had the right outer clypeal sparsely branched (Fig. 15). One specimen (SOUTH CAROLINA—Horry Co., VII-10-44) had a normally branched but unsclerotized and unpigmented right outer clypeal; the left outer clypeal was normal.

Post Clypeal Hairs:—Anophelines normally have two post clypeals. The specimen having three inner clypeals (Fig. 30) also had an additional post clypeal on the right side.

ABERRATIONS IN ANOPHELES PUNCTIPENNIS (SAY)

Inner Clypeal Hairs:—The inner clypeals of *A. punctipennis* are often smaller, more slender and more lightly pigmented than those of *A. crucians* or *A. quadrimaculatus*. For this reason weak branching is difficult to detect under a binocular dissecting microscope (the instrument used in almost all of our identification work). However any variations in these hairs are easily seen under a compound microscope and all specimens suspected of having branched inner clypeals were examined under high power. A careful check revealed that variations and aberrations in these hairs are not too uncommon.

The anomalies are listed in Table 1 and these are very similar to those found in the preceding two species. Two specimens had one of the inner clypeals distinctly smaller in size than the other (Figs. 46, 47). Again simple forking or branching occurred more frequently than multiple branching; either one (Figs. 47, 48, 50, 51, 54) or both (Figs. 49, 52, 53) of the hairs may be affected and the branching may be weak or strong and occur at various levels. Root (1922) noted the forking of the inner clypeal as a rare abnormality. Eight specimens were recorded with only a single, medial inner clypeal (Figs. 55, 58) (See Footnote 4). Three specimens had three inner clypeals. One of these had all three normal in shape and close together (Fig. 56). The others had the accessory hair slightly smaller and separated for some distance to the right of the two normal, medial inner clypeals (Fig. 57).

Outer Clypeal Hairs:—The outer clypeals of some specimens showed considerable variation not only in the branching but also in their position along the front margin of the clypeus. Practically all of these aberrations were restricted to one side of the head only, the other clypeal being normal or broken off.

Three specimens had three outer clypeals, all normally branched. In two of these, two clypeals arose close together on the left side (Fig. 32); in the third they were a little more separated. The outer clypeal may vary from the normal thickly and dichotomously branched hair (Fig. 32) to a sparsely feathered or branched shaft (Figs. 33–39, 43, 44) to a simple hair (Figs. 40-42). Its insertion may also be moved centrally (Figs. 35, 37–44). One specimen with normally branched hairs had the right outer clypeal moved somewhat centrally toward the inner clypeals. Its left outer clypeal was in a normal position (TENNESSEE—Paris, VII-17-44).

The specimens shown in Figures 43 and 44 may be interpreted in two ways. The medial position of the hair might make one consider it an accessory inner clypeal. However the left outer clypeal is absent (See Footnote 4). For this reason the accessory clypeal in these two cases is probably an outer clypeal moved medially, and one whose branching has been greatly reduced. The fact that it is shorter and stouter than the normal inner clypeals may be further evidence for this conclusion. However it will be seen that the inner clypeals may sometimes almost assume the branching of an outer clypeal (Figs. 53, 54) and therefore this additional hair may possibly be an additional inner clypeal. The simple hair to the left of the inner clypeals in Figure 41 is very similar to the additional hair shown in Figure 57 (an inner clypeal), though actually not in line with the inner clypeals. The left thickly branched outer clypeal was absent and since the present series of aberrations shows that an outer clypeal may become simple, this hair probably represents an outer clypeal which has become simple and moved medially towards the inner clypeals. The specimen in Figure 42 can be interpreted in the same manner and probably also represents an outer clypeal (c.f. Fig. 40). One specimen had both outer clypeals weakly branched (Fig. 45).

Frontal Head Hairs:—Anophelines normally have 6 (three pairs) of frontal head hairs. One specimen (GEORGIA—Augusta, V-24-44) had a total of seven frontal hairs, the additional one being inserted between hairs 5 and 6 on the left side. One specimen having a single inner clypeal had only 4 frontal head hairs in the normal position. However one frontal hair was inserted between the inner preclypeals (Fig. 58). Russell

(1925) observed that *punctipennis* larvae caught in a syrup kettle invariably had stunted frontal head hairs. The hairs were shorter, the branches few, as well as shorter, and frequently from 1 to 3 of the frontal hairs were entirely missing. Russell further states that it was not determined whether or not the unusual character of these hairs was inherent or due to the habit these larvae have of browsing upon each other. In the present specimen, noted above, there is no question but that there were never more than 4 frontal head hairs in the normal position since only 4 hairs are present and there is no indication (by basal tubercle or round opening in the sclerite) of any others.

Palmate Hairs:—One specimen was found with 2 palmates on the left side and one on the other (Fig. 66) on the second abdominal segment (GEORGIA—Columbus, VI-12-44). The larger and more darkly pigmented palmate is the additional hair since the palmate on the right side is similar to the palmate having the more slender and more lightly pigmented leaflets (See Footnote 5). Another specimen (NORTH CAROLINA—Durham, VII-11-44) had 3 palmate hairs on segment IV, 2 of these inserted close together on the right side.

Antepalmate Hairs (Hair 2):—Root (1924) and Russell (1925) have shown that the number of branches on the antepalmate hairs of *punctipennis* are highly variable. The 103 specimens examined by Russell came from four counties in Georgia and one county in Alabama. The 37 larvae studied by Root were collected near a single locality near Baltimore, Maryland. Root (1924) states that until the differences (between *A. quadrimaculatus* and *A. punctipennis*) which he found are confirmed in larvae taken from other localities they should not be regarded as definitely established. In their key to the anophelines of the southeastern states, King et al. (1944) state that in *A. punctipennis* the antepalmates on segments four and five are usually double, except in specimens from central Florida, in which they are usually single.

A study of 1,821 specimens from six southeastern states (a total of 31 localities) tends to confirm the observations of Root and Russell. The number of branches of the antepalmates may be highly variable in certain individuals (Table 2). Not only do they vary on segments four and five but they often differ on the right and left side of the same segment. The antepalmates are usually all double (47.39%) but may rarely be all single (1.26%) or triple (3.57%) and sometimes one or more may be four or five branched (See Table 2 for the other possible combinations). The types of branching which may occur in hair 2 are shown in Figure 64.

Russell (1925) reared four *A. punctipennis* adults of the variety sometimes called "*A. perplexens*". The wings of this form show a repression or complete absence of the large pale patch of scales usually found at the outer third of the costa.

TABLE 2.—Showing the number of branches of hair 2 on abdominal segments four and five in 1,821 larvae of *A. punctipennis*. The number of branches on the left and right side of the fourth and fifth segments are indicated by a fraction. For example; under 4 (fourth segment) 1/1 means that both the left and right antepalmates are simple and 3/4 indicates that these hairs are three and four branched respectively.

Abd. Seg.—Abdominal segment; No. of Spcms.—Number of specimens

LOCALITY	Abd. Seg.	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5
	Hair 2	1/1 1/1	1/1 1/2 1/1 2/1 2/1 1/1 1/2 1/1	1/1 2/2 2/2 1/1 2/1 2/1 1/2 1/2 1/2 2/1 2/1 1/2	1/1 3/2 1/1 2/3 2/3 1/1 2/1 3/1	1/2 2/2 2/2 1/2 2/2 2/1 2/1 2/2	2/2 2/2	2/3 2/1 1/2 3/2 2/3 1/2 2/1 2/3 3/1 2/2 2/2 3/1 2/2 1/3	2/2 4/1	2/2 3/2 3/2 2/2 2/2 2/3 2/3 2/2
ALABAMA:—Aliceville; Anniston; Gadsden; Opelika; Selma; Tuskegee. (17 Collections: V-18-44 to VIII-24-44		1	6	7		28	177			64
GEORGIA:—Augusta; Bibb Co.; Cochran; Columbus; Macon; Moultrie; Rome; Savannah. (20 Collections: V-28-44 to VII-2-44)	No.	2	6	12		21	145	3		45
MISSISSIPPI-—Centerville, Grenada; Jackson (11 Collections: VI-1-44 to VII-17-44)		3	12	18	2	20	87	2	1	36
NORTH CAROLINA:—Durham; Maxton; Monroe; Rockingham; Swannanoa (11 Collections: V-3-44 to VII-25-44)	of	3	4	2		11	56			20
SOUTH CAROLINA:—Columbia; Greenwood; Greenville; Horry Co.; Spartanburg (15 Collections: V-25-44 to VII-28-44)	Spcms.	8	8	20	2	33	142	4		43
TENNESSEE:—Dyersburg; Memphis; Nashville; Paris (13 Collections: V-17-44 to VII-13-44)		6	7	16	1	52	256	3		85
TOTAL		23 1.26%	43 2.36%	75 4.12%	5 .28%	165 9.06%	863 47.39%	12 .66%	1 .05%	293 16.09%

TABLE 2.—Continued.

4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 5
2/2 2/4 4/2 2/2 2/2 4/2	2/3 3/2 3/2 3/2 3/2 2/3 2/3 2/3 3/3 2/2 2/2 3/3	2/2 3/4 3/2 2/4 2/2 4/3 2/4 3/2 4/2 3/2 2/3 4/2 4/3 2/2	2/2 5/3	4/4 2/2	3/3 2/1 3/1 2/3 3/2 1/3 1/3 3/2	3/2 3/4 4/3 3/2 2/3 4/3 2/3 3/4 3/4 2/3 3/3 4/2 4/2 3/3	5/3 3/2	4/4 3/3	3/3 3/2 3/3 2/3 2/3 3/3 3/2 3/3	3/3 3/3	3/3 4/3 3/4 3/3 4/3 3/3	3/3 3/5	3/5 3/5	4/4 3/4
2	29								13	14				1
	14	1			1	1			11	14	3			
	22	2			1	3			10	1	1			
	10					2			9	2			1	
2	25	1							8	7				
1	53	4	1	1	2	4	1	1	32	27	2	1		
5 .28%	153 8.40%	8 .44%	1 .05%	1 .05%	4 .22%	10 .55%	1 .05%	1 .05%	83 4.56%	65 3.57%	6 .33%	1 .05%	1 .05%	1 .05%

Russell goes on to state that the larvae of two reared adults with a totally repressed costal spot had all four of their antepalmate hairs on segments four and five unbranched. However one of the other two larvae (which gave rise to adults with partial repressed costal markings) had the usual two branched antepalmates. The last larva had two forked and two simple antepalmates. King et al. (1944) write that specimens of *punctipennis* from central Florida may have the size of the costal spot considerably reduced and in some individuals the wing may be almost entirely dark scaled. These writers further say that this variation has also been observed occasionally in other areas and is possibly the form described as *A. perplexens* (Mount Gretna, Pa.).

In the present study every state yielded one or more larvae with simple antepalmates. Four reared females, received from Paris, Tennessee, had the costal spot at the outer third completely repressed. The six larvae recorded from Tennessee with simple antepalmates all came from the same locality but whether the reared adults, mentioned, came from larvae with simple antepalmates is not known. One female *punctipennis* taken in a resting station (NORTH CAROLINA—Swannanoa, IV-24-44) showed complete recession of the costal spot. Two larvae having three simple and one double antepalmate came from the same locality. H. R. Dodge collected one male and one female *punctipennis* with the melanistic wings (GEORGIA—Baker Co., VIII-44).

Anopheles punctipennis larvae with simple antepalmates are not restricted to Florida and adults with repressed costal markings have been noted from several widely separated areas. Certainly further rearings of this species should be carried out to determine whether any relationship exists between larvae with simple antepalmates and adults with repressed costal markings.

ABERRATIONS IN ANOPHELES BRADLEYI KING

Inner Clypeal Hairs:—Only two aberrant larvae were noted. One of these had a single medial inner clypeal (Fig. 62) and the other had three inner clypeals (Fig. 63).[6]

VARIATIONS IN ANOPHELES ATROPOS D. AND K.

Inner and Outer Clypeal Hairs:—King et al. (1944) in their key to the southeastern anophelines state that the outer clypeals of *atropos* are sparsely feathered or branched (5 to 10 short branches) on the apical half and the inner clypeals are forked or sparsely feathered at the tip (Fig. 59).

In a study of 16 specimens (FLORIDA—Tampa, VI-15;

[6] The adult female reared by Capt. A. H. Halff, from this larva, had the petiole of vein five all dark scaled.

29-44, 15 specimens: Tarpon Springs, VIII-5-43, 1 specimen), only 5 possessed normal clypeals. Of the 11 others, 4 had one, and 1 had both inner clypeal hairs simple (Fig. 61). Two specimens had both, and 1 had only one, of the outer clypeals 4 branched. One specimen had the outer clypeals 3 and 4 branched respectively. Three specimens had one outer clypeal three branched, the other normal. Two specimens had both outer clypeals three branched (Fig. 61) and two branched (Fig. 60).

SUMMARY

A study of a large number of our common anopheline larvae shows that aberrations will occur in hairs that are taxonomically important. The various types of anomalies and the species in which they were found are summarized in Table 3. In general the different anomalies are common to several species of *Anopheles*. It is probable that if a larger number of specimens are examined all of the species would be found to have more or less similar aberrations and other types of anomalies would also be noted. The cause of these abnormalities is not known, but it is probable that the more unusual ones are not genetically transmitted.

Variations which differ only slightly from the normal (i.e. forking or branching of an inner clypeal, Figs. 2-5, 16-19, 48, 49) are comparatively numerous and from the collection data of the specimens will be seen to occur at regular intervals, in many regions. The more unusual aberrations (i.e. three inner or outer clypeals, etc., Figs. 1, 13, 14, 30, 32, 56) which depart strikingly from the normal type, occur either singly, or rarely at irregular intervals.

Larval keys are usually written to determine average specimens and rarely include possible variations. It should always be remembered that not all specimens collected will fit every character described in a key. The descriptions and illustrations in the present paper should tend to emphasize that fact. Almost all of the aberrations have been deposited in the United States National Museum, Washington, D. C.

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TABLE 3.—Various types of aberrations and the number of specimens of each type found in four species of *Anopheles*.

Type of Aberration	Species and Number of Specimens Recorded							
	Anopheles quadrimaculatus	*Figures*	*Anopheles crucians*	*Figures*	*Anopheles punctipennis*	*Figures*	*Anopheles bradleyi*	*Figures*
One inner clypeal 2-branched; the other simple	108	2, 3	67	15,16,17	28	41, 48		
One inner clypeal 3- or more branched; the other simple	13	6, 9	13	20, 21, 25, 27	6	47, 50, 51, 54		
Both inner clypeals 2-branched	18	4, 5	11	18, 19	3	49		
One inner clypeal 3- or more branched; the other 2- or more branched	10	7, 8, 10, 11	5	22, 23, 24, 26	2	52, 53		
Only one inner clypeal	10	1, 12	8	28, 29	8	55, 58	1	62
Three inner clypeals	1	13	1	30	3	56, 57	1	63
Four inner clypeals			1	31				
One outer clypeal sparsely branched or simple			1	15	17	33–44		
Both outer clypeals sparsely branched					1	45		
Three outer clypeals	3	1	1	14	3	32		
Three post clypeals			1					
Aberrant frontal head hairs	1				2	58		
One abdominal segment with three palmates (other segments normal)	2	65			2	66		

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EXPLANATION OF FIGURES 1–13

Aberrations in *Anopheles quadrimaculatus* Say

Fig. 1, Three outer clypeals (the right outer clypeal has been broken off but its basal tubercle remains). Two normally branched outer clypeals are inserted close together on the left side. There is only one medial inner clypeal (GEORGIA—Valdosta, VII-21-44). Two similar specimens with all three outer clypeals attached were collected in MISSISSIPPI—Biloxi, IX-22-44 (two outer clypeals on the right side; the inner clypeal was broken off but only one basal tubercle was present indicating that this specimen, too, had only a single medial inner clypeal): Hattiesburg, X-6-44 (two outer clypeals on the left side; only one medial inner clypeal present).

In Figures 2-12, the outer clypeals are normal or were broken off and are not indicated.

Fig. 2, Left inner clypeal smaller and more slender than the right one. Right inner clypeal with a weak branch (FLORIDA—West Palm Beach, VI-6-44).

Fig. 3, Left inner clypeal strongly branched (SOUTH CAROLINA—Debidue Beach, VI-1-44). One hundred six somewhat similar specimens (58 with the left and 48 with the right inner clypeal strongly or weakly forked at various levels) were taken from the following regions: ALABAMA—Mobile, VI-20-44; VI-29-44 (7 specimens): Opelika, VI-27-44. FLORIDA—Boca Raton, V-23-44; V-31-44 (2 specimens); VI-16-44 (3 specimens); VI-21-44 (3 specimens; VII-6-44 (3 specimens); VII-10-44; VIII-30-44 (6 specimens); IX-14-44 (4 specimens); IX-26-44 (3 specimens); Fort Myers, VIII-11-44 (2 specimens); VIII-24-44 (2 specimens); VIII-28-44: Homestead, VII-14-44 (3 specimens): Marianna, VIII-9-44; X-25-44 (2 specimens): Pensacola, VI-19-44; X-9-44: Tampa, VIII-7-44 (2 specimens); VIII-16-44 (4 specimens); VIII-24-44; VIII-28-44. GEORGIA—Atlanta, VIII-18-44 (4 specimens); Bibb Co., VI-13-44: Chatham Co., VI-13-44 (2 specimens); VII-7-44; IX-28-44: Columbus, VII-18-44: Valdosta, VIII-30-44 (2 specimens). LOUISIANA—Harahan, II-1-45 (6 specimens). MISSISSIPPI —Greenwood, VI-5-44; VI-15-44 (3 specimens); VII-8-44; VII-19-44: Grenada, VI-15-44; VI-29-44: Hattiesburg, VII-4-44 (2 specimens): Centerville, VI-27-44; VII-25-44: Jackson, VI-29-44. NORTH CAROLINA—Goldsboro VII-6-44 Monroe, VI-13-44; VI-17-44 (2 specimens): Rockingham, VIII-22-44: (4 specimens). SOUTH CAROLINA—Columbia, VII-18-44: Myrtle Beach, V-31-44; VI-2-44 (2 specimens); VII-10-44. TENNESSEE—Paris, VI-26-44: Dyersburg, VI-13-44; VII-4-44: Tullahoma, VIII-1-43. Two specimenswith no collection data.

Fig. 4, Both inner clypeals strongly forked or branched (GEORGIA—Savannah, V-26-44). Fourteen similar specimens (branching similar or at different levels) taken from: FLORIDA—Boca Raton, V-23-44; VI-21-44; VII-6-44 (3 specimens): Homestead, VII-14-44: Marianna, X-25-44: Tampa, VIII-24-44.

LOUISIANA—Harahan, II-1-45 (3 specimens). MISSISSIPPI—Grenada, VII-6-44. NORTH CAROLINA—Monroe, VI-17-44 (2 specimens).

Fig. 5, Both inner cypeals forked, the right weakly from the tip (FLORIDA—Boca Raton, V-31-44). Two similar specimens (branches at various levels) taken from: FLORIDA—Pensacola, VI-19-44. MISSISSIPPI—Jackson, VI-9-44.

Fig. 6, Right inner clypeal three branched, left simple (FLORIDA—Boca Raton, V-31-44). Eleven somewhat similar specimens with the branches strong or smaller and weaker, and at different levels; or with the left three branched and the right simple, taken from the following: FLORIDA—Boca Raton, VI-16-44; VII-6-44; VII-10-44; IX-14-44 (2 specimens): Fort Myers, VIII-11-44: Marianna, X-25-44; Tampa, VIII-16-44. LOUISIANA—Harahan, II-1-45. TENNESSEE—Dyersburg, VII-12-44 (2 specimens).

Fig. 7, Inner clypeals three and two branched respectively (FLORIDA—Boca Raton, V-31-44). Five similar specimens (branching at different levels, or two and three branched respectively) taken from: FLORIDA—Boca Raton, VII-10-44. GEORGIA—Atlanta, VIII-18-44: Chatham Co., VI-13-44. MISSISSIPPI—Grenada, VII-6-44. NORTH CAROLINA—Monroe, VI-17-44.

Fig. 8, Both inner clypeals three branched (FLORIDA—Boca Raton, VIII-30-44).

Fig. 9, Left inner clypeal four branched, right simple (FLORIDA—Fort Myers, VIII-11-44).

Fig. 10, Inner clypeals four and two branched respectively (GEORGIA—Atlanta, XI-2-43). One similar specimen with the left two and the right inner clypeal four branched taken from GEORGIA—Columbus, VIII-18-44.

Fig. 11, Inner clypeals four and three branched respectively (FLORIDA—Avon Park, IV-8-44).

Fig. 12, Single medial inner clypeal (FLORIDA—Pinecastle, V-8-43). Six similar specimens taken from: FLORIDA—Tampa, X-5-44. GEORGIA—Atlanta, VIII-18-44: Bibb Co., VI-13-44. MISSISSIPPI—Jackson, IX-28-44: Greenwood, VII-5-44. SOUTH CAROLINA—Myrtle Beach, V-31-44.

Fig. 13, Three evenly and widely spaced inner clypeals. The outer clypeals are normal and only their bases are drawn to indicate position (MISSISSIPPI—Greenwood, VI-26-44).

EXPLANATION OF FIGURES 14–31

Aberrations in *Anopheles crucians* Wied.

Fig. 14, Three outer clypeals, the additional hair inserted on the left side and slightly smaller than the normal. The left inner clypeal is broken off near the base (GEORGIA—Chatham Co., VII-3-44).

Fig. 15, Right outer clypeal five branched. The left outer clypeal was missing and the head was too darkly pigmented to determine whether or not a basal tubercle or scar was present. The left inner clypeal is branched. (GEORGIA—Valdosta, I-11-43).

Fig. 16, Weak apical branching of the right inner clypeal, left simple (GEORGIA—Valdosta, I-26-43). Twelve somewhat similar specimens (weak branching of either clypeal) taken from: FLORIDA—Starke, VII-12-44: Tampa, VIII-2-44. GEORGIA—Chatham Co., VIII-3-44 (4 specimens): Valdosta, XII-42 (2 specimens); I-3-43; IV-21-44; VII-28-44; VIII-16-44.

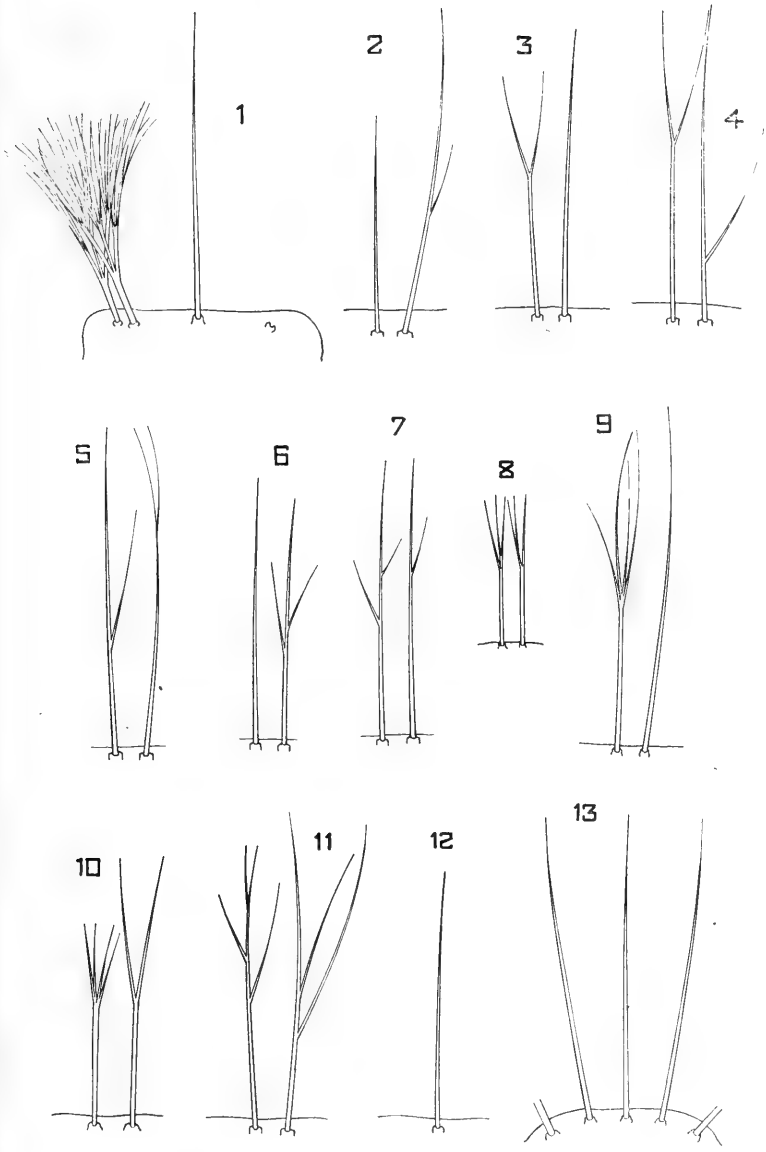
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Fig. 17, Right inner clypeal strongly branched, left simple (SOUTH CAROLINA—Columbia, IV-21-44). Fifty-two somewhat similar specimens (branching of either clypeal at various levels) have been recorded from the following localities: FLORIDA—Avon Park, IV-19-44; Pensacola, III-29-43: Starke, VI-20-44: Tampa, VI-8-44; VIII-16-44: Sebring, VII-14-44: West Palm Beach, VIII-19-44. GEORGIA—Columbus, VII-26-44; Augusta, VII-26-44: Chatham Co., VII-7-44; VII-26-44 VIII-3-44; (4 specimens): Valdosta, XII-42 (2 specimens); I-11-43; I-26-43 (3 specimens); III-31-43; IV-5-44 (2 specimens); IV-15-44; IV-16-44; IV-20-44; IV-29-44; V-3-44; V-23-44; VI-17-44; VIII-16-44: Bibb Co., VI-15-44; VII-18-44; Moultrie, VI-26-44: Liberty Co., VII-17-44; IX-15-44 (2 specimens); IX-22-44 (2 specimens); X-14-44 (2 specimens). MISSISSIPPI—Hattiesburg, VIII-5-44; X-19-44. NORTH CAROLINA—Fayetteville, V-22-44: Rockingham, VI-10-44; VI-26-44; VII-27-44; VIII-17-44: Maxton, VI-22-44; VIII-30-44. SOUTH CAROLINA—Myrtle Beach, VI-27-44.

Fig. 18, Weak branching of both inner clypeals (GEORGIA—Valdosta, I-3-43).

Two similar specimens but with the branches slightly stronger, and arising farther below the apex were taken at Valdosta, IV-21-44; VI-17-44.

Fig. 19, Both inner clypeals strongly branched (NORTH CAROLINA—Rockingham, VI-26-44). Seven somewhat similar specimens were taken from the following regions: FLORIDA—Starke, VII-31-44: Orlando, VII-22-44. GEORGIA—Chatham Co., VII-3-44; VIII-16-44: Columbus, VII-26-44: Valdosta, XII-42. SOUTH CAROLINA—Myrtle Beach, VII-27-44.

Fig. 20, Right inner clypeal with three apical branches, left simple (NORTH CAROLINA—Rockingham, VI-5-44). Five somewhat similar specimens taken from: FLORIDA—Tampa, VIII-16-44 (left three branched, right simple). GEORGIA—Chatham Co., VIII-3-44 (3 specimens); Valdosta, VII-10-44.

Fig. 21, Right inner clypeal with three branches, left simple (GEORGIA—Valdosta, III-17-43). Four somewhat similar specimens (either hair branching at different levels) taken from: GEORGIA—Chatham Co., VI-13-44: Augusta, VIII-26-44: Valdosta, IX-22-44 (2 specimens).

Fig. 22, Inner clypeals with three and two branches respectively (SOUTH CAROLINA—Columbia, IV-21-44). One similar specimen recorded from GEORGIA—Valdosta, VII-28-44.

Fig. 23, Inner clypeals four and two branched respectively (GEORGIA—Valdosta, I-26-43).

Fig. 24, Inner clypeals three and four branched respectively (GEORGIA—Valdosta, I-26-42).

Fig. 25, Right inner clypeal five branched, left simple (GEORGIA—Valdosta, IV-26-43).

Fig. 26, Inner clypeals four and five branched respectively (GEORGIA—Valdosta, VI-17-44).

Fig. 27, Left inner clypeal thickly and dichotomously branched, right simple (GEORGIA—Valdosta, IV-16-44).

Fig. 28, Single medial inner clypeal (GEORGIA—Valdosta, VI-20-44). Six similar specimens were taken from: FLORIDA—Starke, VII-17-44: GEORGIA—Chatham Co., VI-27-44: Augusta, VII-26-44: Savannah, VII-10-44: Valdosta, VII-28-44. NORTH CAROLINA—Rockingham, IX-1-44.

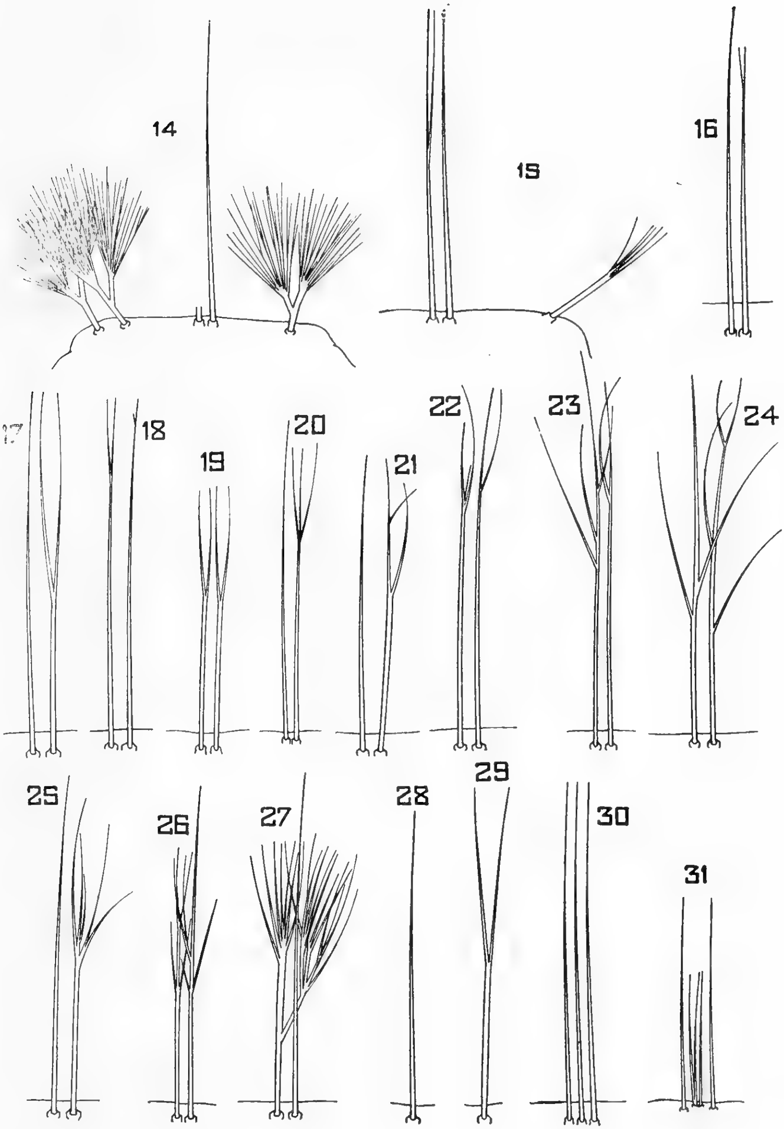
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Fig. 29, Single medial forked inner clypeal. The right outer clypeal normal, the left outer clypeal was broken off (FLORIDA—Starke, VI-20-44).

Fig. 30, Three inner clypeals (this specimen also had three postclypeals) (GEORGIA—Valdosta, I-26-43).

Fig. 31, Four inner clypeals. One of these inner clypeals is branched from the base (MISSISSIPPI—Flora, IV-6-44). (The outer clypeals in Figures 16 to 31 are either normal or were broken off on one or both sides, and are not included in the drawings.)

EXPLANATION OF FIGURES 32–58.

Aberrations in *Anopheles punctipennis* (Say)

Fig. 32, Three normal outer clypeals, two of them closely inserted on the left side (NORTH CAROLINA—Maxton, VI-14-44). Two similar specimens have been taken from: TENNESSEE—Paris, VII-17-44: Nashville, VII-10-44 (in this specimen the additional outer clypeal was separated for some distance to the right of the normal one).

Figs. 33–44, One outer clypeal sparsely branched or simple. The other outer clypeal was normal or sometimes broken off and, in the drawing, is either not shown or is indicated by its base.

Fig. 33, Left outer clypeal with seven branches (MISSISSIPPI—Centerville, VI-5-44). Three somewhat similar specimens had the right outer clypeal sparsely branched (a few more branches) and were taken from: ALABAMA—Tuskegee, VIII-11-44. NORTH CAROLINA—Monroe, VIII-21-44. TENNESSEE—Paris, VI-20-44.

Fig. 34, Left outer clypeal five branched (NORTH CAROLINA—Swannanoa, VI-5-44). Extreme tips of inner clypeals not indicated.

Fig. 35, Right outer clypeal with five branches and moved toward the inner clypeals (GEORGIA—Augusta, V-24-44).

Fig. 36, Left outer clypeal four branched (TENNESSEE—Paris, VI-5-44.)

Fig. 37, Right outer clypeal three branched (TENNESSEE—Nashville, VI-28-44). Two somewhat similar specimens (one with the left, the other with the right outer clypeal three branched, the branches on different levels) taken from: ALABAMA—Anniston, VII-25-44: GEORGIA—Augusta, VIII-17-44.

Fig. 38, Right outer clypeal two branched (MISSISSIPPI—Jackson, V-26-44).

Fig. 39, Right outer clypeal moved medially and with only one abnormally formed branch (TENNESSEE—Paris, VI-20-44).

Fig. 40, Right outer clypeal simple (NORTH CAROLINA—Swannanoa, VI-20-44).

Fig. 41, Left outer clypeal a long slender simple hair, slightly shorter, and a little to the left of the inner clypeals. The right inner clypeal is forked (ALABAMA—Tuskegee, VIII-11-44).

Fig. 42, Left outer clypeal simple and moved close to the inner clypeals (MISSISSIPPI—Jackson, VI-9-44).

Fig. 43, Left outer clypeal sparsely feathered and moved close to the inner clypeals (GEORGIA—Rome, VIII-22-44).

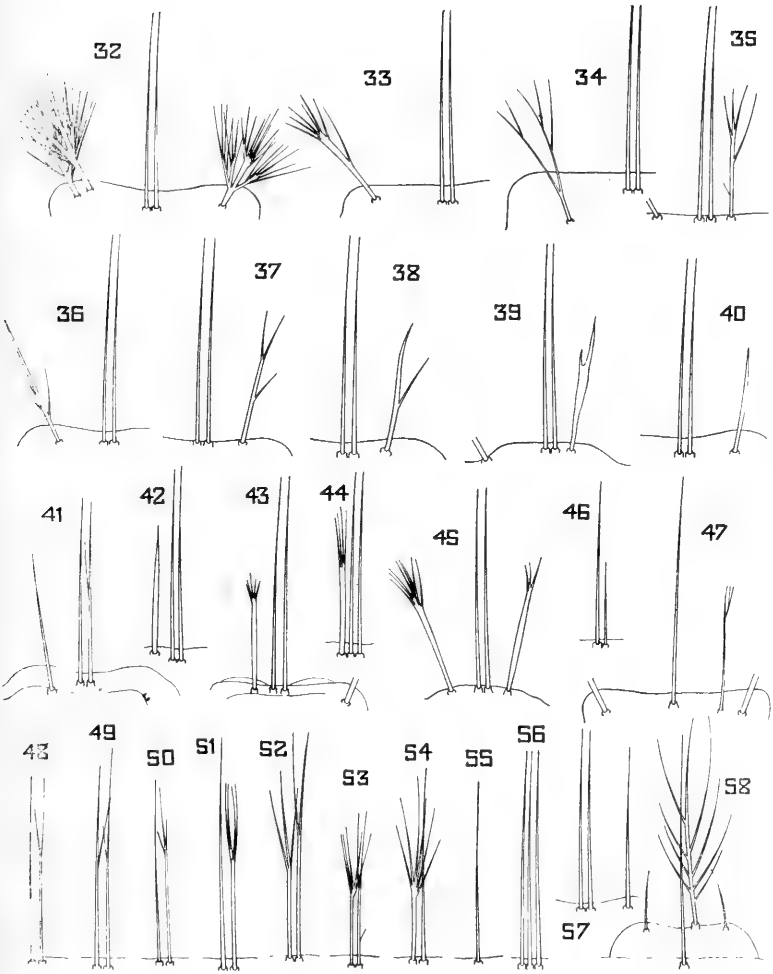
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Fig. 44, Left outer clypeal moved next to the inner clypeals and bearing only four apical branches (NORTH CAROLINA—Maxton, VI-14-44). (See text for further explanation of Figures 41-44).

Fig. 45, Both outer clypeals sparsely branched and moved toward the inner clypeals (TENNESSEE—Paris, VI-26-44).

(Figs. 46, 48-58, The outer clypeals are either normal or broken off and are not included in the drawings.)

Fig. 46, Right inner clypeal smaller and more slender than the normal left, (TENNESSEE—Paris, V-30-44).

Fig. 47, Right inner clypeal, small, slender, with three apical branches and moved toward the base of the right outer clypeal. Only the bases of the normal outer clypeals are shown (ALABAMA—Anniston, VII-17-44).

Fig. 48, Right inner clypeal strongly forked (GEORGIA—Bibb Co., V-25-44, 2 specimens), Twenty-five somewhat similar specimens (nine with the right and sixteen with the left inner clypeal forked at various levels) were taken from the following regions: ALABAMA—Anniston, VI-20-44: Opelika, V-26-44. GEORGIA—Atlanta, V-44: Augusta, VI-9-44: Bibb Co., VI-15-44. MISSISSIPPI—Grenada, IX-2-43; VI-22-44: Hattiesburg, II-21-44: Jackson, VI-15-44. NORTH CAROLINA—Maxton, V-29-44. SOUTH CAROLINA—Greenville, III-19-44 (2 specimens); VI-10-44: Spartanburg, VI-13-44. TENNESSEE—Dyersburg, VI-3-44; VI-13-44: Nashville, VII-10-44 (5 specimens): Paris, V-30-44 (2 specimens); VI-6-44; VII-13-44.

Fig. 49, Both inner clypeals branched (TENNESSEE—Nashville, VI-2-44). Two similar specimens (branching at different levels) were taken from TENNESSEE—Paris, VI-20-44.

Fig. 50, Right inner clypeal with three branches, left simple (GEORGIA—Bibb Co., V-25-44).

Fig. 51, Right inner clypeal four branched, left simple (SOUTH CAROLINA—Spartanburg, VII-5-44).

Fig. 52, Inner clypeals three and two branched respectively (NORTH CAROLINA—Swannanoa, VI-26-44).

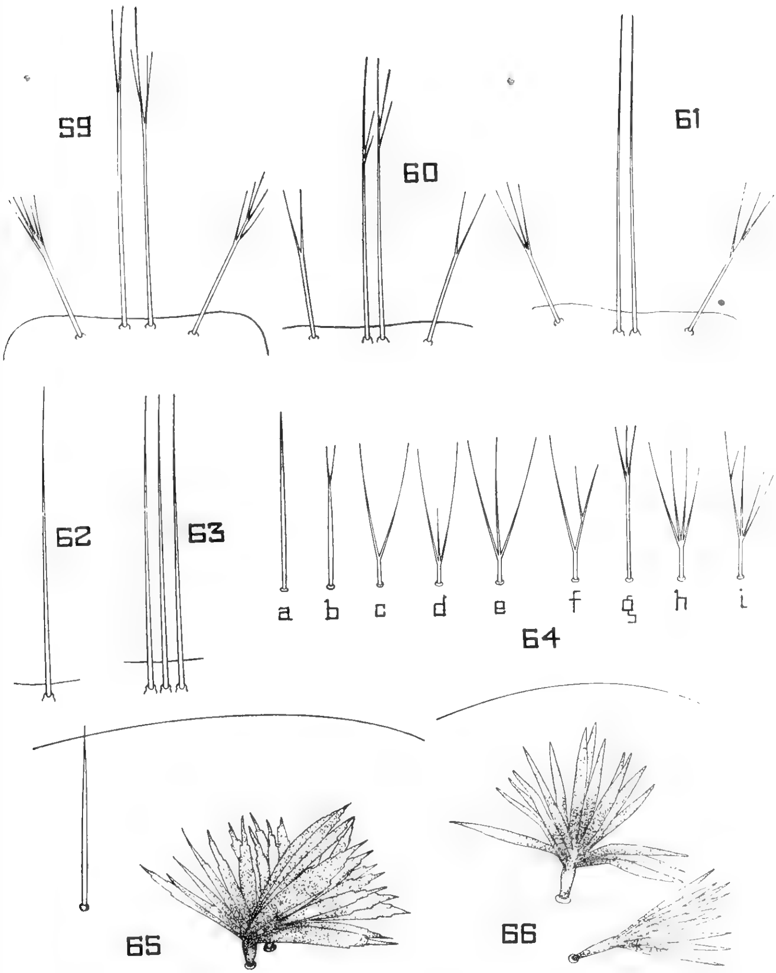
Fig. 53, Left inner clypeal with five branches, right strongly forked near the middle and with a small weak branch from near the base (ALABAMA—Opelika, V-29-44.)

Fig. 54, Left inner clypeal with six branches, the right one simple (GEORGIA—Rome, VI-3-44). Two specimens, one with the left inner clypeal thickly branched apically (about 8 or more branches) taken from ALABAMA—Anniston, VI-13-44; the other specimen with the left inner clypeal apically feathered with weak branches (more than six) and smaller in length than the normal right inner clypeal was taken from SOUTH CAROLINA—Greenville, III-19-44.

Fig. 55, Single medial inner clypeal (ALABAMA—Opelika, V-29-44). Six similar specimens were taken from: GEORGIA—Macon, VIII-2-44. MISSISSIPPI—Grenada, IX-2-43: Jackson, VI-1-44 (2 specimens): TENNESSEE—Paris, V-30-44; VII-26-44.

Fig. 56, Three normally shaped inner clypeals (TENNESSEE—Paris, VI-20-44).

Fig. 57, Three inner clypeals, the additional one being separated for some dis-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tance to the right of the two normal medial inner clypeals. Left outer clypeal normal, right one broken off (GEORGIA—Atlanta, VI-22-44). One similar specimen taken from ALABAMA-Opelika, VIII-12-44, had both normal outer clypeals attached.

Fig. 58, Frontal head hair lying between the inner preclypeals. Only a single medial inner clypeal is present (GEORGIA—Columbus, VI-12-44).

EXPLANATION OF FIGURES 59–66.

Figs. 59–61, Inner and outer clypeals of *Anopheles atropos* D and K.

Fig. 59, Normal inner and outer clypeals (FLORIDA—Tampa, VI-15-44).

Fig. 60, Outer clypeals forked, inner clypeals normal (FLORIDA—Tampa, VI-15-44).

Fig. 61, Outer clypeals three branched, inner clypeals simple (FLORIDA—Tampa, VI-15-44).

Figs. 62, 63, Inner clypeals of *Anopheles bradleyi* King.

Fig. 62, Single medial inner clypeal (MISSISSIPPI—Gulfport, V-19-44).

Fig. 63, Three inner clypeals (SOUTH CAROLINA—Myrtle Beach, VII-3-44; see footnote 6).

Fig. 64, Antepalmate hairs (hair 2) of *Anopheles punctipennis* showing the varied branching which that hair may assume; a, simple; b, c, two branched; d–g, three branched; h, four branched; i, five branched.

Fig. 65, Right half of the fifth segment of *Anopheles quadrimaculatus* (MISSISSIPPI—Greenwood, IV-19-44) showing the additional palmate. The simple antepalmate is also shown.

Fig. 66, Left side of the second segment of *Anopheles punctipennis* (GEORGIA—Columbus, VI-12-44) showing an additional palmate.

PSEUDOLUTZOMYIA, NEW NAME FOR LUTZOMYIA CURRAN, 1934 (Diptera)[1]

By WILLIAM F. RAPP, JR.

Recently the author found that *Lutzomyia* Curran (North American Diptera, p. 387, 1934) is a homonym of *Lutzomyia* França (Jornal de Sciencias Mathematicas, fysicas e naturaes. Academia das ciencias de Lisboa, (3) 5:23, 1927). Therefore, the new name *Pseudolutozmyia* is proposed to replace *Lutzomyia* Curran, 1934. *Lutzomyia* França is a genus of Psychodidae closely related to *Flebotomus*. The type is *Flebotomus argentipes* Annandale and Brunetti, (Rec. Ind. Mus., 2:101, 1910); the type locality is Calcutta, India. The type of *Pseudolutzomyia* is *Lutzomyia americana* Curran, described from Arizona.

I wish to acknowledge my indebtedness to Dr. C. H. Curran of the American Museum of Natural History for permission to change his homonym.

[1]Contribution No. 248 from the Entomology Department, University of Illinois, Urbana, Illinois.

NOTE ON HAEMAGOGUS CAPRICORNII LUTZ, 1904 (Diptera, Culicidae)[1]

By N. L. Cerqueira, *Laboratório do Servico de Estudos e Pesquisas sôbre a Febre Amarela, Rio de Janeiro, and* John Lane, *Instituto de Higiene da Universidade de São Paulo*

Because of the role of *Haemogogus* as forest transmitters of yellow fever virus it is desirable that the exact taxonomy of different members of the genus be described accurately. It is the purpose of this paper to establish definitely the taxonomic characteristics of both males and females, as well as the developmental stages, of *Haemagogus capricornii.* The material upon which these descriptions are based is derived from females captured in the *capricornii* type area, in Horto Florestal, Serra da Cantareira, near the city of São Paulo, Brazil.

The original description of *Haemagogus capricornii* by Lutz was based upon female specimens only. Heretofore no males or larvae stemming from females of the type area have been described. Before discussing our material we wish to refer to the literature bearing upon the taxonomy of this mosquito and reproduce the description given by Lutz.

In 1904, Lutz (in Bourroul's thesis) gave a short description, and in 1905 a more detailed one, of female mosquitoes to which he gave the species name of *capricornii.* The type locality is the Horto Florestal da Serra da Cantareira, near the city of São Paulo. Dyar (1928) considered this species as a synonym of *H. equinus.* In 1939, Antunes revalidated *H. capricornii* and made *H. janthinomys* a synonym of it. Cerqueira (1943) described the female from Bolivia and male genitalia from Brazilian material which had been compared with specimens from the State of São Paulo but not from the type locality.

We wish to add that in our opinion the detailed description given by Lutz in 1905, in which he placed the species in a new genus and added the words "nov. spec." instead of "Lutz (in Bourroul's thesis)", does not invalidate his original description.

Haemagogus (Haemagogus) capricornii Lutz, in Bourroul, 1904

1904 *Haemagogus capricornii* Lutz in Bourroul, Mosq. do Braz. 66:4, Catal. 13.
1905 *Stegoconops capricorni* Lutz, Imp. Medica, 13 (5), 83–84.

We herewith quote from Lutz's original description:

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[1] The studies and observations on which this paper is based were conducted with the support and under the auspices of the "Servico de Estudos e Pesquisas sôbre a Febre Amarela" of the Ministry of Education and Health of Brazil in cooperation with the International Health Division of The Rockefeller Foundation, and the Instituto de Higiene of the University of São Paulo.

X *STEGOCONOPS CAPRICORNI* Nov. gen. nov. spec. (pg. 83–84) (Fêmea). Comprimento do corpo 5 mm., sem a tromba que mede 2.5 mm. Côr geral azul metallico escura, sendo o fundo desnudado preto.

Tromba-Comprida, preta, com brilho escuro, quasi do comprimento do abdomen; os labellos amarellos na ponta, onde ha pellos finos e alguns um pouco maiores no lado inferior da raiz.

Antennas—Quasi do mesmo tamanho que a tromba, Torus muito escuro, quasi preto mas com brilho esbranquiçado e com pellos curtos e escuros do lado interno; no flagello tanto os pellos maiores como os menores são de côr preta, porem os ultimos com brilho prateado.

Palpos—Pretos, com brilho azul e muitos pellos escuros.

Clypeus—Como os torus das antennas.

Occiput—Fundo preto; na margem posterior dos olhos uma fileira de pequenas escamas brancas, espatuladas; o resto é coberto de escamas maiores, chatas e imbricadas, de côr azul metallico; estas, como tambem as do prothorax, pleuras, mesonotum, abdomen e extremidades, são espatuladas com a ponta mais ou menos arredondada; pelo lado de fora e na região mental são substituidas por escamas branco-nacaradas.

Lobulos prothoracicos—Muito salientes, com pellos escuros e escamas, iguaes em forma, côr e agrupamento às do occiput.

Mesonotum—Côr preta, escamas obovais iridescentes em verde-azul, bronze e cobre, como pennas de beija-flor. As mesmas um pouco alongadas, encontram-se no scutellum.

Pleuras—Escamas branco-nacaradas, formando uma mancha continua, de brilho branco um pouco prateado.

Scutellum—Nos lobos lateraes 3 para 4 pellos maiores, no medio 2 para 4. Acima da raiz das azas ha pellos grossos, escuros em numero maior, que seguem sôbre a margem do scutellum, onde existem nos lobos lateraes e no mediano, em numero variavel, como vimos, por serem em parte substituidos por outros mais curtos.

Abdomen—Em cima de côr uniforme, azul metallico escuro, havendo apenas na base dos ultimos segmentos algumas escamas brancas; estas tambem se acham na face ventral, onde cobrem de modo uniforme os primeiros segmentos, e formam manchas obliquas no lado dos ultimos; a conformaçao dos tres ultimos segmentos segue o typo do genero *Carrollia* e *Gualteria.*

Azas—Escamas medianas espatuladas, curtas e largas, com brilho metallico e outras de côr cinzenta, compridas e estreitas, do typo do gênero *Culex;* cellulas forqueadas pequenas, menores do que os seus pedunculos; a primeira mais estreita que a segunda; as duas primeiras nervuras transversaes formam um angulo obtuso, aberto para a base, da qual a terceira se approxima por mais do seu comprimento.

Pernas—De azul escuro uniforme, com excepção do aspecto inferior do femur posterior, que é coberto de escamas nacaradas; ha muitos espinhos principalmente no lado inferior das tibias posteriores, onde são visiveis macroscopicamente.

Unhas das patas anteriores, iguaes, maiores e com dente na base; as das posteriores, diminutas, iguaes e inermes.

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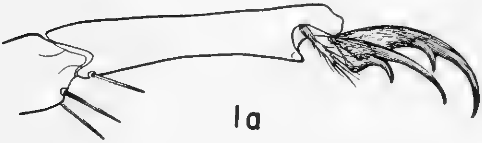

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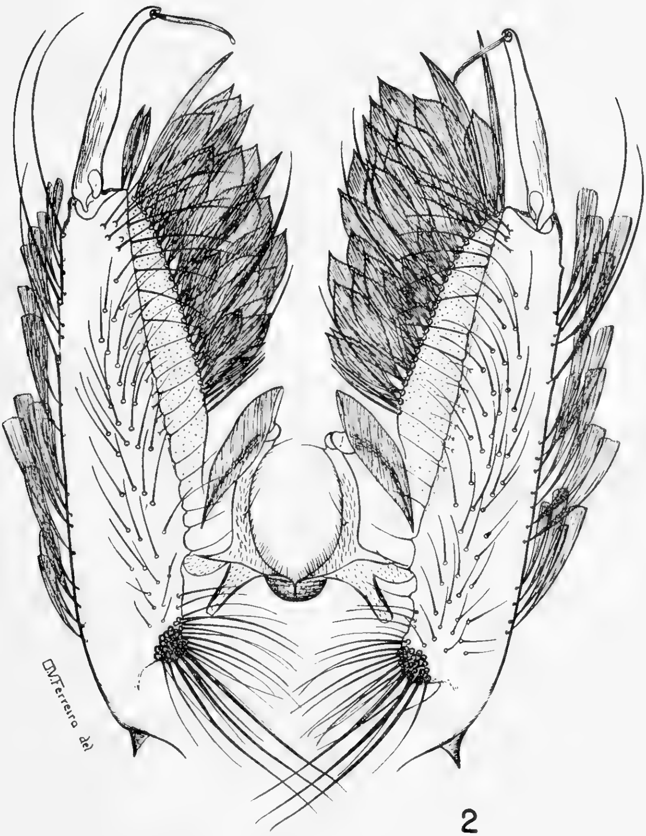

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Haemagogus capricornii Lutz, 1904, Fig. 1 and 1a: Fifth tarsal segment and claws of fore- and mid-legs of the male. Fig. 2: Male genitalia; sidepiece and claspette, ventral view.

NOTA: Esta especie sylvestre predomina na zona atravessada pelo tropico de Capricornio, do que o nome generico é derivado. Não conheço o *Haemagogus cyaneus*, mas pela descrição trata-se de um mosquito semelhante, conquanto differente no gênero e na especie. Desconheço o macho, mas os caracteres da femea indicam que deve ser collocado ao lado de *Stegoconops leucomelas*.

Description of Our Material

The material herein described was derived from females captured in the *capricornii* type locality during the month of April 1944. In all, 13 females were captured, nine of which deposited eggs. From these eggs 136 larvae were hatched, and 46 males and 55 females eventually developed. Thirty examples of each sex, together with the larval and pupal skins, were selected for study.

It is of some interest to note that considerable difficulty was encountered in obtaining eclosion of the eggs. Indeed, eight months and seven or more immersions alternating with periods of desiccation were required to obtain maximum eclosion.

Female.—Head. Proboscis blue-black, long, slender, about one-fifth the length of the forefemur. Palpi of the same color as the proboscis and slightly longer than the clypeus; clypeus and torus shining black. Antennae testaceous. Occiput with broad truncated, adherent scales of a metallic blue color with greenish reflections; eye margins with scales which are arranged in a narrow line that does not reach the vertex when seen from above and which form a patch in the region of the mentum; margin of the eyes and vertex with black setae.

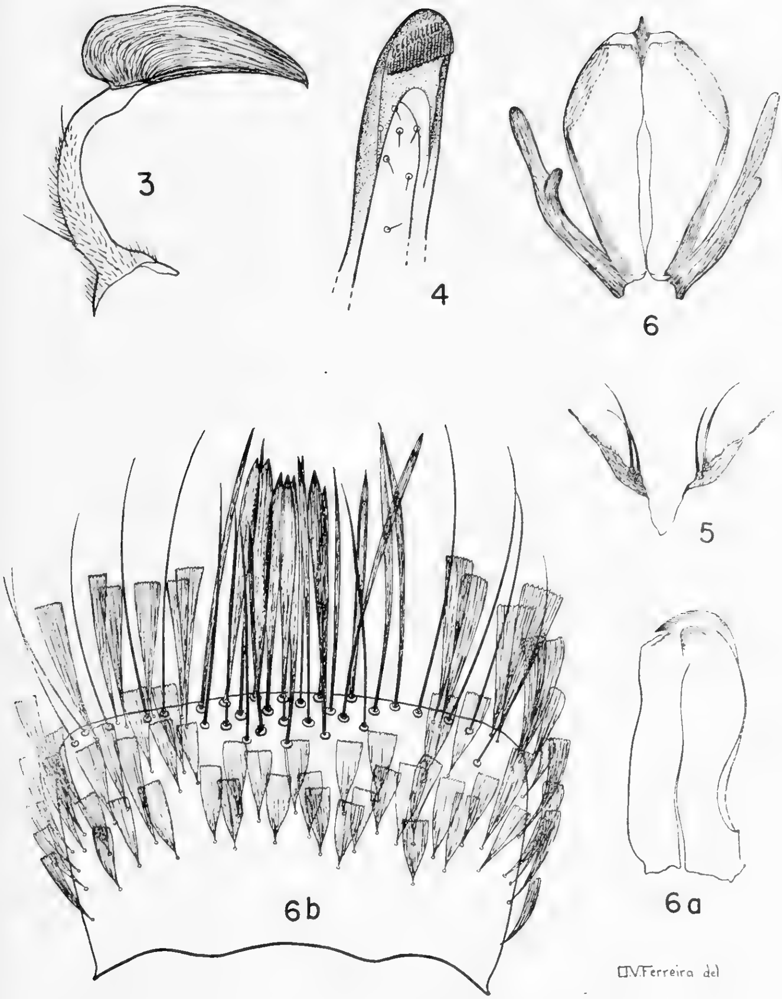
Thorax. Pronotal lobe prominent, nearly united on top, covered with scales of the same color as those of the occiput but in which the green reflection is stronger; many black setae on top and on the anterior margin. Mesonotum with broad, flat ovate scales intermixed with narrow ones, greenish-blue with coppery reflection in the center and blue over the base of the wings in the prescutellar region and the scutellum; the scales in those areas are longer and broader than in the center of the mesonotum; black setae present on the anterior margin, between the pronotal lobes, behind the base of wings and on the posterior margin of scutellum. Posterior pronotum with scales of the same color as those of the mesonotum, the other sclerites and coxae covered with white scales; sternopleuron with two setae.

Abdomen covered with dark metallic blue scales, except for a lateral continuous area of white ones from the first to the fifth tergite and basolateral oblique spots on the sixth and seventh, there being, in some specimens, one or two dorsal white scales on these tergites; venter with basal white bands except on the last segment.

Legs dark metallic blue; fore- and midfemora with internal patches of white scales on basal two-thirds; hindfemur with this patch occupying the basal four-fifths. Fore- and midtarsal claws toothed, the hind ones simple.

Wings with metallic blue scales.

Male.—Coloration as in the female. Antennae densely plumose, about two-thirds the length of the proboscis. Palpi about twice the length of clypeus. Ab-



Haemagogus capricornii Lutz, 1904. Male genitalia. Fig. 3: Claspette, lateral view. Fig. 4: Distal half of the tenth sternite. Fig. 5: Ninth tergite. Fig. 6 and 6a: Mesosome; dorso-ventral and lateral view. Fig. 6b. Eighth tergite.

domi-nal markings which are restricted to the three basal tergites, the others having white spots. Legs with a stronger violet dark-blue reflection. Fore- and mid-tarsal claws (Fig. 1 and 1*a*) large, toothed, the hind ones small and simple.

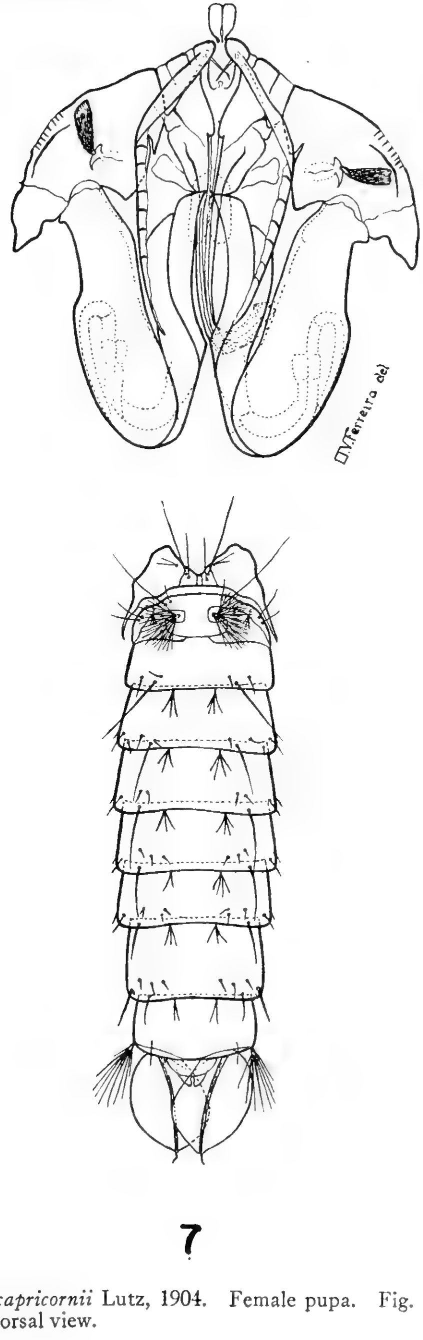
Genitalia (Fig. 2): Side-piece slightly over three times the basal width, lateral margin with long setae and scales, inner margin with long lanceolate scales interspersed with three sizes of broad pointed ones; basal lobe small, reduced, with many long, narrow setae. Clasper short, one-third the length of the side-piece, enlarged at the middle, striated but nude; apical appendicle long, strong, blunt, about half the length of clasper. Claspette (Fig. 3) low; stem curved, moderately short and pilose, with two setae which are somewhat long; filament broad, slightly longer than stem, striated, the apex pointed. Tenth sternite (Fig. 4) high, strongly sclerotised, apex rounded, with two rows[2] of small teeth and a few spicules in the membranous portion. Ninth tergites (Fig. 5) rudimentary, usually with one or two setae. Mesosome (Fig. 6 and 6a) pear shaped, smooth, with a small apical protuberance, the apical outer portion smooth. Eighth tergite as in Fig. 6b.

Pupa.—(Fig. 7) Breathing tube heavily sclerotized, short, enlarged at apex, the opening oblique. Abdomen uniformly sclerotized; dendritic hair black, quite developed; element "B" from the second to the seventh segments single, slightly shorter than the length of same, that of the eighth much shorter than those of the preceding segments; element "C" from the second to sixth segments with two to four short hairs; element "A" of the seventh segment simple, spine-like, that of the eighth branched and of the length of the segment. Paddles darker than the abdomen, the margin toothed, apical seta branched at the end.

Larva.—Skin densely spiculose. Head (Fig. 8) rounded, with distinct latero-frontal depression. Antennae short, cylindric, with a few spines and a short simple internal hair slightly below the middle. Postclypeal hairs branched, small, delicate; frontal internal hairs single, very long, extending beyond the apex of the preoral spine; frontal median hairs also single, more than twice the length of the frontal internal ones; frontal external (ante-antennal) hairs with three or four branches, slightly shorter than the antennae; supraorbital hair double and long. Mental plate (Fig. 9) triangular, with nine lateral teeth on each side, the central one larger than its neighbors.

Eighth segment (Figs. 10, 10a and 10b) with the lateral comb formed by 6 to 8 scales fringed at apex and inserted into a narrow, sclerotized plate. Air tube slightly over two and a half times the length of the basal width; pecten nearly reaching the middle of the air tube, having from 12 to 14 spines followed by a double long hair. Anal segment longer than broad; dorsal plate large, the posterior border spined; lateral hairs long with from 2 to 4 branches; dorsal hair with a triple branch and a single longer one; ventral brush with about 7 pairs of long, double hairs, except the anterior and posterior ones which are shorter. Anal gills about one and a half times the length of the dorsal plate.

[2] We call attention to the fact that in Cerqueira's (3) description of the genitalia, only a single row of teeth was given; re-examining the same mount we noticed two rows, the same as in the mount of the typical specimen which we are describing.



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Haemagogus capricornii Lutz, 1904. Female pupa. Fig. 7: Cephalothorax and abdomen, dorsal view.

Type locality.—Horto Florestal, Serra da Cantareira, São Paulo, April 1944. The foregoing descriptions are based on 13 captured females, and 46 males and 55 females bred from eggs deposited by 9 of the captured females (Col. L. Gomes).

Types.—As the female type of *H. capricornii* does not exist at the Instituto Oswaldo Cruz in Rio de Janeiro we select as neotype one of the bred females and as allotype one of the males. Both specimens with corresponding pupal and larval skins will be deposited in the above-mentioned institute. Neoparatypes will be deposited in the Servico de Estudos e Pesquisas sôbre a Febre Amarela, Rio de Janeiro, the United States National Museum, Instituto de Higiene de São Paulo, and Servicio de Estudios Especiales de Fiebre Amarilla de Colombia.

DISCUSSION

Obviously, the validity of these descriptions hinges upon whether or not the material described represents the species originally designated by Lutz as *capricornii*. We feel there can be no doubt about this for the following reasons:

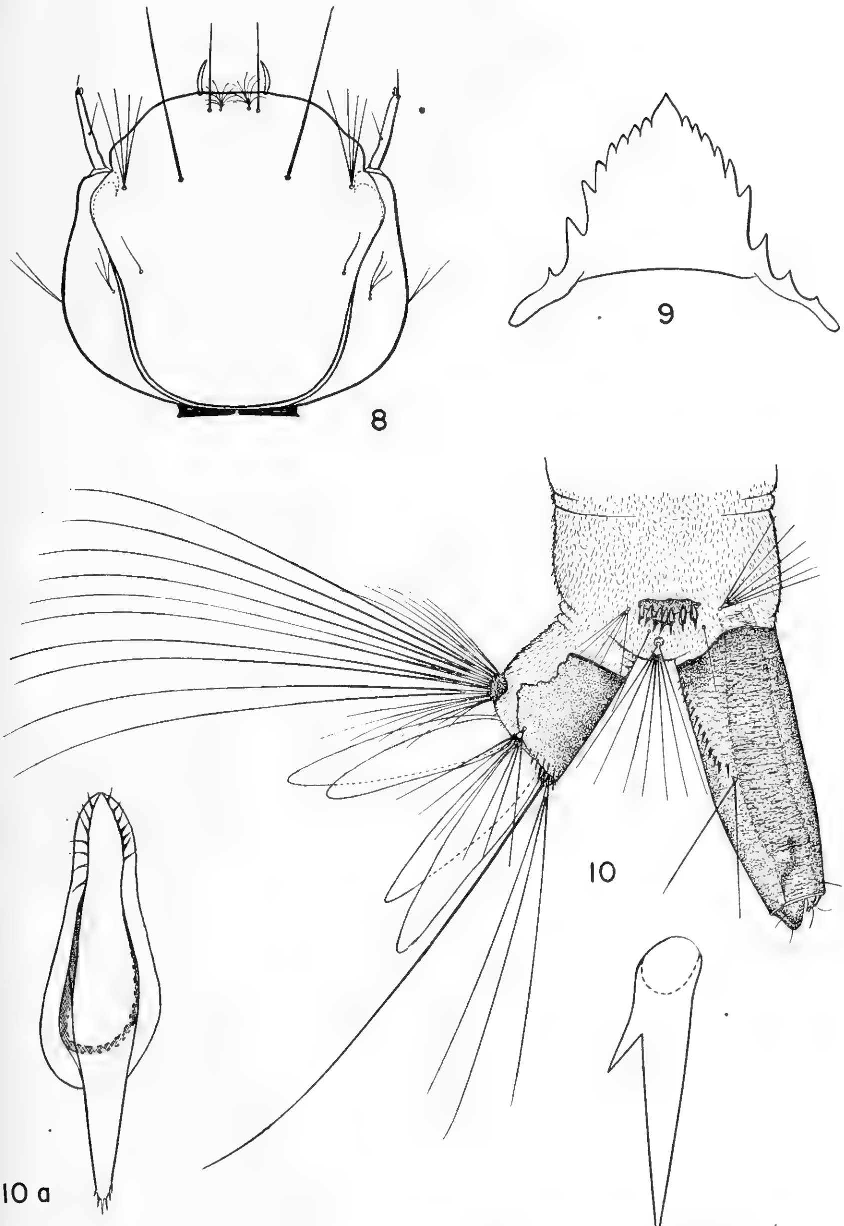
The material was collected in the type locality, the Horto Florestal da Serra da Cantareira, which is a State forest preserve and has been altered little, if any, since Lutz collected his original specimens.

Although the number of females captured was small (13) they were taxonomically identical and correspond to the description given by Lutz. Likewise, all of the males, females, and developmental stages obtained from eggs deposited by nine of the captured females were identical and clearly belonged to the same species. Perhaps even more convincing is the fact that this material represents one of the three species found in Southern South America, the other two being *H. spegazzinii*[3] and *uriartei* from which it can be definitely distinguished.

These findings also permit us to state that the male specimen described and drawn by Cerqueira (1943) from the material used by Shannon et al (1938) in their experiments, as well as the specimens captured in Bolivia, correspond equally to the characteristics given for *capricornii*. Consequently, the mosquitoes from which Shannon et al (1938) isolated yellow fever virus were almost certainly *capricornii*.

On the other hand, the only species found to date in the Ilhéus yellow fever endemic area in Southern Baía is *H. spegazzinii* and this is probably the species used by Antunes and Whitman (1937) in their transmission experiments.

[3] Through the kindness of Dr. Jorge Boshell-Manrique we received some material, male and female specimens, from the *H. spegazzinii* type area in Argentina, which permits us to validate the description given by Cerqueira of this species.



Haemogogus capricornii Lutz, 1904. Fourth-stage larva. Fig. 8: Head, dorsal view. Fig. 9: Mental plate. Fig. 10: Air tube; eighth and anal segment. Fig. 10a.: Scale of comb of eighth segment. Fig. 10b: Apical spine of pecten of the air tube.

SUMMARY

A taxonomic description is given of males, females, larvae, and and pupae of *Haemagogus* mosquitoes stemming from females captured in the *H. capricornii* type area, Horto Florestal da Serra da Cantareira, State of São Paulo, Brazil.

Evidence is presented for believing that the material described represents the species originally designated by Lutz as *capricornii.*

ACKNOWLEDGMENTS

We wish to extend our thanks to Dr. Mary B. Waddell and her technician Mr. Isaltino R. Soares, of the Laboratório do Servico de Estudos e Pesquisas sôbre a Febre Amarela, for rearing the larvae and imagoes from eggs deposited by the females, and to Mr. Lério Gomes for collecting the parent females.

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LEPTOTHORAX LONGISPINOSUS SUBSP. IOWENSIS, NOM. N. (Hymenoptera, Formicidae)

By William F. Buren

The name *Leptothorax longispinosus* subsp. *laeviceps* Buren (*Iowa State College Jour. Science*, 18 (3): 277–312, 1944) is a homonym of *Leptothorax exilis* var. *leviceps* Emery (1898, Ofvers af Finska Vetensk. Soc. Fordandl. 20:11). *Leptothorax longispinosus* subsp. *iowensis*, nom. n. is therefore proposed for the Iowa insect.

A NEW SPECIES OF CULEX FROM NEW GUINEA[1] (Diptera, Culicidae)

By KENNETH L. KNIGHT, Lieutenant, H(S), USNR,[2] and LLOYD E. ROZEBOOM, Lieutenant, H(S), USNR[2]

Among collections of adult mosquitoes taken with a net in woods at an approximate elevation of 1,000 feet above sea level on the slopes of the Cyclops Mountains, were males and females of a *Culex* that did not agree with descriptions of other Australasian species of this genus. Later, some small green larvae were collected from leaf axils of sago palm in a sago swamp near Lake Sentani, (approximately 250 feet above sea level), and adults similar to those from the Cyclops Mountains were bred from these larvae.

Culex(?Neoculex) binigrolineatus, new species

ADULT FEMALE. A medium-sized mosquito with dark wings and tarsi; white hind femora, and a strikingly ornamented scutum. Wing 3 mm.

Head:—Proboscis and labella black. Palpi black, about one-fourth the length of the proboscis. Clypeus bare. Antennae slightly longer than proboscis; tori bare, ochreous; flagellar segments black, with pale pubescence and black whorl-hairs. Vertex with a large central area of narrow, white, curved scales extending forward between the eyes; white upright forked scales over all of central white area, black upright forked scales at the sides of this area; a patch of broad flat white scales laterally, and flat white scales along eye margins extending upwards to the lower edge of the central patch of white curved scales; orbital bristles pale above, black below.

Thorax:—Prothoracic lobes bare, with several long black bristles. Posterior pronotum bare, with several long black bristles near posterior border. Mesonotum (Fig. 4) pale-scaled; a narrow, bare, black stripe on each side of mid-dorsal line, beginning at the anterior margin and the two converging posteriorly into the bare prescutellar area; two short bare dark stripes extending from the lateral lobes of the scutellum to a short distance before wing roots; pale scales white or yellowish, those between submedian dark stripes pale anteriorly, shading into curved black scales posteriorly, the inner border of dark median stripes lined with black scales; prescutellar space and lateral margins of mesonotum dark, bare, a few small black scales before wing root. Mesonotum with several rows of long, black bristles, a denser patch above wing root. Mid-lobe of scutellum with a patch of narrow curved pale scales and several marginal bristles; a clump of long black bristles on each lateral lobe. Postnotum dark brown centrally, pale at lateral margins. Propleuron pale brown, with two long bristles. Post-spiracular area pale brown; sternopleuron pale or greenish, darker above; mesepimeron and meron pale green. Pre-alar bristles black; a

[1] The authors wish to thank Dr. Alan Stone, Division of Insect Identification, U. S. Department of Agriculture, for his assistance.

[2] U. S. Naval Medical Research Unit #2. 7th Fleet.

row of pale bristles along posterior border of sternopleuron; one lower and two or three pale upper mesepimeral bristles. Pleuron without scale patches.

Wings:—Scales all dark, those on costa, subcosta, and vein 1 broad, appressed; smaller and narrower flat scales on veins 3 and 5; stem of vein 2 with long, narrow, curved scales, those on the branches broader and denser distally; long, narrow, curved scales on stem of vein 4 and small, flat, appressed scales on the branches; vein 6 with very small, narrow, flat scales on basal half, and longer, narrow curved ones on distal half. First fork cell about one and one-half times the length of the stem; base of first fork cell slightly more basal than that of second fork cell. Anterior and posterior cross veins well separated. Halteres pale.

Legs:—Coxae and trochanters pale greenish; fore coxa with broad, flat, dusky scales; mid coxa with a few flat pale scales; all coxae with several long pale bristles. Fore femur white basally, dark distally on anterior surface, a pale stripe on posterior surface to the apex; mid femur white at base, dark distally on dorsal surface, pale ventrally; hind femur white except at apex. All tibiae and tarsi dark, without pale markings at the joints; in different lights the tibiae and tarsal segments I appear pale-scaled. First hind tarsal segment longer than the tibia.

Abdomen:—Tergite I bare except for a small median patch of flat black scales; all other tergites densely clothed with black scales; basal lateral white spots on segments VI, VII, and sometimes on IV and V, extending medially as basal bands on tergite VII, and occasionally on V and VI; these bands narrowing medially, often to a single row of scales, but on segments VI and VII they may be very broad; tergite VIII dark. Lateral spot when present on tergite IV composed of only a few pale scales; rarely a few scales basally on tergite III also. Pale bristles arising over all of surface of tergite I; a row of similar bristles at the apices of all other tergites. Venter green or grey, clothed with pale bristles; distal segments with broad flat white scales, becoming progressively denser towards the apex.

ADULT MALE. Very similar to female. Proboscis with a group of long bristles ventrally before the middle. Antennae slightly shorter than proboscis. Palpi longer than the proboscis by the length of the fifth segment; a few pale, unmodified bristles arranged in a row on ventral surface of third segment; fourth and fifth segments upturned, with some long black bristles. Remainder as in female.

Hypopygium (Figs. 6, 9, 10, 11, 12, and 13):—Sidepiece conical, without scales, a number of long hairs on outer and dorsal surfaces. Subapical lobe small, with two long stout spines and several smaller setae. Clasper with small papillated hair on inner surface; terminal spine short, broad. Lateral plates of mesosome with a row of dorsally and laterally projecting stout denticles on inner edge of upper arm. In lateral aspect the denticles appear in a semicircular row, or as an uneven row with several teeth at apex, one or two in the middle, and a prominence with several teeth below. Tenth sternites heavily sclerotized, the inner edge with a row of irregular denticles, the apex with several stout spines; basal arm short, curved. Tenth tergites broad, very lightly sclerotized. Ninth tergite simple, without lobes, evenly clothed with long hairs.

LARVA. *Head* (Figs. 5 and 8):—Head distinctly produced laterally, slightly broader than long; lightly pigmented. Antenna tubular, only slightly tapered beyond antennal hair tuft, clear, occasionally lightly pigmented over apical two-thirds; scattered, clear, acutely tapered spines basally, a few occurring along shaft nearly to hair tuft; antennal hair tuft at apical three-fifths, consisting of 6 to 8 long, finely plumose hairs, a minute clear spine at the base of the tuft; 3 long hairs, one short spine and a short, stout, rodlike appendage directly at the apex of the antenna. Major head hairs pigmented, stout, finely plumose and extending apically about as far as tip of antenna; ante-antennal tuft 4- to 7-branched, usually 5; lower and upper head hairs 2- to 3-branched, usually 3. Remaining head hairs elongate, fine, unpigmented, sparsely and indistinctly feathered; sub-antennal hair 1- to 3-branched, average 2; orbital hair 1- to 4-branched, average 3; outer occipital 3 to 6, average 5; inner occipital 1 to 4, average 2; posterior clypeal 1- to 3-branched, average 2; outer clypeal extremely minute, single. Preclypeal spine pigmented, slender, acutely tapered. Mentum evenly triangular with 9 to 11 (average 10) subequal teeth laterally and one stout protruding central tooth.

Thorax:—Outstanding hairs extremely long, the main mesothoracic hair extending well beyond the head.

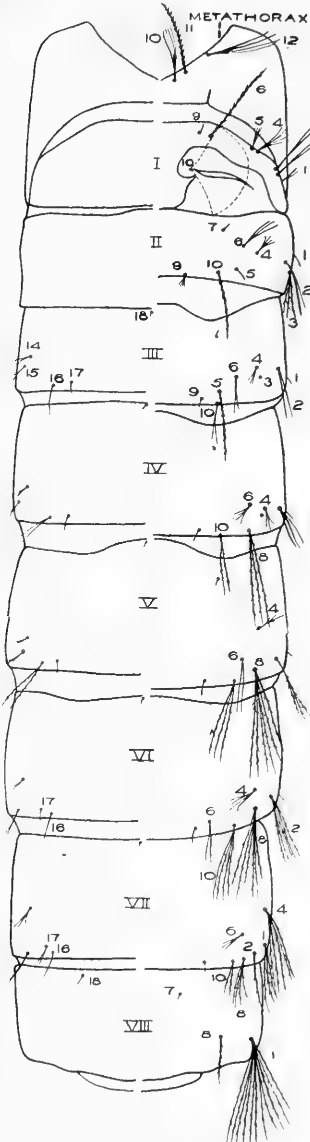
Abdomen (Figs. 7a, b, and c):—Dorso-lateral hair of first two segments well developed, usually 2-branched; lateral hair shorter, generally single or double, the hair on VI equalling or exceeding those of I and II in length. Comb scales approximately 30 in number (observed range 26-43), arranged in broad triangular patch of about 3 rows, with a stout apical thorn and fine lateral fringe. Lateral hairs of VIII well developed, finely plumose; first (most dorsal) and second hairs single; third generally 6-branched, observed range 6 to 10; fourth hair single and fifth double. Siphon strongly pigmented, noticeably curved from base to apex, slightly tapered, widest at basal one-fifth; siphonal index approximately 3.5 to 1; acus well developed; 3 pairs of strong, elongate (somewhat over one-half the length of the siphon), finely plumose, subventral, siphonal hair tufts, each 3-branched, observed range 3 to 5; pecten of 11-12 teeth, observed range 9–15, smaller and more closely spaced basally, teeth broad, acutely tapered with a fringe of fine spines; apico-dorsal hair short, stout, directed basad; dorso-lateral valve spine stout, recurved. Anal segment longer than wide. Anal plate well pigmented, incomplete subventrally, the surface rugose with short transverse lines of minute spinules; latero-caudal margin with a patch of well developed spines; lateral hair stout, single, finely plumose and exceeding the plate in length; dorsal brush exceeding the siphon by nearly twice its length, the inner hair double, the outer single and more strongly developed; ventral brush consisting of a single pair of short, stout hairs, no barred area; anal gills broadly lanceolate, the upper pair at least twice the length of the anal plate.

PUPA. *Cephalothorax* (Fig. 2):—Basal third of trumpet darkly pigmented, transversely striated, slightly enlarged medially; remainder of trumpet pale, increasing slightly in diameter to tip, apical notch shallow, basal notch deep and averaging slightly more than one-third the length of the trumpet. Dorsal area of cephalothorax from anterior end of median keel along base of trumpets to the upper portion of the wing covers darkly pigmented; wing covers partially pigmented along medio-dorsal line; remainder of cephalothorax pale. Vertical plate notched apically, median area membranous, ratio of length to width varies from 1.1 to 2.5:1. Hair 2 prominent, nearly twice as long as any other of the cephalothoracic hairs, 3- to 4-branched, finely plumose; hair 11 (on metathorax) single, finely plumose, nearly spine-like.

Abdomen (Figs. 1 and 3):—Well pigmented, segment II being markedly so. Nearly all of dorsal abdominal hairs finely plumose; hair 6 of segment I single, strongly developed; hair 10 of II single; hair 10 of III single, rarely double; hair 8 of IV 3- to 4-branched, hair 10 2- to 4-branched, shorter than 8; hair 8 of V 3-to 5-branched, prominent, hair 10 2- to 4-branched; hair 8 of VI 4- to 7-branched, exceedingly well developed, hair 10 1- to 4-branched; hair 8 of VII 3- to 7-branched; hair 1 of VIII 9- to 14-branched, strongly developed, fan-like. Paddle without marginal fringe or apical hairs, only basal one-third of lateral margin sclerotized, ratio of length to width approximately 1.7 : 1.

TYPES. *Holotype:*— ♂, with larval and pupal skins and dissected genitalia, elevation approximately 250 feet, Lake Sentani, Hollandia, Dutch New Guinea, 2 March 1945 (K. L. Knight). *Allotype:*— ♀, with larval and pupal skins, data same as for holotype. *Paratypes* (7 ♂♂, 7 ♀♀):—3 ♂♂ with larval and pupal skins, 3 ♀♀ with larval and pupal skins; 2 ♀♀ with pupal skins; 1 ♂ with pupal skin; 4 larval skins and 3 whole larvae, elevation approximately 250 feet, Lake Sentani, Hollandia, Dutch New Guinea, 2 March 1945 (K. L. Knight); 2 ♀♀ and 3 ♂♂ collected by net over aseepage area and along damp rock wall in jungle, elevation approximately 1000 feet, on the slopes of the Cyclops Mountains, Hollandia, Dutch New Guinea, 17 January to 16 March 1945 (L. E. Rozeboom, J. L. Laffoon, and C. Schultz). *Holotype* and *allotype* to be deposited in U. S. National Museum. *Paratypes* to be deposited in U. S. National Museum, University of Sydney, and the Johns Hopkins School of Hygiene and Public Health.

TAXONOMIC DISCUSSION. The exact subgeneric position of this species is difficult to determine. However, it appears to be most closely related to the subgenus *Neoculex*, which it resembles in having a simple mesosome, consisting of a pair of tuberculate plates joined by a bridge at the middle and at the base. This character, as well as the absence of a large, dense tuft of spines at the apex of the tenth sternite would seem to exclude it from the subgenus *Culex*. Except for the lack of specialized hairs on the ventral surfaces of the male palpi, the species would enter the subgenus *Culiciomyia* rather well. The larva differs from all known species of the genus *Culex* in possessing only a single pair of ventral hairs on the anal segment.


METATHORAX
I
II
III
IV
V
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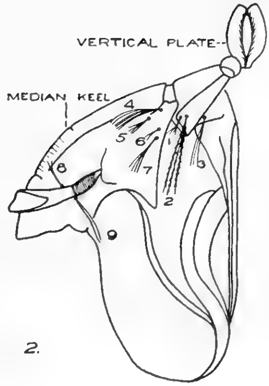
VIII
VENTRAL
DORSAL

1.


VERTICAL PLATE
MEDIAN KEEL

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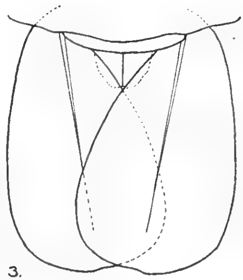

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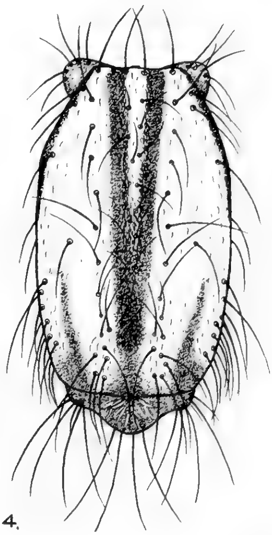

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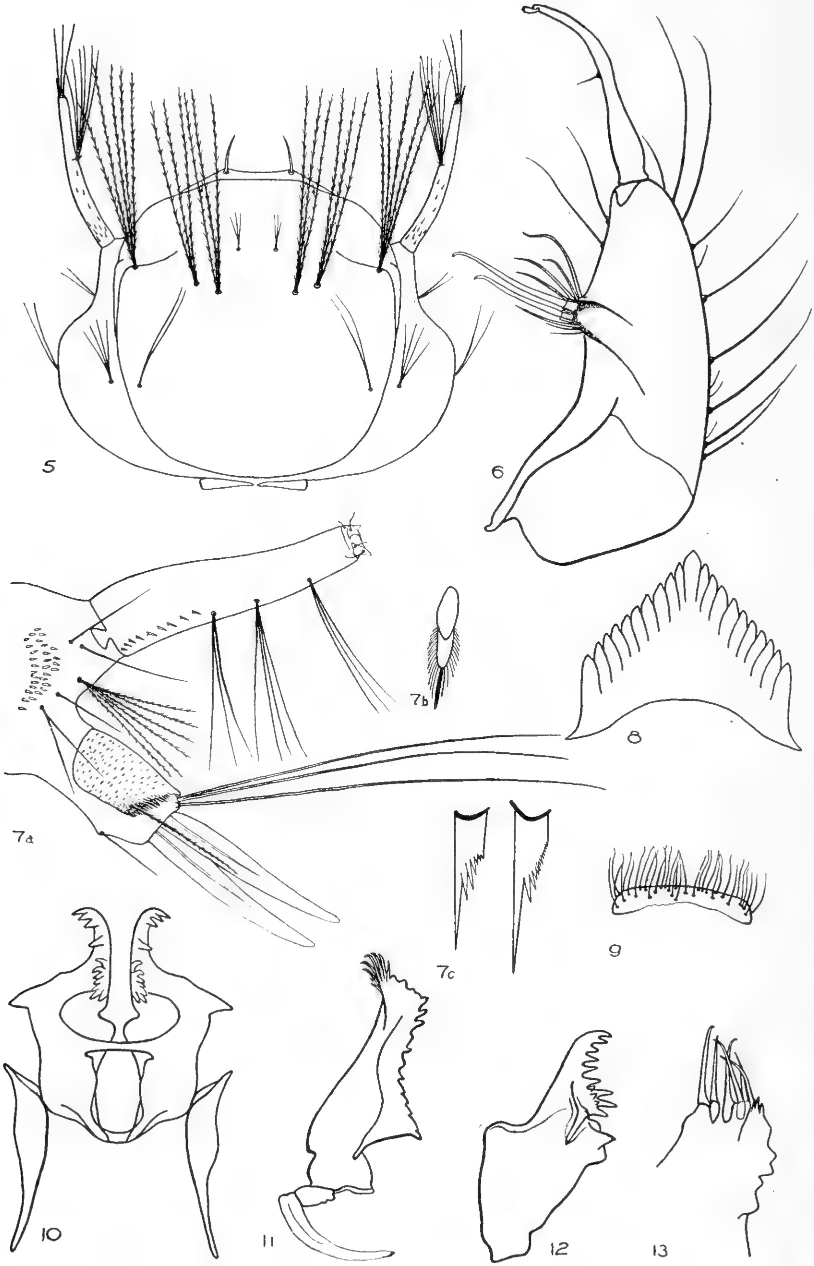
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7a
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Edwards (1932)[3] divides the *Neoculex* into three groups of which this species is most closely related to Group A or *apicalis* Group. However, it differs from his definition of this group in lacking apical markings on the abdominal tergites, but Edwards includes several species in the group which also lack apical pale markings. In 1941 Edwards[4] recognized five groups of *Neoculex*, to none of which the species can be referred definitely. However, it appears to be related most closely to Group B (*Neoculex* s. str.), although these mosquitoes are without obvious thoracic ornamentation.

Of the Australasian and Oriental species of *Neoculex*, *C. fergusoni* Taylor and *C. nematoides* D. & S. differ from *C. binigrolineatus* in having apical abdominal bands; *C. brevipalpis* Giles and *C. tenuipalpis* Barraud in having short palps in the male; *C. pseudomelanoconia* in lacking abdominal bands and a mesepimeral bristle; *C. crassistylus* Brug and *C. simplicornis* Edw. in having different scutal markings and in possessing a leaf on the subapical lobe of the sidepiece. No description was available for *tricuspis* Edwards (Sunda Islands).

EXPLANATION OF PLATES

Plate I

Figure 1. Metanotum and abdominal segments I–VIII of pupa.

Figure 2. Cephalothorax (cast skin) of pupa.

Figure 3. Segment VIII and paddles of pupa.

Figure 4. Dorsal aspect of anterior prothoracic lobes, mesonotum and scutellum of adult.

Plate II

Figure 5. Dorsal aspect of larval head.

Figure 6. Sidepiece of male genitalia.

Figure 7. a. Lateral aspect of larval terminal segments. b. Comb scale. c. Pecten teeth.

Figure 8. Dorsal aspect of mentum.

Figure 9. Nonth tergite of male genitalia.

Fig. 10. Undissected mesosome of male genitalia.

Fig. 11. Tenth sternite.

Figure 12. Dissected lateral plate of mesosome. Lateral aspect.

Figure 13. Lateral aspect of apex of 10th sternite.

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[3] Edwards, F. W. 1932. Genera Insectorum. Culicidae. Fasc. 173, pp. 1-258. F. Wytsman, Brussels.

[4] Edwards, F. W. 1941. Mosquitoes of the Ethiopian Region. 3. Culicine adults and pupae. 499 pp. British Museum.

WYEOMYIA CARACULA DYAR & NUNEZ-TOVAR, A DESCRIPTION OF THE LARVA AND PUPA AND A REDESCRIPTION OF THE ADULT[1] (Diptera, Culicidae)

By Rolla B. Hill and Claire McDowell Hill

Wyeomyia caracula was described by Dyar in 1927 from adults bred out from larvae found in bromeliads by Nuñez-Tovar. The larva and pupa have never been described, while the drawing of the male terminalia in Dyar (1928) is, according to Lane and Cerqueira, insufficiently figured.

The species is a common one in Jamaica, at altitudes up to 2500 feet. We have found it principally in cut bamboo stumps, but have also bred it out from water from the cut base of the travelers' palm. Mr. W. H. W. Komp has kindly confirmed the identification from terminalia mounts.

The larvae are easily distinguishable with the naked eye, being large, long, and fat, whitish in color, sluggish in movement, and hanging straight down from the surface.

Larva

Head: sub-quadrangular, anterior margin rounded, preclypeal spines fairly prominent; antenna short, barely extending beyond the anterior margin of head, cylindrical, glabrous, bearing a single very fine short hair at apical 1/3, and 4 sub-equal spines at the rounded tip; ante-antennal hair in 4 or 5, head hairs simple, occipital hair small, in 2; mental plate with central tooth thicker and more prominent than the other 8 on each side; abdominal segments glabrous; lateral comb of eighth segment with 8 to 16 simple spines in an irregular row; anal segment as wide as long, the plate beyond the middle, dorsal tuft of 10 (6 + 4) long and slender; lateral tuft in 3, as long as the dorsal hairs; ventral tuft of 8 short prominent hairs; gills over twice as long as segment, stout with rounded tips; respiratory siphon about 3 times as long as width at base, slightly tapering to the truncated tip, which bears 2 prominent spines dorsally; siphon has 3 inconspicuous simple hairs in line on lateral surface, (2 at basal 1/3, 1 at apical 1/6), long double hair ventrally near basal 1/3, and a fine simple hair at apical 1/6.

Pupa

Respiratory tube: normal, chitinized, slightly tapering at base, fluted on upper margin; postero-lateral main hair (hair B) of segments 4 to 6 simple, longer than segment; other hairs very small; postero-lateral tuft of segment 7 many-branched, smaller than that on segment 8; paddles short, as long as eighth segment, with a median striation, a few small spicules at tip.

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[1] From the Public Health Training Station, Jamaica, B.W.I., supported by the Government of Jamaica, Colonial Development and Welfare, and the International Health Division of The Rockefeller Foundation.

Female

Proboscis: moderate, shorter than the abdomen, swollen at tip, black with dark blue reflections, a thin line of narrow bluish-white scales almost entire length of ventral aspect; palpi black, clypeus yellowish-white; occiput bluish-black, a narrow white line around eyes, widening to a patch below, 2 or 3 lemon-colored hairs extending forward between the eyes. Prothoracic lobes: bottom half silver, upper half black with a small silver spot at median tip. Mesonotum: dull black with deep blue and bronzy reflections, a small tuft of white scales on anterior edge medially. Pleura: silver-scaled. Abdomen: black above, with dull metallic blue reflections, venter solid silver, the colors sharply divided.

Legs: bluish-white to silver-white on all femora and tibiae internally, black with dark blue and bronze reflections externally. Mid-leg with apical fourth of second tarsus, all of third and fourth and basal half of fifth tarsus broadly silver without, the fifth tarsus varying to all white or all black; hind tarsi narrowly silver on fourth and fifth segments inside, often interrupted on apical $\frac{1}{4}$ of fourth segment.

Wing: costa and first vein black with bluish reflections, with appressed scales. Outstanding scales narrow, appressed scales toward apical portion of first 4 veins broader, narrowly triangular.

Male

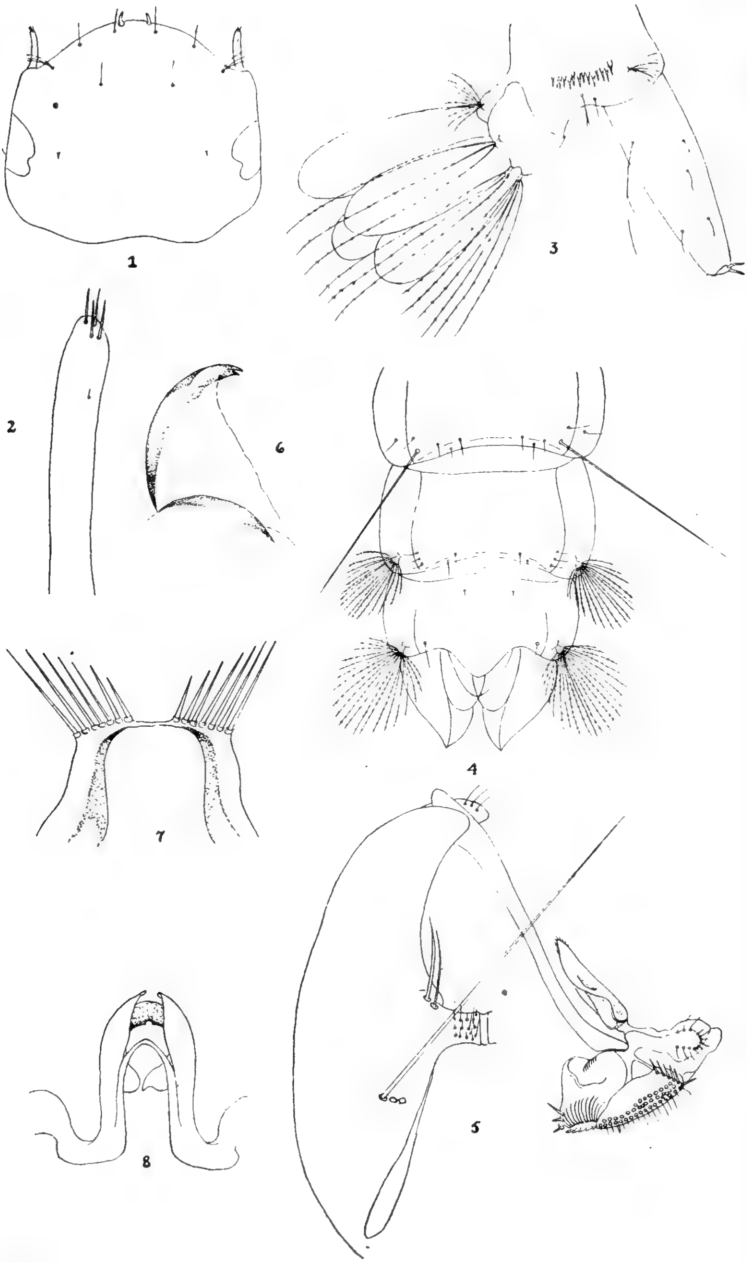
Coloration same as in female, except that the line of bluish-white scales on under side of proboscis is broader, the palpi are shorter and silver-scaled; the second, third, fourth, and fifth segments of mid-tarsus are silver-scaled inside and out, except for the inner basal half of the second segment.

Terminalia: Side-piece slender, ovate, three long stout hairs on a plate at basal fourth; two stout colorless spines at upper attachment of median plate, which has a number of fine hairs. Clasper with a long cylindrical stem, terminating in 2 lobes, one on each side of stem. The smaller lobe, extending outwardly, has a rounded upper margin bearing about 12 fine hairs, and also has a smaller downward rounded projection and a long arm extending parallel to the stem and about half its length. This arm bears a horn pointing upward from the middle. The tip of the arm, nearest the side-piece, bears a number of fine spicules.

The larger inner lobe, roughly quadrangular in shape, has a curved, raised, oval upper (apical) surface above the stem, studded with fine spicules arising from tubercles, with 6 spines extending from the outer margin, overlying the inner lobe. Inward from this oval piece (away from the stem) are a number of hairs in a row, the lobe terminating in several short spines on its upper inner edge. The whole of this inner lobe reminds one of a horse's head and neck with mane, with a spiculose saddle just behind the neck.

Ninth tergite convex, interlobular space rather narrow, each lobe bearing from 6 to 9 stout spines, gradually increasing in length outwardly.

Mesosome of 2 broad, parallel leaflets widely separated below, joined by an acute-angled arch which springs from the base of the leaflets and is separated from them in its apical portion; the leaflets are also joined, where the arch separates from them, by a circular band narrowly interrupted in front, and enclosing a central space.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Explanation of Plate

Fig. 1. Head of larva.
Fig. 2. Tip of antenna, enlarged.
Fig. 3. Larva: terminal abdominal segments.
Fig. 4. Pupa: terminal segments.
Fig. 5. Male: side piece and clasper.
Fig. 6. Tenth sternite.
Fig. 7. Ninth tergite.
Fig. 8. Mesosome.

(Drawings made by camera lucida)

ENTOMOLOGICAL SOCIETY OF WASHINGTON 555th MEETING MAY 3, 1945

The 555th regular meeting of the Society was held at 8 P. M., Thursday, May 3d, 1945 in Room 43 of the National Museum. President Poos presided and 40 members and 11 visitors were present. The minutes of the previous meetings were read and approved.

H. J. Reinhard, Agricultural Experiment Station, College Station, Texas was elected to membership.

Dr. E. N. Cory, in behalf of the Staff of the University of Maryland, invited the Society to hold its June meeting in the form of a picnic at College Park. After discussion on transportation problems, the Society voted that the invitation be gratefully accepted.

The first paper on the program was presented by Dr. J. M. Valentine: Parthenogenesis and Speciation in a Genus of Elaterid Beetles.

The North American fauna of the Conoderini, a tribe of click beetles, was discussed from a taxonomic and evolutionary point of view, with especial emphasis upon one species, now known as *Drasterius mellillus* (Say), in which parthenogenesis is the usual method of reproduction.

This species, which ranges through temperate North America, is extremely variable but has been found to be roughly divisible into numerous non-overlapping, ecological and geographic races. Relatively stable in eastern United States, it becomes increasingly unstable in the west in response to varying environmental conditions. Apparently, however, a high raciating potential is not primarily correlated, in this case, with parthenogenesis, since a far greater degree of uniformity is encountered in the eastern United States where reproduction is almost exclusively parthenogenetic, than in the west where there are innumerable races and subraces and where males are occasionally found. A combination of parthenogenesis and the raciating stimulus (ecological segregation), on the other hand, does seem to result in a marked increase of individual variation within populations, especially in areas, such as the south west, where ecological conditions reach a maximum of diversity. At relatively high elevations in two localities (central Arizona and northern Mexico), populations exhibit normal sexual reproduction, males and females being found in approximately equal numbers, with consequent stabilizing effect on the morphology of the race. An important indicator of instability was found to be wing variability, a character common to all races inhabiting the Rocky Mountain region generally but reaching an extreme in northern New Mexico and becoming stable again in the high altitude races above referred to in which the wings are consistently rudimentary. It is difficult, however, to interpret flightlessness exclusively as an effect of high altitude, since in the eastern lowlands another parthenogenic species, *Drasterius thoracicus* Schfr., closely related to the normally fully winged *mellillus*, is completely flightless.

With the aid of lantern slides, it was pointed out that the genitalic and body differences separating races of *mellillus*, though trenchant when extremes are compared, are actually gradational and quantitative in value. These were contrasted with the relatively stable differences of qualitative value separating closely related and usually associated species of the genus. True speciation and racial parallelism, as exhibited by a similarity in response to desert conditions in two closely related and associated species (*mellillus* and sp. nov.), were also demonstrated. (Author's abstract).

Mr. Cyril Abbott inquired about the cause of the wing reduction mentioned for species living at high altitudes. Dr. Valentine replied that, although certain insect groups show wing reduction at high altitudes, it is not a character specific to high altitudes since other insects display the same tendency at low altitudes. The underlying causes are not definitely known.

Mr. J. A. Hyslop was not able to present his scheduled paper and Mr. Stage substituted interesting color films taken on his official trip to Alaska in July and August of 1944, and to Panama in January and February of 1945. Both trips were made by airplane and many of the shots were made through the nose of the plane under flight conditions. The Panama experiments were made to test the effect of various DDT solutions on mosquito larvae and adults. Airplane spraying proved effective over jungle areas, giving a mortality of over 90 percent. There was excellent penetration of the jungle canopy and the toxic effect persisted for about two weeks.

Discussion by Weigel, Abbott, and Stage followed.

The meeting adjourned at 9.40 P. M.

INA L. HAWES,
Recording Secretary

PICNIC—JUNE 7, 1945

The regular meeting of the Society, scheduled for June 7, 1945, was held on the campus of the University of Maryland as a joint picnic with the Insecticide Society of Washington. About 175 members and their families spent a pleasant evening exploring picnic baskets, playing games, and getting better acquainted. The University provided generous supplies of hot coffee, cold drinks, and real ice cream. There was no doubt that the informal meeting was thoroughly enjoyed and a letter of appreciation was later sent to our hosts, Dr. Cory and the Staff of the University of Maryland.

INA L. HAWES,
Recording Secretary

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Actual date of publication, December 28, 1945

ANNOUNCEMENT

Memoir Number 2, **"A Classification of Larvae and Adults of the Genus Phyllophaga,"** by Adam G. Böving, is now available for distribution.

To non-members and institutions......................	$3.00
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A morphological and taxonomic study of this economically important genus of beetles, with keys to the larvae, and a classification based upon both larval and adult structures.

Back numbers of the Proceedings are available at the general rate of 50 cents per number. Some of the older articles are also available as reprints. Memoir Number 1, "The North American Bees of the Genus Osmia," by Grace A. Sandhouse, is for sale at $3.00 ($2.50 to members of the Society). Members are entitled to discounts on certain types of orders. We welcome inquiries concerning this literature.

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PROCEEDINGS OF THE
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TWO COMMON PONERINE ANTS OF POSSIBLE ECONOMIC SIGNIFICANCE, ECTATOMMA TUBERCULATUM (OLIVIER) AND E. RUIDUM ROGER

By Neal A. Weber
University of North Dakota

Generally speaking, ants of the subfamily Ponerinae are of little or no direct economic importance the world over, this rôle being furnished chiefly by members of the subfamilies Myrmicinae, Dolichoderinae and Formicinae. The worst stinging ants are ponerines and some have other interesting habits but most are inconspicuous and of neutral significance.

Over 40 years ago, however, the United States Department of Agriculture became concerned in a ponerine ant for introduction into the United States to combat pests of cotton. This ant, *Ectatomma tuberculatum* (Olivier), called the "kelep" by the Indians of Guatemala to whom it was well known, became the subject of an unfortunate controversy which has apparently caused it to be largely forgotten. The Department of Agriculture reports by O. F. Cook (1904–1905) were bitingly criticized by W. M. Wheeler (1904–1905) and the resulting controversy in SCIENCE did not further continued investigation.

A closely related but smaller and darker species of *Ectatomma*, *ruidum* Roger, appears to have been completely ignored for its relations to cultivated plants, or even its general biology, but the records here given suggest that both species should be considered of possible significance to agriculture. The rôle is difficult to evaluate precisely but they often tend homopterous insects. Since they so commonly are found on plants, such as cotton and citrus, in the act of tending membracids or other harmful insects the ants are able to transport fungal and other pests as they go from plant to plant.

The present paper brings together the known citations of these two species and gives many additional locality records. The biology of both is described, including the hitherto unpublished biology of *ruidum*. These ants are far from uninteresting ponerines. They have dark brown to blackish eggs compared with the usual white of ant eggs and in *ruidum* the locomotion of the larvae was an unexpected habit. Both species feed on extra-floral nectaries and both are carnivorous as well as membracid-tenders. They carry droplets of nectar in their mandibles and *ruidum* workers boldly robbed fungus-growing ants of papaya fruit. The first mermithergate of *ruidum* and the presence of *Microdon* in a nest are also described.

Ectatomma tuberculatum (Oliv.) (Figs. 8, 9)

1791 *Formica tuberculata*, Olivier, Encycl. Méthod., Ins. 6:498 (w.)
1802 *Formica tuberculata*, Latreille, Hist. Nat. des Fourmis, p. 210, t.8 figs. 46a, c (w. ♀)
1804 *Formica tridentata*, Fabricius, Syst. Piez., p. 42 (w.)
1836 *Ponera tuberculata*, Lepeletier, Hist. Nat. Ins. Hymén, 1:192 (w. ♀)
1858 *Ectatomma tuberculatum*, Smith, Cat. Hymen., 6:102 (♀ ♂), t.7, figs. 10-13
1860 *Ponera (Ectatomma) tuberculata*, Roger, Berl. ent. Zeitschr. p. 306
1862 *Ectatomma tuberculatum*, Mayr, Verh. Zool-bot. Ges. Wien, 12:732
1868 *Ectatomma ferrugiens*, Norton, Proc. Essex Institute, 6:5 (w. ♂), fig.; Amer. Nat., 2:61, t.2, fig. 4
1890 *Ectatomma tuberculatum*, Emery, Bull. Soc. Ent. Ital., 22:40; Dalla Torre, Cat. Hymen. 7:26
1890 *Ectatomma tuberculatum*, var. *punctigerum*, Emery, Mem. Ann. Soc. Ent. France, 10:55
1896 *Ectatomma erubculattum* (*Sic*), Emery, Boll. Mus. Zool. Anat. Univ. Torino, 11:1
1899 *Ectatomma tuberculatum*, Forel, Biol. Centr.-Amer., Hymen. 3:5
1904 Kelep ant, Cook, Science, 19:862-864 (♀), *loc. cit*, 20:666-670 (w.)
1904 Kelep ant, Cook, U.S. Dept. Agric., Bur. Ent., Bull. 49, pp. 1-15, (w. ♀)
1904 *Ectatomma tuberculatum*, Cook, Science, 20:310-312 (w.), *loc. cit.*, 20: 611-612 (w.); Wheeler, *loc. cit.*, 20:437–440, 20:766-768
1905 Kelep ant, Cook, Science, 21:552-554
1905 *Ectatomma tuberculatum*, Cook, U.S. Dept. Agric. Tech. Ser. 10, pp. 1-55 (w. ♀ ♂)
1905 *Ectatomma tuberculatum*, Wheeler, Science, 21:706–710, *loc. cit.*, 23:348–350
1906 *Ectatomma tuberculatum*, Cook, Science, 23:187–189; Wheeler, *loc. cit.*, 23: 348–350
1909 *Ectatomma tuberculatum*, ssp. *acrista*, Forel, Deutsche Ent. Zeitschr., p. 254 (w. ♀)
1912 *Ectatomma tuberculatum*, Forel, Mém. Soc. neuchat. Sc. Nat., 5:9
1916 *Ectatomma tuberculatum*, Wheeler, Bull. Amer. Mus. Nat. Hist., 35:2 (♀)
1921 *Ectatomma tuberculatum*, v. *irregularis*, Santschi, Bull. Soc. Vaud. Sc. Nat. 54:83 (w.)
1922 *Ectatomma tuberculatum*, Mann, Proc. U. S. Nat. Mus., 61:6 (w.)
1924 *Ectatomma tuberculatum*, Wheeler, Jour. Hered., 15:147–165
1925 *Ectatomma tuberculatum*, Wheeler, Ark. for Zool., 17:4 (w.)
1929 *Ectatomma tuberculatum*, Forel, The Social World of the Ants Compared with that of Man. A. and C. Boni, New York, 2 vols.

w. = worker.

1930 *Ectatomma tuberculatum*, Wheeler, Psyche. 37:48-54, Fig. 1 (w.)
1935 *Ectatomma tuberculatum*, Menozzi, Redia, 21:4 (w.)
1936 *Ectatomma tuberculatum*, Wheeler, Proc. Amer. Acad. Arts Sc. 71:189
1938 *Ectatomma tuberculatum*, Haskins, Ann. New York Acad. Sc., 37:97-162
1942 *Ectatomma tuberculatum*, Wheeler, Bull. Mus. Comp. Zool., 90:24

DISTRIBUTION. Southern Mexico to Paraguay and Southern Brazil. Unpublished records from author's collection:
HONDURAS: Corocito, 3.iv.24 (J. Bequaert).
GUATEMALA: Pto. Barrios, 24.iv.24 (J. Bequaert).
PANAMA: Barro Colorado I., C.Z., 12,26.vi., 13.viii.38 (N. A. Weber).
COLOMBIA: Restrepo. Dept. Méta, 500 m., viii.36 (J. Bequaert).
VENEZUELA: Surukum, iii.42; Selvade de San Camilo, x.44 (P. Anduze); Orinoco Delta, Caño Orocaima of Caño Toro, 6.ii.35 (N. A. Weber).
TRINIDAD: Fyzabad, 12.i.24 (F. W. Urich); Botanical Gardens, Port of Spain, 10.v.35, Sta. Cruz, tending aphids on herb, 29.ix.34, Northern Range, 1500–1700 ft., 2.xii.34, Maracas Valley under cacao, 26,31.v.36, Spring Hill Est., 1200 ft. 6.iv.35, Aripo Valley, 1000–2500 ft., 19.iv.35, Morne La Croix, 750 ft., 7.iv.35, Piarco Savannah, 24.iii.35, Anan dale Est., Cumana Bay, 18, 19.v.35, Tacarigua R., 18.xii.34, Turure R., 200–300 ft., 9.iv.35, by *Atta cephalotes* nest, Matura Bay, Mora forest. 26.xii.34, Mayaro Bay, 24.xi.34, Nariva Swamp, 5.xii.34, 10.iii.35, by *Atta cephalotes* nest, Guayaguare Bay, carrying a pupa, 22.xii.34, Galeota Pt., 23.xii.34, Rio Claro, under cacao, 11.iii.35, Guapo Bay, about buildings, 4.iv.35, Basin Hill For. Res., 700 ft., 1.iv. 35, (N. A. Weber).
BRITISH GUIANA: Upper Essequebo R., 20.xi.35 (J. G. Myers 5733); Cuyuwini R., 15.xi.35 (J.G.M. 5631); Kamakusa (H. Lang); Kartabo Pt., 15.vi.36, Forest Settlement, Mazaruni R., virgin Greenheart forest, 23.viii.35, Oko R., Cuyuni trib., 20,23,25,26.vi.36, Courantyne R., Waricabra Falls, 10.vii.36, Courantyne R., above Wonotobo Falls, 14.vii.36, Oronoque R., 2°42′, 25.vii., 2.viii.36 (N. A. Weber).

TAXONOMY. *E. tuberculatum* is a large, reddish brown ant with coarse sculpture, the latter being subject to considerable variation particularly on the gaster. For this reason several varieties have been established, *acrista* from Paraguay, *punctigerum* from Venezuela and *irregularis* from Colombia. Wheeler referred Trinidad and Northern Colombia specimens to the variety *punctigerum*. These forms are not separated here since there is a question on their validity.

w. = worker.

In British Guiana I was impressed by the similarity in nests, ecology and habits between *tuberculatum* and *Paraponera clavata* Fabr., a large and fierce ponerine in a genus and tribe by itself. This similarity would suggest that the two tribes are closely related and is substantiated also by their morphology.[1] Both species here had a chimney entrance to the nest at the base of a tree. Workers of each would run up the tree when the nest was distributed, would scatter over the ground and would pursue one for a short distance. They also had similar habits in Panama. *Paraponera*, however, differs in being restricted to the probable primitive habitat, tropical rain forest, while the *Ectatomma* has become more versatile, being found in savannah, cultivations, etc.

Description of a worker from Barro Colorado Island, Canal Zone (Weber No. 865):

Length 11 mm., of head 3.4 mm., of thorax 4 mm. Head in front view with subparallel, feebly convex sides, occipital margin nearly straight, feebly convex, ending in tuberculate corners; anterior clypeal margin strongly convex; eyes large, 0.5 mm. in diameter, situated closer to the occipital margins than their diameters; antennal scapes 2.3 mm. long, exceeding occipital tubercles by nearly half their diameters; antennal segments longer than broad; mandibles slender, falcate, outer margin feebly sinuate. Thorax with three prominent tubercles anteriorly of which the lateral are slender and acute, the median lower and more a gibbosity; mesonotum evenly convex, meso-epinotal suture marked; epinotum evenly convex and with two teeth smaller than the pronotal tubercles. Node of petiole large, in side view anterior margin concave, posterior margin convex, the junction a rounded acute angle. Postpetiole feebly convex above, first gastric segment more strongly convex, the junction a deep suture on all sides.

Strongly sculptured, shining. Frons of head reticulate-striate, becoming longitudinally striate between antennal insertions and on the sides and under surface; mandibles finely striate. Thorax with concentric striations continuous on sides, front and dorsal surface of mesonotum, irregular between anterior tubercles. Basal surface of epinotum transversely vermiculate, striate on sides but running vertically or posteriorly. Anterior face of petiole mostly smooth, crest vermiculate-reticulate, posterior face striate. Upper surface of postpetiole striate, forming a whorl posteriorly as in the friction ridges of human finger, sides striate. Upper surface of the first gastric segment similar to postpetiole but more finely striate. Anterior coxae finely and regularly striate, median and hind coxae smoother.

Moderately pilose, the hairs attaining lengths up to a half-millimeter, a scanty pubescence on the appendages distally and on the tip of gaster. Light ferruginous brown, the dorsal surface somewhat darker.

[1] The general habitus of the workers is similar, one of the most striking differences being that of the petiolar shape. The venation of the males is also essentially similar (Fig. 2 and 5). The male genitalia follow generally the same pattern although much larger in *Paraponera* than in *E. ruidum* or *tuberculatum* (Figs. 4, 7, 8, and 10). All have a prominent tooth to the volsellae.

This species is subject to considerable variation as indicated above and several varieties have been established. The tubercles vary in prominence and the sculpturing in depth. Some workers may have piligerous punctations on the gaster. Others may lack the whorl on the postpetiole and may be evenly striate transversely here. Some may vary in size, one worker being 4.4 mm. in thoracic length (the single best length for comparison). The validity of naming these is questionable.

BIOLOGY. Cook (1904–1905) was the first to make known the habits of *tuberculatum* and met a skeptical response for years because some of the habits differed from those known for other ponerines. He also mistakenly considered this insect to be unique and to represent a group with only superficial resemblances to the ant family. On a trip to eastern Guatemala in 1902 to study the culture of coffee and rubber for the United States Department of Agriculture the ants were commonly found to be associated with cotton. The association was apparently long known to the Indians who called the ant the "kelep." Where the ants were abundant the cotton was free from weevils. The ants were predatory on the weevil larvae and also visited the extra-floral nectaries of the cotton. Cook proposed to introduce colonies of these ants into the cotton fields of Texas and later did so.

Cook stated that the ants excavated a nest in the form of a tunnel one to three feet in the ground with three to six small chambers. A chimney extends up from the ground along the under side of the cotton plant stem from one to six inches. This is fibrous in nature. Wheeler overlooked this description when he figured the chimney in 1924 and stated that Cook "failed to mention" it. The queen with some of the eggs and younger larvae usually was in the lowest chamber while the pupae were in the upper and the remainder of the brood were in the intermediate chambers. The ants used one or more chambers for insect remains and other debris in which scavengers lived. The population of colonies was given as usually "between 200 and 300 individuals...., seldom less than 100, and sometimes 400 or more." Several queens were found in nests, fifteen occurring in one. Males may be present at all times of the year. Eggs laid by the queens turned deep gray or blackish, those laid by workers remained white. The eggs were elliptical in form. The slender larvae "have long flexible necks which enable them to reach inside and clean out the sections of boll weevils laid by the workers carefully on the fat stomachs of their baby sisters." The workers covered the larvae with dirt when the latter were ready to pupate, pupation in colonies introduced into Texas taking one and one-half hours. The cocoons changed with age from a light gray to a pale reddish brown. The pupal stage in Texas nests lasted 35½ days for queens and 39–40½ days for workers. He found the ants to prey on insects of every order as well as centipedes. A habit he described which was particularly criticized was that the ants carry droplets of nectar or other liquid in their opened mandibles but this was later admitted to be true by Wheeler and I have often confirmed the habit. About 4,000 ants in 89 colonies were taken to Texas in 1904 and "scarcely more than a dozen died during the voyage." These colonies averaged between 40 and 50 individuals and were later believed to represent only portions of colonies. The ants were gathered in Guatemala some time after late April 1904 and were "planted" in Texas after the middle of July. In Cook's last article on the colonies dated in March 1905, he did not expect them to survive much beyond the month and nothing further was heard of the experiment.

Cook found the sting of the worker to be too small to penetrate the skin of the palm but elsewhere it might penetrate and produce a smarting effect for a few minutes. He stated that the Indians believed that the keleps were able to combat also the dreaded *teken* or leaf-cutting ants (probably *Atta cephalotes* —N.A.W.). The *Ectatomma* "may prevent the growth of new colonies by killing the workers as fast as they appear above ground." This appears to be most unlikely.

After the bitter controversy with Wheeler (1904–1905) the ant was largely ignored until Wheeler in 1921 in a study of Tachigalia ants referred briefly to this ant feeding on the honey dew of membracids and extra-floral nectaries of *Inga*. In 1925 he published an article briefly describing a few of its habits but mostly devoted to a mimic, *Cardiacephala myrmex* Schiner. The chimney entrance to the nest and extra-floral nectaries of *Inga*, to which the insects were attracted, were figured. In 1930 a mermithergate was described and in 1936 the termite, *Nasutitermes* (*N.*) *acajutlae* (Holmgr.) was given as prey.

The ants have frequently been cited in species lists as may be seen above but without adding to a knowledge of the biology.

On Barro Colorado Island, Panama Canal Zone, I found the ants in rain forest and at the edge of the small savannah below the laboratory. The workers were seen to carry both winged sexes, dead or alive. The ants ascended trees for several feet.

In Venezuela the ants were also seen in high rain forests of the Orinoco Delta.

They occurred in Trinidad in various types of vegetation: rain forest of the Nariva Swamp and Northern Range, "lastro" or scrub forest in numerous places, Mora forest, the Piarco Savannah with thin, scattered trees and in cacao plantations. They were sometimes taken in sweepings over grass, herbs and shrubs. In altitudinal range they varied from sea level to 1500–1700 feet. In Colombia, Forel (1912) recorded the species from about 6000 feet but, if not an error, the record is unusually high by probably 500 feet or more. The workers were often nocturnal, being found stalking slowly on the leaves or ground or at nectaries of flowers. In addition to tending membracids they were found with aphids on herbs. While taken several times by *Atta cephalotes* nests, the association was doubtless fortuitous.

My records in British Guiana are also from various types of forest: rain forest of several kinds including a virgin greenheart forest and one including Brazil nut (*Bertholletia*). One nest was surmounted by a chimney of clay quite unlike the fibrous or felted type described in Panama and Guatemala. A worker was taken carrying a dead *Pheidole* soldier.

The similarity between this species and *Paraponera clavata* in ecology and habits is described above under TAXONOMY.

Ectatomma ruidum Roger (Figs. 1–4)

1860 *Ponera (Ectatomma) ruida*, Roger, Berl. ent. Zeitschr., 4:306 (♀ ♀)
1862 *Ectatomma ruidum*, Mayr, Verh. Zool.-Bot. Ges. Wien, 12:732; 37:539
1862 *Ectatomma scabrosa*, Smith, Trans. Ent. Soc. Lond. (3), 1:31 (♀); Roger, Berl. ent. Zeitschr. p. 292
1890 *Ectatomma ruidum*, Emery, Bull. Soc. Ent. Ital., 22:14; Dalla Torre, Cat. Hymen, 7:26
1896 *Ectatomma ruidum*, Emery, Boll. Mus. Zool. Anat. Univ. Torino, 11:1
1899 *Ectatomma ruidum*, Forel, Biol. Centr.-Amer., Hymen, 3:6, t.1, figs. 3, 3a (w.)
1907 *Ectatomma ruidum*, Forel, Mitt. Nat. Mus. Hamburg, p.1
1912 *Ectatomma ruidum*, Forel, Mém. Soc. Neuchât. Sc. Nat., 5:9
1922 *Ectatomma ruidum*, Mann. Proc. U.S. Nat. Mus., 61:6 (♀)
1924 *Ectatomma ruidum*, Wheeler, Jour. Hered., 15:147–165
1931 *Ectatomma ruidum*, Santschi, Rev. Ent., 1:265 (♀)
1934 *Ectatomma ruidum*, Borgmeier, Arq. Inst. Biol. Veget., 1:95 (♀ ♂)
1938 *Ectatomma ruidum*, Weber, Ann. Ent. Soc. Amer., 31:499–503
1941 *Ectatomma ruidum*, Williams, Bull. Chicago Acad. Sc., 6:79
1942 *Ectatomma ruidum*, Wheeler, Bull. Mus. Comp. Zool., 90:24

DISTRIBUTION. Southern Mexico to Brazil. Unpublished records from the author's collection:

HONDURAS: Corocito, 3.iv.24 (J. Bequaert).

COSTA RICA: Sta. Clara, iv.37 (A. Alfaro).

PANAMA: Panama City, across bay, 16.vi.38 (N. A. Weber). Canal Zone: Barro Colorado I. 14–19.vii.38 (E. C. Williams), 12–25.vi.38 (N. A. Weber); Gatun, 17.vi.38 (N. A. Weber).

COLOMBIA: No locality (Sr. Murillo, Sr. Armero, via Bequaert); Puerto Colombia, 1936, Los Flores, Sta. Marta,

w. = worker.

24.xii.22 (J. Bequaert); Rio Porce, Cauca trib., 17–21.vii.38, 2.viii.38, Porcecito, 21.vii.38, Buenaventura, 7–9.viii.38 (N. A. Weber).

VENEZUELA: San Esteban, 30.xi.39, Caño del Tigre, ix.43 (P. Anduze); Puerto Cabello, 10.v.36, Caracas, 11.v.36, Cumana, 12.v.36, Barrancas, Orinoco R., 15–16.ii.35, junction of Orinoco and Caroni, 31.i.35, s. of Isla Paloma, Orinoco Delta, 6.ii.35, Patos I. nr. Trinidad, 12.vii.35 (N. A. Weber).

ECUADOR: Guayas, Prov. Balao, vii-ix.20 (W. Buthn).

TRINIDAD: St. Augustine, 1935–1936 (E. R. Leonard, W. R. McCreary); Mt. St. Benedict, 1936 (D. Vesey-Fitz-Gerald); Patos I. (see Venezuela), Gasparee I., 1.vii.35. Port of Spain, Botanical Gardens, 10.v.35, Maracas Valley, 900 ft., 23.iii.35, 1000 ft., 18.xi.34, 19.iii.35, 28.v.36, Aripo Valley, 700 ft., 9.iv.35, Tucuragua R., 5.v.35, Tacarigua R., 18.xi.34, Sangre Grande, rubber est., 21.xi.34, Cumana Bay, Anandale Est., 18.v.35, Arena Forest Res. nr. Arima, 12.xii.34, Arima, Mason's Est., 28.iv.35, Foothills north of Tunapuna, 200 ft., 14–25.v.35, St. Augustine, numerous times, 1934–36, Mt. St. Benedict, 850 ft., 27-xi.34, 1.i.35, Nariva Swamp, 5.xii.34, 22.iv.35, Mayaro Bay, 25.xi.34, 6.xii.34, 13.i.35, 10.iii.35, 2.vi.36, Galeota Pt., Ortoire R., Rio Claro, 3.i.35, San Fernando Hill, 500 ft., 3.iv.35, Basin Hill Forest Res., 700 ft., 1.iv.35 (N. A. Weber).

BRITISH GUIANA: Waikarabi Creek, Barama R., 28.iii.35, S. Rupununi Savannahs, 11.xi.35, (J. G. Myers 5023, 5606); Oronoque R., 2°42′ N. Lat., 21 ,31.vii.36, (N. A. Weber).

TAXONOMY. *E. ruidum* may in a sense be considered a junior edition of *tuberculatum*. In coarseness of sculpture and general arrangement of tubercles it is similar. It lacks, however, the occipital tubercles, the head being more rounded behind, and the thoracic tubercles may be much lower. The mesonotum is more strongly delimited here and the thoracic sculpture more reticulate. There is even more contrast between the postpetiole and first gastric segments dorsally, the former being coarsely reticulate-punctate, the latter being finely striate-punctate. *Ruidum* is always much darker, the body being dark brown to blackish brown, the appendages, especially legs and funiculi, being a much paler ferruginous.

Roger's original description is as follows:

P. (*Ectatomma*) *ruida* n. sp.

w. Castanea, nitida, pilosa, valde rugosa, mandibulis, antennis pedibusque rufescentibus, pro- et metathorace bidentatis.

8 Millm. long.

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w. = worker.

♀ 11-12 Millm. long.

Diese Art hat mit dunkleren Stücken der *tuberculata* Latr. die meiste Aehnlichkeit, ist aber kleiner als diese, namentlich ♀. Arbeiter und Weib sind dunkel kastanienbraun, aber mit etwas Bronzeschimmer; Mandibeln, Fühler und Beine sind röthlich-braun. Die abstehende Behaarung ist nicht reichlich. Der Kopf ist auf dem Scheitel grob unregelmässig-, auf der Stirne und dem Clypeus längsgerundzelt. Der Prothorax hat stumpf gezähnte Vorderecken und ist grob, vorn etwas quer gerunzelt; die abschüssige Fläche des Metathorax ist ebenfalls quer-, der übrige Thorax aber unregelmässig gerunzelt. Der Metathorax hat 2 spitze Zähnchen. Die Schuppe hat unten und vorn nur einen kelinen zahnartigen Vorsprung. Das erste Hinterleibssegment ist sehr grob, unregelmäfsig gerunzelt (bei) (einem Stück ist die Sculptur etwas weniger grob als bei den andern Exemplaren); das zweite Segment ist fein, aber scharf, theils längs, theils schräg gestreift.

Die 3 ♀, die mir volagen, sind sehr dunkel braun und viel keliner als die von *tuberculata*; der Prothorax hat die Vorderecken ungezähnt, und ist quer-, der Mesothorax mit dem Schildchen längs-, der Metathorax sammt der Schuppe stark quergestreift. Der glänzende bronzeschimmernde Hinterleib ist auf dem ersten Segment an der Basis mehr quer-, gegen die Spitze hin längsgestreift; das zweite Segment ist in verschiedener Richtung feiner und schärfer gestrichelt. Die Vorderflügel, die bräunlich sind, haben nur die Länge von 9½ Millm., bei *tuberculata* 12 Millm. und darüber.

BIOLOGY. *E. ruidum* is more terrestrial than *tuberculatum* and is commonly found about cultivations and savannahs as well as in scrub and luxuriant rain forest. I have found it from sea level to 1000 feet in Trinidad although doubtless it ascends higher here. In Columbia, however, while it occurred at sea level on the Pacific side and at 3500 feet along the Cauca River system (Rio Porce), I did not find it at Medellín (5500–5800 feet) so that it would appear to be limited to the warm tropical regions. Forel (1912) recorded it from about 5100 feet here but not higher. Similarly at comparable latitudes in the Anglo-Egyptian Sudan (Weber, 1943, Bull. Mus. Comp. Zool. Harvard, 93:263–389) few species of ponerine ants reached 6000 feet on the mountains.

It may be exceedingly common locally. In 1934–1935 the workers were always to be found on the savannah of the Imperial College of Tropical Agriculture, Trinidad and during rains in May and November-December the winged forms were also common. It was the most common ponerine on Gasparee I., Trinidad, July, 1935. *E. ruidum* was the most common or conspicuous ant in an old clearing on a promontory of Barro Colorado Island, Panama Canal Zone, when I visited it with Professor A. Petrunkevitch, who captured here, in a single sweep of his net, a worker ant and two spiders of different families which resembled the *ruidum*.

The nests differ markedly from those of *tuberculatum* in naturally smaller size but especially in lacking the peculiar chimney of clay or fibrous material, the entrance being a simple hole. The observation colony described below came from a nest whose entrance in a sub-vertical road cut was a circular hole three millimeters in diameter rimmed by neatly agglutinated clay particles. In the entrance a worker stood with antennae extended. A tunnel led from the hole about 10 centimeters diagonally into the bank and connected with a discoidal chamber about 15 mm. high by 40 mm. lateral diameter. Larvae, pupae and winged sexes were present here. The males were timid and did not attempt flight. A second discoidal chamber was slightly lower and the ants retreated to this. It also contained refuse in the form of other ant and insect remains with unidentifiable debris. Several sowbugs (Oniscus type) were here.

A nest in the El Hormiguero Creek bottom of the Rio Porce, Colombia was in a hummock 22 cm. high at the side of the little valley. The hummock also contained a nest of the fungus-grower, *Trachymyrmex cornetzi brevispinosa* Weber. The *Ectatomma* nest was 2–12 cm. below the fungus-grower which itself was about 20 cm. deep and consisted of a series of small, horizontal chambers. Brood was arranged according to size, eggs and small larvae in one chamber, large larvae in another, etc. The number of larvae was unusually large and may be accounted for by the large number of dealate females present, 13 being collected. The workers collected amounted to 24 in number but some escaped. The eggs were brown in color after preservation in alcohol seven years and the cocoons pale yellow to brownish yellow.

The nesting habits probably vary somewhat according to the available sites. The ants which were found on dry soil of the arid to semi-arid coast of Venezuela at Cumaná must have been nesting more deeply to maintain the requisite humidity for the brood. Others found in towns and villages (as Porcecito, Colombia and Gatun, Canal Zone) may also modify their habits.

The chief importance of this species lies in its habit of tending homopterous insects on economic crops. The Ecuador record listed above was accompanied by numerous membracids which the ants were tending. At St. Augustine, Trinidad McCreary found them tending *Saissetia oleae* on citrus and I have often found them tending unidentified membracids here, including nymphs and adults on various trees. The habit is much more widespread than the above specific records indicate.

The ants are also predatory and were taken in Trinidad while capturing live earthworms and while carrying locustids, mantids and miscellaneous insects. By the Oronoque River, British Guiana a worker was observed to take a mole cricket (*Scapteriscus*) away from a heavy-set sphecid which was a little shorter than the common *Sceliphron*. A worker in the Canal Zone carried a wing of *Atta cephalotes*, an obvious inedible structure. A worker at Puerto Cabello, Venezuela carried a tiny male ant. Trinidad workers were taken in an old *Nasutitermes* nest.

Like *tuberculatum*, these ants frequent extra-floral nectaries, such as of *Inga* trees, for the sweetish fluid. At Cumana Bay, Trinidad they and *tuberculatum* workers were both at nectaries of flowers from 9 to 10 p.m. Since they were on vegetation at sunrise the next morning the ants may well be active all night.

The ants are commonly found in sweepings with *tuberculatum*. They may also ascend tree trunks. Several times they have been taken in Trinidad in the immediate vicinity of *Atta cephalotes*, *Apterostigma* and other Attini nests but are certainly not likely to prey on the larger workers though the slow-moving smaller ants might readily fall victim. Workers beside an unusually large *Cyphomyrmex rimosus* nest on the beach in Panama (Weber, Rev. Ent., 12:101–103, 1941) probably ignored the deliberate, minute and thick-skinned attines.

A colony of the leaf-cutting ant, *Acromyrmex octospinosus* Reich, was intimidated by *ruidum* workers one day in Trinidad. The workers of *Acromyrmex* were climbing papaya trees and cutting off pieces of the ripe fruit and flowers. They took these back to their fungus gardens in long files over their own paths. The entrances to the nests were in the form of simple holes in the weedy ground. At one entrance numbers of *ruidum* workers were standing about. The *Acromyrmex* were filing in continually, each bearing a piece of fruit or flower. Every now and then a *ruidum* would jump at a leaf-cutter laden with fruit and would sometimes startle the ant into dropping its load. The ponerine would then snatch it up and dash off. One *Acromyrmex*, however, refused to let go and I watched a tug-of-war between it and a *ruidum* over an elongate piece of fruit. For a moment they tugged back and forth, the ponerine gradually drawing the leaf-cutter away from the path, though both ants were of about the same size. Finally the *Acromyrmex* let go and the ponerine made off. At other nest entrances there were similar hold-ups by the predatory ants.

Workers commonly carry females and males about, both dead and alive.

OBSERVATION NEST. A colony of *ruidum* which I was able to keep in an observation nest in Trinidad, B.W.I., revealed several unusual habits, particularly in the locomotion of the larvae and the dark color of the eggs.

It was collected May 5, 1935, in a clay bank beside the Tucuragua River, Northern Range. Females, males and workers with brood were taken. The pupae were in white cocoons. The next day the males attempted flight when the nest was disturbed. The ants killed termites (*Nasutitermes*) that were placed in the nest for food. Two workers were watched removing the cocoon from a pupa and the inner larval skin. Two larvae were feeding on the callow inside. Later the larvae were watched under a binocular microscope. They rasped the integument of the callow of everything removable. The lower mouth parts were used with the aid of the sharp mandibles above. One larva pierced a femur and, when fluid exuded, the clear liquid was drawn into the mouth, presumably by capillarity. A white mite was also feeding on the callow inside its cocoon but kept out of range of the larvae. Two other larvae were feeding steadily on a termite, one larva being on its side, the other resting on its dorsal surface.

About May 21 cylindrical dark brown shiny objects, later proving to be eggs, were noticed stuck together by their long axes. They were beside several small larvae. Larvae had also apparently been feeding on sugar. May 23 they were given a wood-boring insect larva on which the ants fed. May 25 the eggs were still beside the larvae. The long hairs of the larvae were clearly of service in keeping them off the wet floor. The larvae were seen to progress slowly forward by an undulating motion and could also raise the anterior half of the body in the air at times. May 26 three larvae had their heads inside the carcass of a fly given them the previous day.

June 5 there were 25 larvae, including some of very small size, and 13 eggs. The queen died about the middle of May and in the interval a worker had developed a swollen gaster. There were six males. June 11 there were 23 larvae, 18 workers, 6 males and 23 eggs. The additional eggs had had to have been laid by the worker caste and the worker with swollen gaster was present. The workers fed greedily on ripe papaya fruit. June 21 three males and one larva were feeding intently on the anterior end of another larva. Two Collembola were running about the nest and even feeding on the juices on the male mandibles.

July 8 a packet of 15 eggs was present and 6 males, 13 larvae and 15 workers. Two males, a Collembola and a larva were all feeding on one piece of a fly. The larvae and eggs were all preserved. By July 15, 17 eggs had been laid by the worker but no larvae or pupae had appeared. July 31 the ants were given a small piece of a snake, a green tree boa, and the ants shortly were seen to feed upon it. By August 3, 35 eggs had been laid by the worker and these were a lighter brown than formerly. A worker was carrying a male by grasping its antennal scapes in the mandibles and holding it at right angles to the worker's body. There were 16 workers and 6 males. The colony was preserved August 7 with the same population as before.

During the latter part of the period few observations could be made and at this time three larvae, apparently *Microdon*, appeared.[2] They were not at any time observed to feed on

A MERMITHERGATE OF ECTATOMMA RUIDUM

This common ponerine ant has not been recorded before as infested with the parasitic nematode worm, *Mermis*. Few ponerines, indeed, of any genus have been found to contain these worms compared with the numbers of individuals of *Pheidole* and other genera found to be infested. It was not until 1930 that Wheeler recorded *Mermis* in *Ectatomma tuberculatum* from two specimens sent to him from Panama and Trinidad.

March 28, 1935, I found a worker of *ruidum* with considerably swollen gaster walking beside a path at an elevation of 1800 feet on the slopes of Morne Bleu, Trinidad and, suspecting its nature, put it in a container to keep alive. It was given water and sugar. The next day it was actively running about but could not climb glass, presumably because of the weight and bulk of the gaster. It continued to be active on succeeding days and finally on April 6 a live *Mermis* one millimeter in diameter and 128 mm. long emerged.

As described below, the ant shows peculiar combinations of female and worker characters. The sculpturing, particularly on the frons of head, dorsum of thorax, and gaster is that of the female while the more fundamental anatomy is that of the worker caste. The rounded occipital region and thorax is clearly worker. The eyes are intermediate between female and worker while there are traces of ocelli which workers lack. The antennal scapes are longer than in either caste. The petiole and gaster are greatly inflated as the presence of a worm 128 mm. long would necessitate.

To produce these changes the parasite would seem to have entered the ant while in the larval stage. The pupa is protected by a tough cocoon and the adult would seem to be hardly plastic enough, even while callow, to be altered so greatly.

larvae or infrabuccal pellets as they are known to do in other ant nests.

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[2] The myrmecophilous larvae (Fig. 6) are of the Microdon type and are as large or slightly larger than the worker ant larvae. One preserved larva is 2.5 mm. x 6.6 mm. The integument under the microscope appears finely punctate and is scantily covered with hairs. In outline each segment may show one or two large, coarse hairs which are densely and finely plumose as well as shorter and much finer hairs. These two types cover the surface generally. In addition each of the median segments ventrally bears a row of nearly a score of short, truncate setae which may be important in locomotion. Dorsally the segments bear about six of the coarser type of hairs which are directed medially. One might speculate that these hairs function as trichomes or as protection from the mandibles of the ants.

Length with gastric segments distended 14 mm., of head with mandibles 2.8 mm., of thorax 3.4 mm. Length of normal worker from same locality 9 mm., of head with mandibles 2.6 mm., of thorax 3.2 mm. Length of normal worker from Cumaná, Venezuela with gastric segments distended 9.6 mm., of head with mandibles 2.5 mm., of thorax 3.1 mm. Width of mermithergate head back of eyes 1.55 mm., of same Trinidad normal worker 1.42 mm., the eyes themselves being 0.50 and 0.40 mm., respectively. In addition to being larger the mermithergate eyes are more protuberant and more impressed posteriorly than the normal worker.

The corresponding measurements of a normal winged female with contracted gaster from St. Augustine, Trinidad are as follows: total length 11 mm., of head 2.85 mm., of thorax 3.7 mm., eyes 0.60 mm. in diameter though less protuberant than in the mermithergate, width back of eyes 1.74 mm.

The configuration and sculpture of the head of the mermithergate exhibits both worker and female characters. At the site of the median ocellus present in the female is an infuscated depression in the mermithergate and the site of the lateral ocelli are also suggested. The longitudinal striae of the frons is continued farther back than in the worker though less than in the female. The occipital margin, however, is more like the worker than the female, being convex and without occipital angles. The antennal scapes are longer (2.1 mm.) than in the Trinidad worker (2.0 mm.) and much longer than in the female (1.7 mm.). The mandibles appear narrower, more correct and less finely striate than in either.

The thorax from above is generally of the worker type although the three anterior tubercles are much better developed in the mermithergate than in the Trinidad worker or the female. These tubercles, however, vary considerably in the worker caste. The coase reticulation of the normal worker is replaced by longitudinal rugae as in the female. The transverse vermiculations of the epinotal basal surface in the normal worker are also replaced by a more regular transverse rugulation as in the female.

The thorax in side view is also generally of the worker type. The mesonotum, however, is more convex and the sculpturing more regular. The epinotal spiracle is larger and more conspicuous than in either caste and the epinotal tubercle is smaller.

The petiole is distinctly inflated and thicker than in either caste. The sculpturing of the gaster (including the postpetiole) dorsally and laterally is similar to the female and entirely different from that of the worker. It consists, on segments 1-4, of concentric whorls and lines resembling the pressure ridges of the human finger. The distended gaster of the Venezuelan worker alluded to above also shows segments 1-4 clearly but segments 2-4 are smooth and shining. The pilosity is normal but for slightly longer hairs than in the worker. Coloration dark ferruginous as in both worker and female though appearing shinier as in the female due to more regular sculpturing and lack of punctuation.

Explanation of Plate

Fig. 1—Outline of worker of *Ectatomma ruidum* (after Forel).

Fig. 2—Wing of male *Ectatomma ruidum*—Trinidad.

Fig. 3—Outline of larva of *Ectatomma ruidum*—Trinidad.

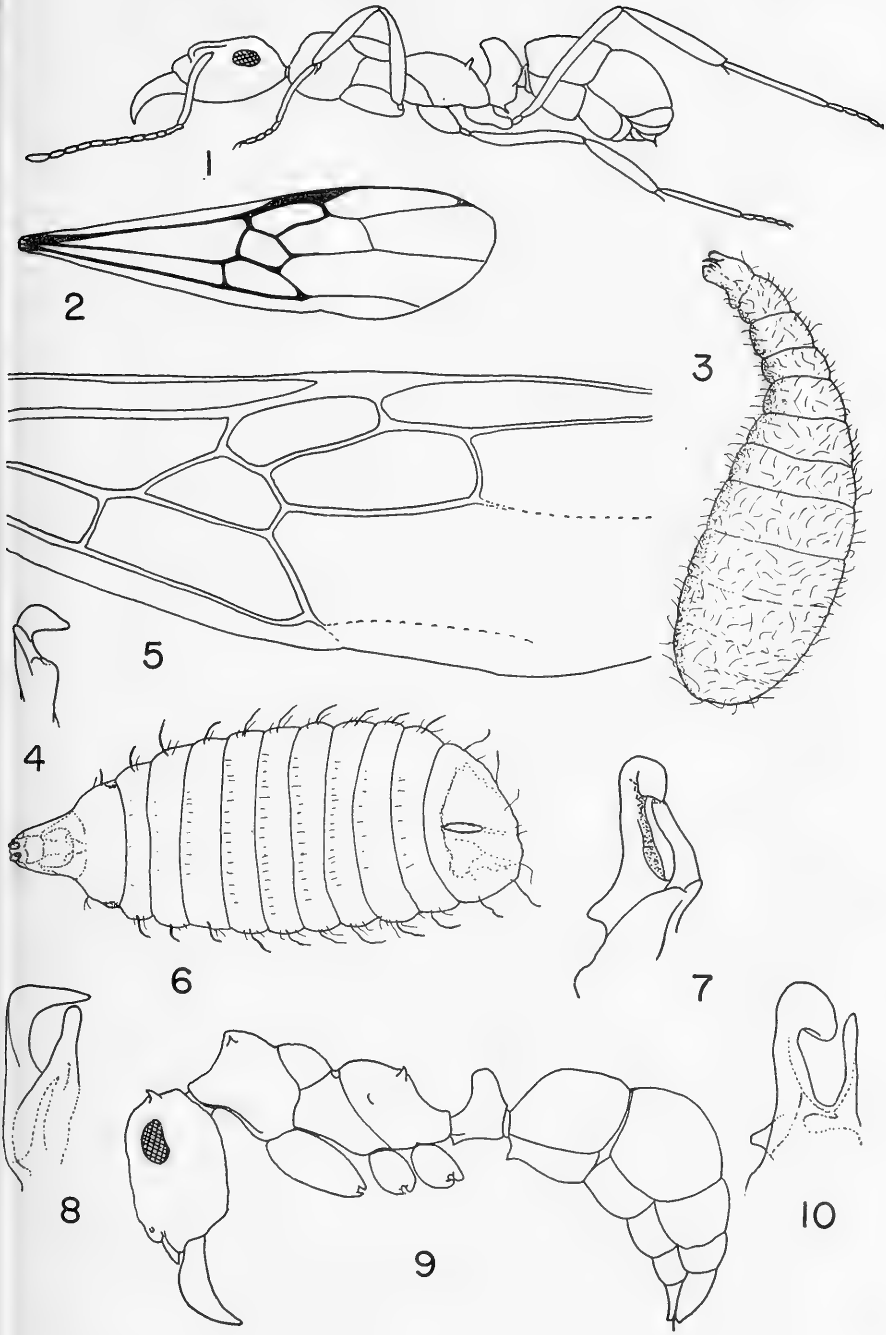
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Fig. 4.—Volsella of male *Ectatomma ruidum* to same scale as Figs. 7, 8, and 10.—Trinidad.

Fig. 5.—Median portion of wing of male *Paraponera clavata* to same scale as Fig. 2, showing similarity in venation to *Ectatomma*—British Guiana.

Fig. 6.—Microdon type of larva from *Ectatomma ruidum* nest showing outline of body and ventral rows of short setae.—Trinidad.

Fig. 7.—Volsella of male *Paraponera clavata* showing long tooth as in *Ectatomma ruidum* and *tuberculatum*.—British Guiana.

Fig. 8.—Volsella of male *Ectatomma tuberculatum*.—Brazil.

Fig. 9.—Outline of worker of *Ectatomma tuberculatum* (after Wheeler).

Fig. 10.—Opposite member of pair of volsellae of *Paraponera clavata* from that shown in Fig. 7 and from another angle.

BEE-KILLING ASILIDAE OF THE SOUTHEASTERN STATES (Diptera)

By S. W. Bromley

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The receipt of a collection of nearly 1,000 asilids with their prey from Mr. M. Eugene Smith of Anniston, Alabama, and Madras, Georgia, throws an interesting light on the prey of southern robber flies. Taken in conjunction with the data obtained from my own collecting and the records and information from the following collectors in the Southern States, the result has been a representative cross-section of asilid prey-habits in this part of the United States:

R. M. Goslin, Dr. and Mrs. H. J. Knull, F. S. Blanton, R. H. Beamer, J. D. Beamer, P. W. Oman, H. H. Bess, C. S. Brimley, D. E. Hardy, E. G. Wegenek, J. Nottingham, L. D. Tuthill, T. H. Hubbell, F. W. Walker, J. W. Johnson, J. R. Watson, R. Foster, J. D. Haynie, William T. Davis, George Barber and the late C. W. Johnson.

The following table illustrates the total number of prey records that I have for the 20 species of "Bee-killers" from the Southeastern U. S. under consideration, the number of honey-bees represented as prey, and the percent honey-bee prey of the total for each asilid species.

HONEY BEE PREY

Asilid	% of total	No. honey-bees	Total prey records
1. *Mallophora orcina* Wied.	82.9	38	47
2. *Mallophora bomboides* Wied.	79.4	27	34
3. *Proctacanthus rufus* Will.	61.1	11	18
4. *Diogmites discolor* Loew (in many collections as *Deromyia ternata*)	50.0	26	52
5. *Proctacanthus heros* Wied.	48.0	12	25
6. *Promachus rufipes* Fabr.	44.0	26	59
7. *Mallophora rex* Bromley (in some collections as *Mallophora bomboides*)	41.6	5	12
8. *Promachus bastardi* Macq.	30.5	23	76
9. *Proctacanthus brevipennis* Wied.	27.4	17	62
10. *Diogmites crudelis* Bromley (in many collections as *Deromyia bigoti*)	20.0	1	5
11. *Mallophora clausicella* Macq.	18.5	5	27
12. *Diogmites esuriens* Bromley (in some collections as *Deromyia bilineata*; others *D. ternata*)	14.2	1	7
13. *Diogmites salutans* Bromley (in some collections as *Deromyia rufescens*)	12.5	3	24
14. *Mallophora laphroides* Wied.	12.5	1	8
15. *Diogmites neoternatus* Bromley (in collections as *Deromyia ternata*)	10.0	1	10
16. *Stenopogon subulatus* Wied	9.9	1	11
17. *Erax interruptus* Macq.	4.0	7	172
18. *Diogmites misellus* Loew (in collections as *Deromyia winthemi*)	2.3	2	84
19. *Erax rufibarbis* Macq.	1.4	4	281
20. *Erax aestuans* L.	.7	1	147

This tabulation confirms the observations of Dr. P. W. Fattig, Curator of Insects, The Emory University Museum, Georgia, that *Mallophora orcina* is the outstanding bee-killer of the Southeastern States.

Dr. Fattig recorded 41 instances of this species killing honey-bees. Next in importance, considering relative abundance, wide distribution, and preference for honey-bee prey, would be *Promachus rufipes*, *P. bastardi* and *Diogmites discolor.* In certain localities, *Mallophora bomboides*, *M. rex*, *Proctacanthus rufus*, and *P. heros* might be more serious bee-killers but their habitats are decidedly restricted and their numbers fewer, rendering them of less importance in the over-all picture.

For further information on bee-killing asilids the reader is referred to the recent Emory University Museum Bulletin III, entitled "The Asilidae or Robber Flies of Georgia," by P. W. Fattig, June 1, 1945.

STUDIES IN THE MELOLONTHINE SCARAB BEETLE GENERA OF THE AMERICAN CONTINENTS. I. REVISION OF THE GENUS ATHLIA.

By Lawrence W. Saylor

Research Associate, California, Academy of Sciences
San Francisco, California

This is the first of a projected series of studies in the genera of scarab beetles belonging to the subfamily Melolonthinae. The species are quite plentiful in the Americas and approximately 105 genera and 2,200 supposedly-valid species (550 species from the United States and 1,640 species from Central & South America and the West Indies) have been described to date; hundreds of proposed names now known to be synonyms are not taken into consideration in the above count. Numerous undescribed species and several undescribed genera await description in the writer's collection, and it is planned to describe these miscellaneous new species in these papers discussing the generic characters and proper taxonomic position.

In no other group of the scarab beetles are the genera so little known and understood, nor as poorly characterized, as in the present subfamily. Moreover, many of the genera are very rarely represented in collections, and at least one-fourth of the known genera are totally unrepresented in United States collections, and I have examined the collections of nearly every one of the larger institutions and museums.

To illustrate the confused condition, in the *Plectris*-group of genera, there are at least four other genera in "common" use today that are either directly synonymous with *Plectris* (when one studies hundreds of species) or must be entirely revaluated and restricted or expanded if we are able to keep and use these names at all. Moser himself, formerly one of the outstanding experts on the group before his death in the 1920's, has described species in *Plectris*, or *Philochlaenia* or *Rhinaspis*, and later decided to move them from one genus to the other for various reasons, and Moser "knew" more species in these "genera" than any previous author.

Based on the study of hundreds of Moser's types in the Saylor Collection (acquired through the courtesy of the world expert on the ruteline scarabs, Dr. Ohaus), it is obvious that Moser's understanding and use of the 'genus' is a little at variance with the commonly accepted use of this category. Many of his genera are well set off, but others (as in the *Barybas* complex) are divided merely on the number of antennal segments, and as any intensive worker on the scarabs knows, this is a highly variable character in many groups; in fact, very many cases are known where a particular specimen has different numbers of antennal segments on the two sides of the head. Moser also used the claw characters extensively and often divided species merely on the possession of cleft as opposed to simple and entire claws; this is frequently variable in the same species and unless it is correlated with other characters, especially differences in *facies*, I do not consider such a valid genus. Thus several of Moser's genera will be reduced in later papers, due to the lack of any *facies* differences, or any differential characters other than highly variable ones.

The principal general writers on the scarabs in the past have been Blanchard, Burmeister, Lacordaire, Bates, Arrow, Ohaus, Casey, Moser and Boucomont. Other individuals have done intensive work either on specialized groups or over short periods of time, among them Brenske, Erichson, Hohne and Prell. Arrow of the British Museum and Ohaus of Mainz, Germany are the only writers left of the former group, and both have been extremely active over many years and are still continuing in the field; Ohaus specializes mainly in the subfamily Rutelinae, and Arrow has worked in the entire family, being especially active lately in the Dynastinae.

Arrow, Ohaus and Moser write excellent papers and descriptions, but the previous older writers are a source of constant trouble to present day writers. Most descriptions of the older authors are usually very short or the most important characters (sexual differences, antennal club length and shape, mouthparts, tarsal characters, genitalia, etc.) are entirely ignored and the most obvious characters are mentioned—namely the color, size and pilosity, with usually only the vaguest references to the type of dorsal sculpturing. Some, such as Blanchard, gave three to five line of Latin and it is very difficult to place the species from these descriptions. No doubt for those times these descriptions were considered adequate and I only mention this to point out the extreme difficulty of deciding which of two or three, or even a dozen or more good species, was the one before Blanchard etc., and to which the name must apply.

In Blanchard's 1850 Catalogue he has widely separated many genera belonging close together and described the two sexes as different genera, and also included in some genera species belonging to different tribes. Burmeister's work is much more extensive and considerably better than Blanchard's short catalogue, but he also frequently ignores sexual differences and other important characters. Lacordaire's work on the scarab genera was indeed an excellent and outstanding piece of work, but he included only 47 genera of our present 105 so is hopelessly out-of date. Much of our present day scarab classification is based in part or entirely on the systems of Erichson, Lacordaire and Burmeister.

Bate's work was usually very good though one must be careful if considering dorsal puncturation in his descriptions: I have noted that in species where the surface is very finely punctate or minutely setose, Bates is quite likely to call it entirely smooth and impunctate, or entirely glabrous. His misidentification of certain older described species in the Biologia, as for example in *Ancognatha* and *Cyclocephala*, is something which may well be expected of any author dealing with the brief color descriptions, or when he lacks access to the types.

Boucomont worked almost entirely in the subfamilies Coprinae, Aphodiinae, Geotrupinae and related laparostict scarabs, and published very extensively from a world standpoint.

Erichson's papers were variably good, in some the species being fairly well described, but in most of his papers the species are very difficult to correctly place from his descriptions.

Casey published extensively on the United States and many Central American scarabs, but limited his work to the subfamilies Rutelinae, Dynastinae and Cetoninae. Even though many of his species, in fact by far the greatest majority of them, have proven to be synonyms of already-known species, his generic work and acuteness of eye in noticing many points of taxonomic interest which had escaped previous authors was outstanding, and he contributed a great deal to our scarab knowledge.

The only writers publishing extensively on the Central and South American scarabs the past five years have been Arrow, Ohaus, Prell and Saylor, but a great deal of work remains to be done; the first part of which is the proper evaluation of the genera, based on the numerous new species continually turning up in nearly every collection.

The Genus ATHLIA

This distinctive genus of scarab beetles, with species in Chile, Peru and Argentina, has long been known to entomologists, but specimens are rare in collections outside of those countries. Since the genotype, *A. rustica* Erichson, was described in 1835, and *plebeja* Burmeister in 1855, no new species have been made known except the Argentine *bruchi*, described by Moser in 1924. Three new species in the Saylor Collection have been awaiting characterization for some years, and the opportunity is taken to review the entire genus, since the characters have never been adequately described, nor the natural affinities pointed out.

Rivers has given an account of the biology of *plebeja* Burm. which is a synonym of *rustica* Er.

Athlia is a very distinctive genus and belongs in the subtribe Sericoidini which includes *Sericoides* Guer. and *Apterodema* Fairm.; it may be immediately separated from these and all other South American melolonthine scarabs at present known to the writer by the labrum being on exactly the same plane as the clypeus; in fact a superficial examination would lead one to believe that the labrum was actually the clypeal apex, unless he looked for the suture between the two. The before-apex insertion of the hind tibial spurs in *Athlia* is the same as in many of the species of the typically-Chilean genus *Sericoides*.

The sexual characters are not well indicated; the main points of difference are in the abdomen, as viewed laterally: that of the male is concave, while the female abdomen is slightly to strongly convex.

ATHLIA Erichson

(Derivation of name: from the Greek, meaning "miserable").

Athlia Erichson, 1835, Arch. fur Naturg., I, P. 1, p. 266; Casternau, 1840 Hist. Nat. II, p. 143; Curtis, 1845, Trans. Linn. Soc., XIX, p. 452; D'Orbigny, 1849, Dict. Univ. d'Nat. Hist., II, p. 293; Blanchard, 1850, Cat. Col., I, p. 84; Solier, in Gay, 1851, Hist. Chile, Zool. V., p. 118, t. 17, f. 9; Burmeister, 1855, Hand. Ent., IV, 2, p. 125; Lacordaire, 1856, Gen. Col., III, p. 210.

Rivera Germaine, 1855, Anal. Univ. Chile, p. 125, (new synonomy); l.c., 1903, CXII–CXIII, Ano. 61, p. 392; Rivera, 1904, Rev. Chile, VIII, p. 241-5, (biology).

Generic characters: Labrum strongly prolonged beyond the clypeal apex but *on the same plane* with the latter, and separated from it at sides by a strong *notch.* Apex of labrum strongly reflexed or not. Mentum longitudinally sulcate in basal half, apex broad and faintly emarginate. Form elongate, elytra more than three times longer than the strongly transverse thorax. Antenna 9-segmented, club 3-segments, ovate and minute. Abdominal segments *free.* Front coxae strongly conical; central and hind coxae both contiguous. Front tibia tridentate, with a narrow inner spur. Tarsi all elongate, variously pilose below in some species. Posterior tibia 7-8 times longer than its greatest width, not flattened, though slightly spinose; with two long, narrow, tibial spurs set on the inner side and definitely *before the apex.* Fifth abdominal sternite *free* and not connate with the propygidium, the last abdominal spiracle set *below* the suture and not contiguous with it.

Key to Species

1. Size very small (7.5 mm.); color entirely testaceous; dorsal hairs very sparse. Argentina........................... *parvissima,* new species
   Size much larger (10–15 mm.); color never pale testaceous............ 2
2. Clypeus entirely convex and sparsely punctate; labrum short, smooth strongly thickened, and not reflexed, the center apex strongly and narrowly incised. Dorsal hairs very sparse and surface strongly shining. Brazil.................................. *brasilica,* new species
   Clypeus convex at center only, and densely punctate; labrum longer, not thickened, usually reflexed, apex at most broadly and not deeply emarginate; Surface dull and pruinose, at most faintly shining 3

3. Above with sparse hairs, the thorax only moderately subdensely punctate; above subshining and pruinose; clypeus coarsely, cribrately and contiguously punctate; elytral hairs and punctures very sparse. Argentina..*bruchi* Moser

   Above densely hairy, hairs of two lengths; thorax very dull and densely though very finely punctate; clypeal punctures not contiguous; elytral hairs very dense, some procumbent and the remainder erect....... 4

4. Color light brown to rufobrunneous and highly pruinose, varying to piceocastaneous and only slightly pruinose; middle apex of labrum from above truncate or very nearly so, if emarginate then very widely and shallowly so, the middle of the emargination *never reaching* to or near the *clypeal apex;* form more flattened and elytral striae strongly indicated, the hairs moderately long and dense. Chile....*rustica Erichson*

   Color rufobrunneous, somewhat dull; middle apex of labrum from dorsal view rather strongly, and somewhat narrowly incised, the incision nearly or quite *reaching* the *clypeal apex;* posterior half of body strongly rounded; elytra with fine short hairs, the striae weakly indicated. Peru and Chile........................*rivera*, new species

Athlia rustica Erichson

A. rustica Erichson, 1835, Arch. fur Naturg., I, p. 267, t. 3, f. 4; Castelnau 1840, Hist. Nat. II, p. 143; Solier, in Gay, 1851, Hist. Chile, Zool. V. p. 118; Burmeister, 1855, Hand. Ent., IV, 2 p. 125.

A. plebeja Burmeister, 1855, Hand. Ent., IV, 2, p. 125 (new synonmy).

Rivera plebeja (Burmeister), Germain, 1903, Rev. Chile, VII, p. 392; Rivera, 1904, Rev. Chile, VIII, p. 241–245, (biology).

Male.—Form elongate oval, slightly wider behind. Color light brown, varying to piceocastaneous, surface very dull to faintly shining. Clypeus coarsely and densely punctate, disc tumid and often with short erect hairs; sides evenly rounded, the apex truncate. Exposed part of labrum nearly one-sixth as long as the clypeus, the apex of the former reflexed and varying from slightly and widely emarginate to truncate, the angles very broadly rounded and the sides separated from the clypeal angles by a distinct notch. Head with front densely, moderately finely punctate, with short erect hairs (surface often rubbed and nearly glabrous). Antenna 9-segmented, club 3-segmented and small and globose, segments 4–7 short and globose, the third a little longer. Mentum strongly impressed in basal half, transversely carinate at the apical two-fifths, then declivous to the faintly emarginate, wide apex. Prothorax strongly transverse, with the sides evenly arcuate, front angles bluntly rectangular, hind angles broadly and subangulately rounded, the base with strong complete marginal line; disc finely and very densely punctate, the punctures separated by 1–2 times their diameters, with short suberect hair. Elytron with strong sutural and 4 other strong equidistant striae, the intervals finely and not densely punctate, the punctures separated by 3–4 times their diameters and with short suberect hairs. Pygidium with short, dense, suberect hair, those at apex a little longer. Front and mid tarsi densely pilose beneath, the segments hardly at all widened. Hind tarsus much less densely hairy below. Claws all deeply cleft, the lower tooth broader and a little shorter. Abdomen finely and not densely punctured, with suberect short hair; 5th and 6th sternites same as the preceding, though the 5th is a little shorter than the others.

Female.—A little larger and with a broader behind; Tarsal pilosity beneath shorter, the front tibial teeth usually larger than in male. Otherwise similar to male. Length 10.5–14.5 mm. Width 5–6.5 mm.

The writer has examined numerous specimens from many localities in Chile, among them Coronel; Santiago; nr. Pangal, VII-1930; Limache, Chili Central, XII-9-24, A. Faz Coll.; Limache, January; and many just plain 'Chili'. *A. rustica* and *plebeja* are only color variations of the same species, although a small very pale specimen certainly does look different from a large and dark one.

Athlia rivera, new species

Male.—Same as *rustica* in all essential characters, except as follows: Form obviously robust and oval behind, the elytra much more rounded dorsally; labrum deeply emarginate at middle, the center of emargination reaching back to the clypeal apex; dorsal hair finer and shorter; elytral striae not well indicated, the interval puncturation much finer; male genitalia identical with those of *rustica*. Length 11-12 mm. Width 6-6.5 mm.

The male *holotype* is from "Chile, Concepcion, P. Herbst. S., Moser det: Athlia n. sp.," and was given to the writer by Dr. Ohaus. The male paratype is from "Peru"; both are in the Saylor Collection. Named for Senor Rivera, who contributed an important beginning towards an understanding of the biology of this interesting genus.

Athlia brasilica, new species

Male.—Form definitely elongate, only slightly wider behind. Color rufo-castancous, the thorax more rufous, strongly *shining* and apparently *glabrous* above. Labrum rather thick, *deeply* and narrowly emarginate at middle, the apex hardly reflexed at all, the angles very broadly rounded. Clypeus with disc evenly convex and sparsely somewhat coarsely punctate. Head with front finely and sparsely punctate. Prothorax finely, unevenly, and sparsely punctate, the punctures separated by 3–5 times their diameters; hind angles obtusely angulate and somewhat explanate. Elytra nearly 4 times longer than thorax, the striae weakly indicated, and the intervals coarsely punctate. Abdomen highly polished, *glabrous*. Pygidium very finely and extremely densely punctate in basal two-thirds, the center-base somewhat granulate; apical third highly polished and finely, very sparsely punctate, with long erect hairs. Tarsi only normally-pilose beneath. Claw of front tarsus cleft, with the lower part very much shorter and broader than the long, slender apical part, Mid and hind tarsal claws strongly cleft, the two parts of nearly equal length. Male genitalia of nearly similar form as those of *rustica* Er. but the parameres stouter and shorter in the present species. Otherwise as in *rustica*. Length 12-14 mm. Width 5.5 mm.-6 mm.

The *holotype* and *paratype*, both males, are from "Nova Galicia, S. Catharina, Brazylja", and remain in the Saylor Collection.

Athlia bruchi Moser

A. bruchi Moser, 1924, Stett. Ent. Zeit., p. 121.

Female.—Form elongate; color rufocastaneous, highly pruinose, slightly pilose above. Labrum widely and shallowly emarginate, very strongly reflexed. Clypeal disc tumid, very coarsely and scabrosely punctured over the entire surface, the punctures contiguous. Thorax very finely and sparsely punctured, with short suberect hairs and with a slight impunctate median line. Elytral striae strongly indicated, the intervals very sparsely, irregularly and finely punctate, the punctyres separated by 3-10 times their diameters, with a few short hairs. Pygidium and abdomen finely and densely punctate, with short suberect hairs. Tarsi only normally pilose beneath. Claws deeply cleft. Otherwise as in *rustica* Er. Length 15 mm. Width 6.5–7mm.

The species was described from Cordoba, Argentina. I have specimens labeled "Argentina" and "Argentina, Neuquen, Moser det.: Athlia n. sp." The coarsely cribrate clypeus, shining surface and less punctured surface will easily distinguish the species, even though males are not at present at hand.

Athlia parvissima, new species

Form very small, highly *polished*, entirely *testaceous*. Thorax and elytra with very minute, semierect hair. Labrum large, strongly reflexed, apex widely and narrowly emarginate. Clypeal disc very tumid, finely and not densely punctate; clypean suture strongly biarcuate. Front very minutely and sparsely punctate. Front angles of prothorax strongly and acutely angulate, hind angles not indicated but very broadly rounded; disc minutely and not densely punctured. Elytra nearly 4 times longer than the thorax, the striae obvious but not strong; intervals minutely wrinkled, finely and sparsely punctate. All tarsi only normally-pilose below. First segment of hind tarsus shorter than second. Claws finely cleft, the lower portion very much shorter than the upper. Length 7.5 mm. Width 3 mm.

The unique *holotype* in the Saylor Collection, apparently a female, is from "Zapala, Neuquen, Argentina, December." The markedly smaller size and entirely testaceous color, and the rounded hind thoracic angles immediately set off this species from all others as yet known.

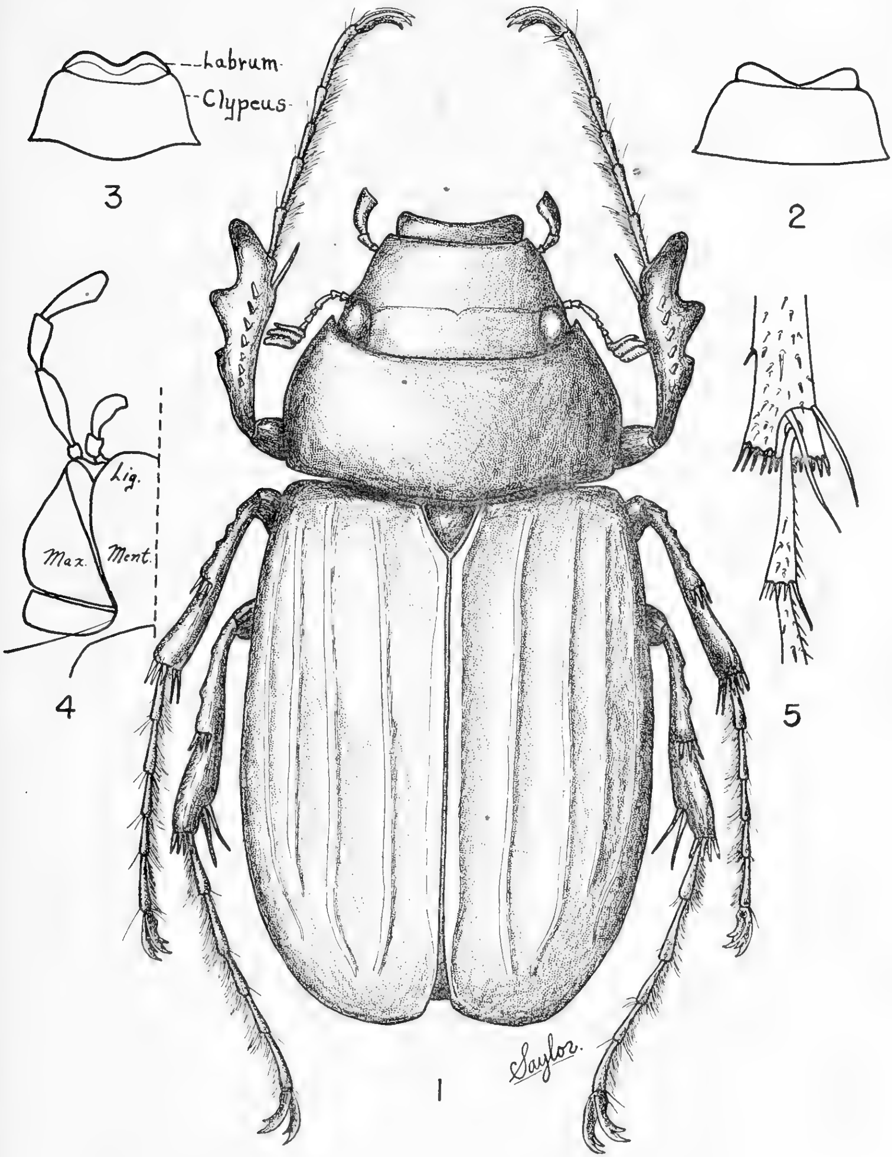

Fig. 1.—*Athlia rustica.* Erichson. (Dorsal vestiture not shown).
Fig. 2.—*Athlia rivera.* Saylor. Clypeus and labrum.
Fig. 3.—*Athlia brasilica* Saylor. Clypeus and labrum.
Fig. 4.—*Athlia brasilica* Saylor. Mouthparts.
Fig. 5.—*Athlia bruchi* Moser. Inner side hind tibia, to show insertion of spurs and tarsus.

MINUTES OF THE 557TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON
October 4, 1945

The 557th regular meeting of the Society was held at 8 P. M., Thursday, October 4, 1945 in Room 43 of the National Museum. President Poos presided and 39 members and 11 visitors attended. The minutes of the 555th regular meeting and those covering the picnic held on June 7, were read and approved.

President Poos announced the death of John D. Maple and appointed C. P. Clausen and H. H. Stage as a committee to prepare a suitable obituary.

C. M. Packard presented the names of eight applicants for membership in the Society and they were elected.

Dr. C. E. Abbott, Wesley Junior College, Dover, Delaware.

Dr. R. F. Anderson, U. S. Bureau of Entomology and Plant Quarantine.

G. P. Callaghan, U. S. Bureau of Entomology ahd Plant Quarantine.

H. R. Dodge, U. S. Public Health Service, Macon, Georgia.

Pedro Galindo, Panamanian Embassy, Washington, D. C.

J. G. Shaw, Laboratorio Entomologico, Apartado 3, Colonia Anahuac, D. F., Mexico.

G. S. Starkey, Tech. Sgt., Medical Department, U. S. Army.

H. H. Swift, U. S. Bureau of Entomology and Plant Quarantine.

E. N. Cory announced that the annual meeting of the American Association of Economic Entomologists will be held at Dallas, Texas, December 3, 4, 5, and 6. The Cotton States Branch of the Association will meet at the same place and time, as will also the Texas Entomological Society.

R. E. Snodgrass reviewed a recent paper by Bt.-Col. Sir S. Richard Christophers, published in the Transactions of the Royal Entomological Society of London, v. 95, pt. 2, p. 25–34, June 1945 entitled: Structure of the Culex Egg and Egg-raft in Relation to Function. The physical reasons why the rafts float, with the eggs in an upright position, were explained. The anterior end of each egg, as it emerges from the female, is downward in the water and it was pointed out that the means by which the female gets the egg into the proper position was not explained.

The first paper on the regular program, entitled: *Parlatoria chinensis* in the United States, was presented by Howard Baker, Bureau of Entomology and Plant Quarantine.

Parlatoria chinensis is a diaspine scale insect which is recorded as having been first collected by Dr. C. L. Marlatt at Taira, Japan in 1901 and later that year at several points in China. It was described by Dr. Marlatt in 1908 from specimens collected on crabapple at Tientsin, China. Subsequent to Dr. Marlatt's collection and description of the scale it attracted but little attention for many years. It has, however, been reported from various points in Upper Egypt and has been intercepted at quarantine stations in the United States on plant material from China, Japan, and India, mostly on various species of *Prunus* and *Pyrus*.

Parlatoria chinensis was first found established in the United States on *Althea* in April 1940 in St. Louis, Missouri and has since been found distributed on about 150 kinds of plants in the city and county of St. Louis and on various species of ornamental *Ficus* in 4 counties in Florida. The infestation in St. Louis is heaviest in the area in and around the Missouri Botanical Garden. No evidence has been obtained to indicate when, where, or in what manner the insect was first introduced into either St. Louis or Florida. However, the introductions into the two areas were apparently independent. Hosts in St. Louis include all of the common deciduous fruits, a number of our common shade trees, and a large variety of ornamental shrubs. Spread outside the vicinity of the generally infested area in St. Louis has been due largely to removal of plants and it is the belief that infested plants have been moved to more distant areas than have been found infested.

The scale overwinters for the most part as an adult female although in mild winters a few immature forms may survive and develop to the adult stages in the spring. There are ordinarily two complete and a small partial third generation each year, crawlers of the first brood appearing from the first to middle of May to early in July and those of the second brood from around the 10th of July to well into September. Third-brood crawlers appear in small numbers from near the end of September until reproduction is stopped by low temperatures, usually by the middle of October. Adult females produce about 40 eggs each which hatch in from 1 or 2 to 10 or 12 days after extrusion, depending upon the prevailing temperature. Crawlers settle in a few hours, usually near the point of emergence and on the woody part of the host in a depression or near a bud, lenticel, or other obstruction. About two-thirds of all scales reaching maturity were found to be males. The seasonal cycle varied within narrow limits from one year to another. Temperatures below near 70° F. and extremely high temperatures retard activity and development.

The results of spray tests carried out in the laboratory and in the field indicate that a quick-breaking type of oil emulsion made from a near 100 viscosity paraffine base oil applied late in the dormant season at a concentration of 3 percent will give a highly satisfactory degree of control as will a 2 percent concentration of a similar emulsion with from .01 to .02 percent cube resins containing a high percent of rotenone added. Likewise, a quick-breaking type of oil emulsion prepared from a highly refined 80 to 90 viscosity paraffin base oil applied during the summer at the times (middle to last of June and middle to last of August) when a majority of the scale population is in the immature developmental stages at a concentration of 2 percent will give a high degree of control as will a 1 per cent concentration of a similar emulsion with from .01 to .02 percent of cube resins added. In control experiments a late dormant application of oil alone or with cube resins followed by one summer application of oil alone or with cube resins gave what appeared to be perfect control in two instances, one of which was in the heaviest infested part of the generally infested area. (Author's abstract).

Comments and questions followed by Poos, Townes, and Siegler.

The second paper on the program, entitled: The Fumigation of Stored Products in England, was presented by A. P. P. Page, Imperial College of Science and Technology, London: Insect fumigants are applied as liquids which vaporize, the gas so formed distributing itself throughout the space being fumigated. Four factors influence the effectiveness of fumigation. These are: the method of application, the circulation of the gas, the loss of gas through leakage from the chamber, and the loss through adsorption on the product being fumigated. Methods of measuring the concentration of gas in the main space in the chamber and in the microspaces, such as the intergranular space, as well as the amount of gas adsorbed by the product were explained. Dr. Page pointed out that it is not possible to predict the effectiveness of fumigation in a warehouse until tests have been made. The difficulties involved in getting the gas evenly distributed throughout the chamber were explained, the best results being obtained by heating the fumigant and circulating the gas through the building by agitating the air. Apparatus devised to measure the amount of gas adsorbed by the material being fumigated was explained. Often sufficient gas is adsorbed to reduce the effectiveness of the fumigation. A series of slides was shown which represented results of adsorption experiments with four fumigants on different products; such as, wheat, wheat bran, corn, etc. (Abstract by Acting Secretary).

Adjournment followed at 10:08 P. M.

W. H. ANDERSON
Acting Recording Secretary

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ANT HOSTS OF THE FUNGUS, LABOULBENIA FORMICARUM THAXTER

By MARION R. SMITH,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The parasitic ant fungus, *Laboulbenia formicarum* Thaxter, has been previously recorded in the United States from only a few forms of ants belonging to the genera *Lasius* and *Formica*, of the subfamily Formicinae. Its discovery on eight new hosts, and especially on ants in two additional genera, *Polyergus* and *Prenolepis*, seems worthy of record. At the same time it would seem desirable to list all our ants known to be affected by the fungus and to make such comments as seem pertinent.

The list below is based on two sources, the writer's identifications and records obtained from literature. New host records are indicated by an asterisk. David H. Linder, curator of the Farlow Reference Library and Herbarium of Cryptogamic Botany, Harvard University, kindly confirmed the writer's identification of the fungus on the ants *Polyergus lucidus* Mayr and *Prenolepis imparis* (Say).

Those who are interested in the morphology, taxonomy, or biology of the fungus will find that these subjects have been rather adequately treated by Thaxter, Wheeler, and Bequaert as indicated in the bibliography at the end of this article.

**Prenolepis imparis* (Say)—Harrisburg, Pa., P. R. Myers.

Lasius (*Lasius*) *niger alienus americanus* Emery—Cambridge, Mass., Roland Thaxter; Columbus, Ohio, M. R. Smith; Raleigh, N. C., Z. P. Metcalf; Battle Creek, Mich., Horace Groskin.

Lasius (*Lasius*) *niger* var. *neoniger* Emery—Ellisville, Mass., W. M. Wheeler; Urbana, Ill., M. R. Smith; Battle Creek, Mich., Horace Groskin; Cedar Point, Ohio, C. H. Kennedy.

Formica (*Proformica*) *neogagates* Emery—Cambridge, Mass., Roland Thaxter; Urbana, Ill., M. R. Smith.

**Formica* (*Proformica*) *neogagates lasioides vetula* Wheeler—Battle Creek, Mich., Horace Groskin.

**Formica* (*Proformica*) *neogagates* var. *vinculans* Wheeler—Ames, Iowa, Wm. F. Buren.

**Formica* (*Neoformica*) *pallidefulva nitidiventris* Emery—Battle Creek, Mich., Horace Groskin; Palos Park, Ill., Robt. E. Gregg.

Formica (*Neoformica*) *pallidefulva schaufussi* Mayr—Forest Hills, Boston, Mass., Joseph Bequaert.

Formica (*Neoformica*) *pallidefulva schaufussi incerta* Emery—Sioux City, Iowa, C. N. Ainslie; Urbana, Ill., M. R. Smith; Battle Creek, Mich., Horace Groskin.

**Formica* (*Formica*) *cinerea* var. *neocinerea* Wheeler—Low prairie, Lake Calumet, Chicago, Ill., Robt. E. Gregg.

Formica (*Formica*) *fusca* Linnaeus—Sioux City, Iowa, C. N. Ainslie.

Formica (*Formica*) *fusca* var. *argentea* Wheeler—Urbana, Ill., M. R. Smith.

**Formica* (*Formica*) *fusca* var. *subsericea* Say—Philadelphia, Pa., Horace Groskin.

Formica (*Formica*) *subpolita* var. *camponoticeps* Wheeler—Hollister and Twin Falls, Idaho, A. C. Cole, Jr.

Formica (*Formica*) *sanguinea puberula* Emery—Nampa, Idaho, A. C. Cole, Jr.

**Formica* (*Formica*) *sanguinea subintegra* Emery—Battle Creek, Mich., Horace Groskin.

Formica (*Formica*) *sanguinea subnuda* Emery—Rogerson and Twin Falls, Idaho, A. C. Cole, Jr.

**Polyergus lucidus* Mayr—District of Columbia, Theodore Pergande.[1]

It is difficult to understand why the fungus has been found to infect some forms in every subgenus of *Formica* but is not known to occur on any forms of *Lasius* belonging to the subgenera *Chthonolasius* and *Acanthomyops*. The most plausible explanation is that the various forms of *Formica* are more commonly associated with each other as host and parasite than are those of *Lasius*. If this hypothesis is true, then one should eventually expect to find the fungus recorded from a very large number of species of *Formica*. It would not be unreasonable to expect that most of the forms of *Polyergus* may be found infected by the fungus, since through their slave-making habits they are intimately associated with many forms of *Formica*.

From data now available the following inferences may be drawn: The fungus undoubtedly has a very wide distribution in this country as indicated by records from such widely separated localities as Cambridge, Mass., Urbana, Ill., Twin Falls, Idaho, and Raleigh, N. C. In this country it may be confined to ants of the subfamily Formicinae, and it should eventually be recorded from many other species of ants belonging to the genus *Formica*, and also probably from various species of *Polyergus*. The fungus is known to affect ants living in such diverse habitats as arid areas and bogs, as well as under more normal conditions. There is evidence that all castes of adult

[1] After this article had been prepared for publication the writer received specimens of *Polyergus rufescens breviceps* Emery infected with a fungus which he believes to be *Laboulbenia formicarum* Thaxter. The ants were collected at Durango, Colorado, June 20, 1945, by Dr. Robert E. and Elizabeth V. Gregg. They were taken at 7.15 P. M. while raiding across a sidewalk.

ants in a colony may be infected by it. The fungus grows on almost any part of the body, including the compound eyes, but it appears to grow most commonly on the dorsal surface of the head, on the gaster, and on the appendages. Present anatomical evidence supported by biological observations indicates that it causes the host ant no serious injury; in fact, the fungus is so superficially seated on the integument that it is often easily dislodged.

In Argentina a closely related fungus, *Rickia formicicola* Spegazzini, has been recorded from *Paratrechina* (*Nylanderia*) *silvestrii* Emery, another member of the subfamily Formicinae. In Europe there appears to be only the single species, *Rickia wasmannii* Cavara, which infects *Myrmica laevinodis* Nylander and *M. scabrinodis* Nylander, both members of the subfamily Myrmicinae.

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A NOTE ON A GRAVID TROMBICULID MITE

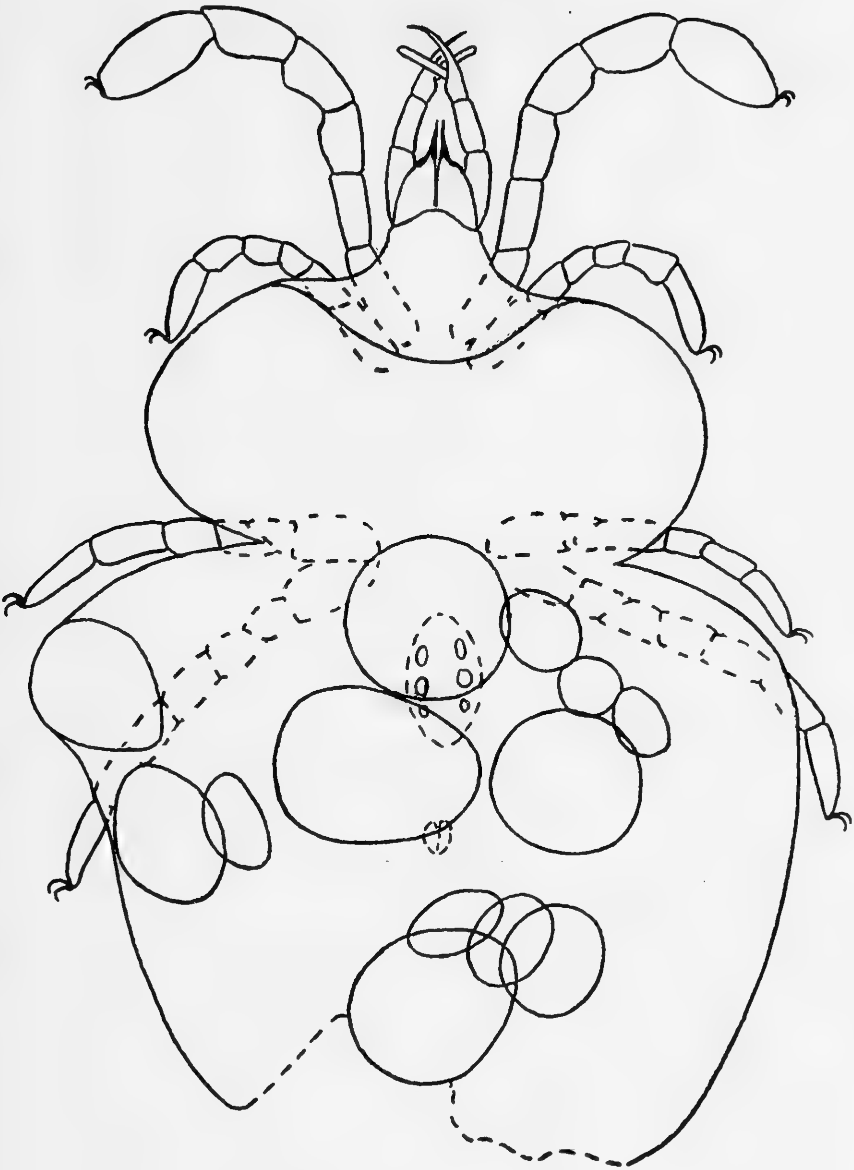
By Donald S. Farner[1]

The manner in which the eggs of trombiculid mites are developed and deposited has been a matter of some interest and diversity of opinion. Dr. H. E. Ewing (1944, p. 340) has recently suggested that the eggs are produced one at a time in the body of the female. He (personal communication) bases this generalization on the examination of a number of gravid females of several species. No more than one mature egg was observed in any one female and in no case has there been another egg approaching half the diameter of the mature egg. No exception to this observation can be found in the collection of adult Trombiculidae in the U. S. National Museum. If this generalization were true it would distinguish the Trombiculidae from the Trombidiidae in which several or many eggs develop simultaneously. Miyajima and Okumura (1917, p. 8) in describing the life cycle of *Trombicula akamushi* (Brumpt) stated that "it may be inferred that the full grown female deposits one egg at a time, because not two ovarian ova mature simultaneously." However, they failed to record definitely whether or not other developing ova of observable size were present at the same time as the mature ovum. In further reference to this species it is of interest to note the diagrammatic illustration by Kawamura and Ikeda (1936, p. 559) of an adult female with five large eggs of approximately the same diameter as well as three smaller ova. Willman (1940b, p. 132) in his re-examination of then type of *Trombicula minor* Berlese observed a single egg in this adult female but regarded it as an abnormal condition apparently believing that trombiculid mites like the Trombidiidae normally develop several mature eggs at the same time. He suggested the possibility that *minor* might normally show a series of developing eggs of increasing size with a single mature egg such as he (1940b, p. 133) found in another cave species, *Speleothrombium caecum* Willmann (1940a, p. 216).

On August 29, 1945 while observing investigations on acaricides at Orlando, Florida,[2] the author collected a specimen which may prove interesting in relation to this problem. The areas in which the tests on acaricides were conducted is an old, partially dry, lake bottom in which the larvae of *Acariscus masoni* Ewing were extremely abundant. Despite rather intensive searching for adults only a single dead specimen with its abdomen crushed was found. However, this single specimen is of interest because it contains at least 13 eggs.

[1] Lieutenant H(S) USNR attached to the U.S.A. Typhus Commission.

[2] At the laboratory of the Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture.



The positions of these eggs are shown in the accompanying camera-lucida outline prepared by Dr. E. W. Baker. The egg nearest the genital opening is spherical and is 0.24 mm. in diameter. This egg has a well developed chorion whereas the others do not. The mite is about 1.4 mm. in length; its greatest breadth at the shoulders is about 0.85 mm. Dr. Ewing (personal communication) has observed at least two (possibly three) types of adult trombiculid mites in the Orlando area. The specimen described here is apparently identifiable with one of these types. Since these adult types have not been associated as yet with the known larvae of the area it is not possible to identify this specimen. It has been deposited in the U. S. National Museum; subsequent systematic investigations will doubtless make its identification possible.

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A NEW SPECIES OF KEIFERIA ON EGGPLANT (Lepidoptera: Gelechiidae)

By Carl Heinrich,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

In the course of the 1944–45 special survey which the Bureau of Entomology and Plant Quarantine conducted in the vicinity of the ports of entry, a new species of *Keiferia* distinct from, but easily confused with, two other economic species of the genus was collected and reared from larvae on eggplant. Since the new species may have some importance as an enemy of eggplant, the following description is offered.

Keiferia peniculo, new species

In habitus (size, color, and markings) hardly to be distinguished from *glochinella* (Zeller) and *lycopersicella* (Busck), somewhat paler than the former, the face somewhat more whitish than ochreous, the white scaling on the palpi a little more marked and the ill-defined, broken, longitudinal lines on the forewing more ochreous than brown; coloration generally like that of pale examples of *lycopersicella*. Yellowish hair pencil on hindwing of male, moderately stout, extending from base to slightly beyond middle of costa.

Alar expanse, 8–11 mm.

Genitalia (pl. 4, figs. 1–4) differing markedly from those of *glochinella* and *lycopersicella*. Harpe of male broadened toward apex; cucullus somewhat broader but considerably shorter (more nearly triangular) than that of *glochinella*, and not forked like that of *lycopersicella*. Aedeagus (fig. 3) short, about half as long as that of *glochinella* or *lycopersicella*. Female genitalia (fig. 4) with ductus bursae weakly sclerotized for a very short distance from genital opening, except for a narrow ring near the opening itself. In *glochinella* and *lycopersicella* the ductus bursae is a strongly sclerotized tube for some distance from the opening.

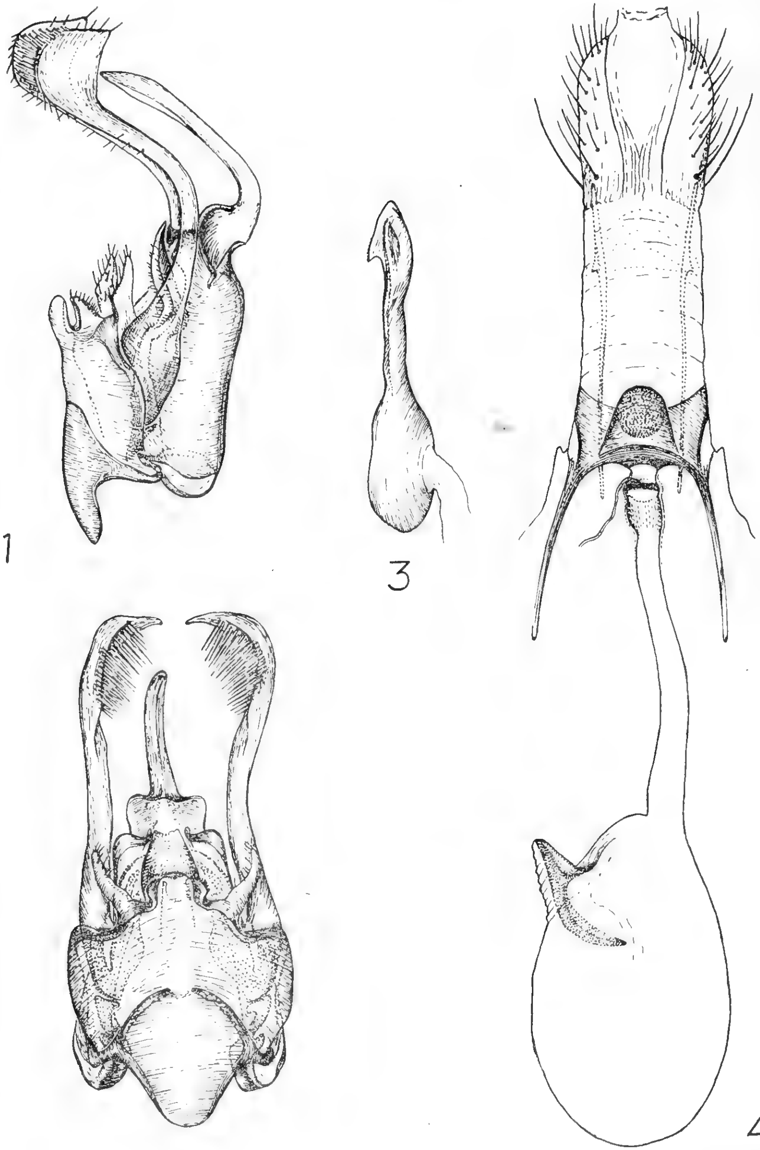
Type and paratypes.—U. S. N. M. No. 57687.

Type locality.—Brownsville, Tex.

Food plant.—*Solanum melongena* (eggplant).

Described from male type (reared under Brownsville No. 58039, June 10, 1944) and 2 male and 3 female paratypes (S. S. No. 24252, December 1, 1944) from the type locality; 5 male and 1 female paratypes from Ysleta, Tex. (S. S. No. 21038, October 10, 1944); 2 male and 1 female paratypes from Tornillo, Tex. (S. S. No. 21315, October 11, 1944). The Brownsville and Special Survey (S. S.) numbers are those under which the specimens are recorded in the files of the Division of Foreign Plant Quarantines of this Bureau.

In addition to the foregoing we have larvae from Laredo and Carrizo Springs, Tex., Las Cruces and Deming, N. Mex., and Indio, Calif. Larval as well as adult characters readily distinguish the species. A detailed description of the larva along with a key separating it from other North American species of *Keiferia* and *Gnorimoschema* is being published by Hahn W. Capps.



2 *Keiferia peniculo, n.sp.* SH

Keiferia peniculo, n. sp. Fig. 1. Male genitalia, lateral view, aedeagus omitted. Fig. 2. Male genitalia, ventral view, aedeagus omitted. Fig. 3. Aedeagus. Fig. 4. Female genitalia, ventral view. (Drawings by Mrs. Sara H. DeBord, of the Bureau of Entomology and Plant Quarantine.

TWO NEW SPECIES OF AEDES (FINLAYA) FROM NEW GUINEA (Diptera: Culicidae)[1]

By WILLARD V. KING, *Lt. Colonel, Sn. C.*, and
HARRY HOOGSTRAAL, *Captain, Sn. C. AUS*

The following two species of subgenus *Finlaya* are of interest in that the mesonotum of each has a narrow median longitudinal stripe of silvery scales similar in appearance to species of the *scutellaris-albopictus* group of subgenus *Stegomyia*. They are, however, readily distinguished from these by having narrow instead of broad scales on the scutellum and vertex of head. More complete descriptions of both species, including the larvae, will be given in a subsequent paper dealing with species of *Finlaya* of the *papuensis* group.

Aedes, (Finlaya) dobodurus, new species

FEMALE.—Mesonotal scales all dark except for a median longitudinal stripe of white scales about one-sixth the width of the thorax, the stripe of about even width throughout except posteriorly where it tapers to a short point, ending in front of antescutellar space. Scutellar scales narrow, entirely dark. Posterior pronotum bare except for a patch of broad white scales on lower third. Proboscis and palpi dark. Fore and mid tarsi with small dorsal white spots at base of segments 1 and 2, and a few white scales at base of 3; hind tarsi with broad white rings on the first four segments, the fifth entirely dark. Abdomen with large lateral basal white spots on segments II to VII, unbanded dorsally.

MALE.—Similar to female except that the mesonotal markings consist of a broadly oval or egg-shaped patch of silvery scales a little more than half the width of the thorax and extending onto upper third of the fossae; palpus with a white ring on the long segment and white spots on basal third of the two apical segments. *Hypopygium:* Coxite with a basal lobe in the form of an elongated ridge having a row of about ten bristles along the rim and scattered shorter hairs; clasper slender, the apical appendage about a fifth as long; apical portion of harpago much longer than the basal portion, the blade slender but with a wide membranous striated keel extending from base nearly to tip; ninth tergite connected in middle by a narrow band, the rounded shoulders without hairs.

Holotype.—Female (K142B), reared from larva taken in a cup fungus near Dobodura, New Guinea, 7 December 1943 (W. S. Monlux, collector). *Allotype.*—Male, same lot as above. *Paratypes.*—8 males, 18 females, mostly with larval exuviae, from Dobodura (Australian New Guinea), Hollandia and Sansapor (Netherlands New Guinea). Collected at elevations ranging from about 100 to 2,000 feet. Holotype, allotype and paratype material deposited in the United States National

[1] From the 19th Medical General Laboratory, U. S. Army Service Forces. Contribution No. 5 from the Entomology-Mammalogy Department.

Museum; other paratypes in the Museum of the Division of Economic Entomology, Council for Scientific and Industrial Research, Canberra, A. C. T. Australia.

The combination of all dark scutellar scales and dark fifth hind tarsal separates this species immediately from closely related species. The size of the membranous keel of the harpago is also distinctive among the known males of New Guinea species. In *A. derooki* Brug, which likewise has a dark-scaled scutellum, the mesonotal stripe is wider (about a fourth the width of the thorax) and the fifth hind tarsal is marked with white.

Aedes (Finlaya) hollandius, new species

FEMALE.—Mesonotum with a median longitudinal stripe of silvery scales very similar to that of *A. dobodurus*. Scutellar scales all pale, narrow. Posterior pronotum with narrow black scales on upper half in addition to the patch of broad pale scales below. Hind tarsi with broad white basal rings on all segments, that on 5 usually more than half the length of the segment. Abdominal segments with large lateral basal white spots.

MALE.—Mesonotum with a patch of white barely touching the edges of the fossae anteriorly and somewhat bulged posteriorly, ending in a short median point in front of antescutellar space. Markings otherwise similar to female (except the palpi, which are similar to the male of *dobodurus*). *Hypopygium:* Clasper with a terminal appendage more than a third its length; apical portion of harpago about equal to the basal arm in length, without a wide membranous keel but with a thin striated membrane around a portion of the blade, the striations having the appearance of coils of wire.

Holotype.—Female (797C–6) reared from larva taken from a fallen palm leaf in mossy forest, elevation about 5,300 feet, Mount Dafonsero, Cyclops Range, Hollandia area, Netherlands New Guinea, 4 March 1944 (W. R. Fullem and H. Cook, collectors). *Allotype.*—Male (797A), same data as holotype except that the elevation was about 4,600 feet. *Paratypes.*—55 males and 53 females, mostly with larval exuviae and all from the Hollandia area (at elevations ranging from 200 to 5,325 feet), except one female each from Finschhaven and Dobodura in eastern New Guinea.

In *Aedes* (*Finlaya*) *argenteitarsis* Brug, the scutal stripe is somewhat wider anteriorly than in the above species and then tapers for most of its length to end in a long sharp point. The scutellum is distinctive, in that the scales of the mid lobe are all white while those of the side lobes are all dark. The male (not previously described) has white scales on all lobes and is similar to the male of *hollandius* except for the shape of the scutal patch, which is triangularly tapered behind instead of rounded.

PHONIOMYIA HIRSUTA, A NEW SABETHINE FROM JAMAICA (Diptera, Culicidae)[1]

By ROLLA B. HILL and CLAIRE McDOWELL HILL

In the course of mosquito collecting we bred out a sabethine which we were unable to identify. Through the courtesy of Mr. W. H. W. Komp, mounts of a larval and pupal skin and male terminalia were sent to Dr. John Lane, who reported that it was a new species of *Phoniomyia.*

FEMALE

A small mosquito. Proboscis slightly expanded at tip, black above, broadly silver striped below. Palpi very short. Tori white, clypeus with whitish reflections. Occiput very dark scaled, a silver patch between the eyes. Eyes bordered with a thin stripe of silver scales, expanding to a large silver spot laterally. Prothoracic lobes with silver scales laterally and below. Mesonotum with dark grayish appressed scales, a few silver scales at anterior margin. Pleura with silver patches. Abdomen black above, silver below, the two colors meeting in a straight line. Legs dark outwardly, with bluish reflections. Femora and tibiae silvery white beneath, extending narrowly onto first tarsal segment. No distinct white markings on other tarsal segments.

MALE

Coloration of the female.

Terminalia. Side-piece small, conical. Median plate with a seta at outer edge. Clasper with 3 main arms and 2 smaller arms coming off the central stalk, each main arm with a different shape. The central stalk ends bluntly, with a central notch, and bears a number of fine hairs at the apex. The external arm looks like a pupal breathing trumpet, and is split in two at the tip. There are a number of blunt hairs on a stalk in the depression caused by this splitting, and a seta and a hair at the outer apex. The middle arm is smaller, bearing setae at the tip. The inner arm is the largest, and is roughly sickle-shaped, with fine hairs at the elbow. The two smaller arms are slender, and bear two or three fine hairs at the tip. Tenth sternite normal, with one terminal spine. Ninth tergite with two stout spines on each side, with a wide interlobular space.

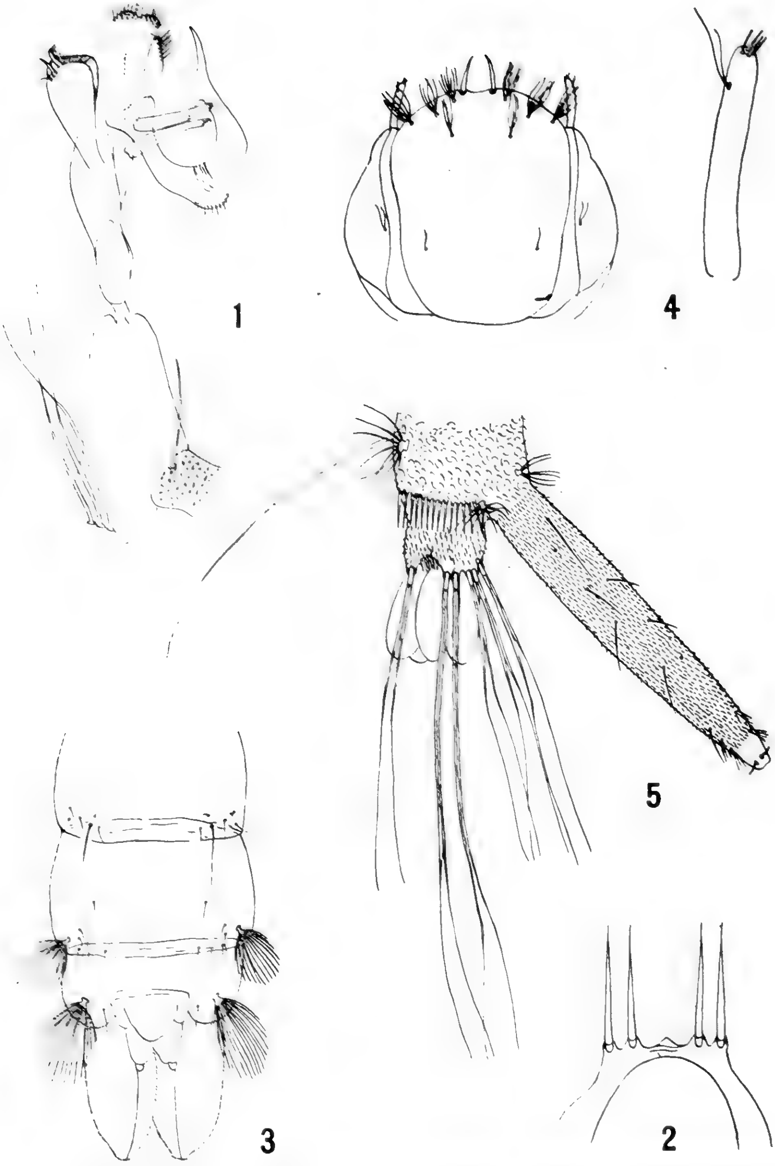
PUPA

Respiratory tube short, cylindrical. Hair B in segments 4–6 longer than the segment. Tuft on segment 7 fan-shaped, slightly smaller than that on segment 8. Paddle longer than eighth segment, bluntly pointed, somewhat spiculose at apex.

LARVA

Head rounded, antennae short, slightly curved, a double hair at apical fifth.

[1] From the Public Health Training Station, supported jointly with funds from the Colonial Development and Welfare Act, the Government of Jamaica, and the International Health Division of The Rockefeller Foundation.



Phoniomyia hirsuta, new species. Fig. 1. Male terminalia. Side-piece and clasper. Fig. 2. Ninth tergite. Fig. 3. Pupa. Terminal segments of pupal skin. Fig. 4. Head of larva, and enlarged drawing of antenna. Fig. 5. Terminal segment of larva. (Camera lucida drawings).

Dorsal head hairs are near the anterior margin, stout, branched. Mental plate with a stout projecting central tooth, circa 12 smaller teeth on each side. Comb of eighth segment of about 24 very long simple spines in a row, projecting well below margin of segment. Respiratory siphon 6 times as long as width at base, tapering to tip, with 2 rows of 5 simple hairs dorsally, and a horizontal row of short branched hairs near tip. Siphon finely pilose except at extreme tip. Anal segment as wide as long, gills almost twice as long as segment, rounded at tips. Dorsal hairs in 6 (4 and 2) lateral hairs in 4, all long. Ventral hairs in 2. The whole segment is finely pilose.

The thorax and abdomen, as well as the terminal segments, are densely covered with fine short hairs. The lateral hairs of abdominal segments 4–7 are long, simple. Other hairs on the abdominal segments are conspicuous, many-branched, and slightly recurved, the whole giving a distinctive appearance to the larva. The hairy appearance of the larva gives the name to the species.

Type locality. Hermitage Dam, Jamaica. Found in epiphytic bromeliads, at an elevation of 1,500 feet.

Type. Holotype 1 female. Allotype 1 male, deposited in the U. S. National Museum.

STUDIES IN THE MELOLONTHINE SCARAB BEETLE GENERA OF THE AMERICAN CONTINENTS. NO: II—A NEW GENUS AND SPECIES FROM GUATEMALA

By Lawrence W. Saylor, *Research Associate, California Academy Sciences*

This very distinctive new genus belongs nearest the genus *Ceraspis* Serv., from which it may readily be separated by the clypeal shape and the non-incised basal margin of the prothorax.

ZABACANA, new genus

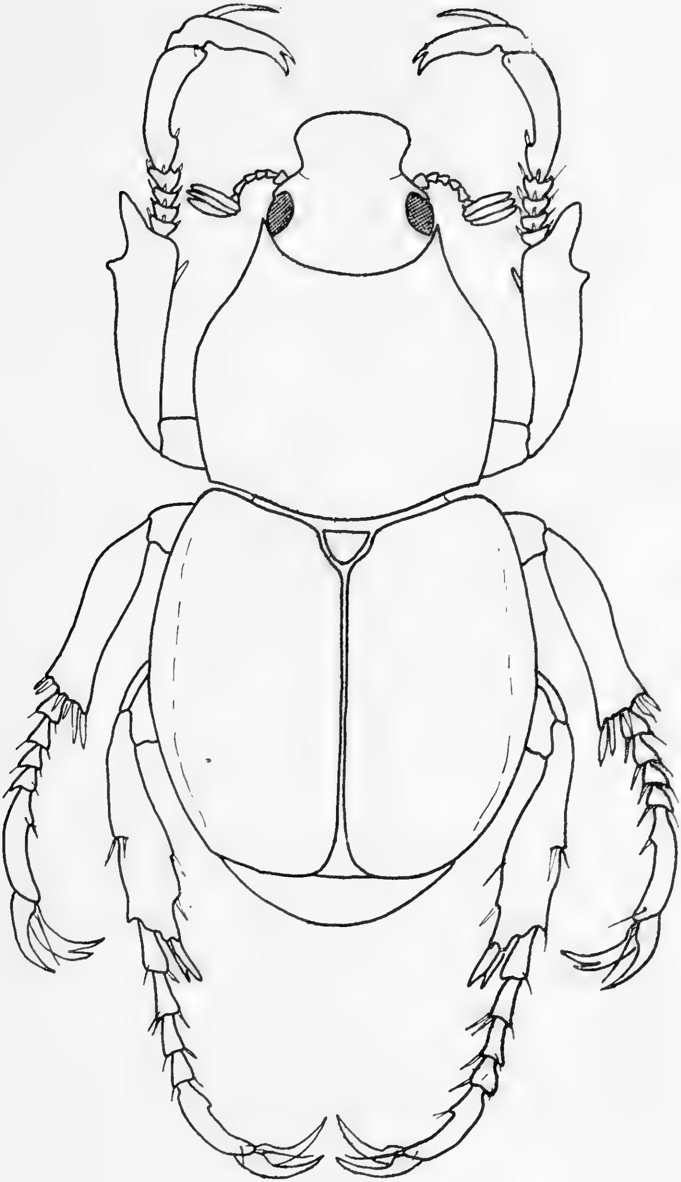
Diagnostic characters: Separable from all American melolonthine genera by the combination of the short stubby body, totally black color, basally-convergent sides of the strongly reflexed clypeus, nearly obsolete clypeal suture, strongly sculptured elytra, strongly unequal claws (each pair of which vary in size and shape), and the evenly arcuate, completely margined thoracic base.

♂: Body short and robust, the elytra broad and hardly longer than the total width. Clypeus long and narrowed basally, the apex markedly reflexed; clypeal suture entirely lacking at sides, only faintly indicated at the very middle. Eyes small in dorsal view. Antenna 9-segmented, segments 2–6 of approximate length, and globose; club 3-segmented. Labrum very wide and entirely hidden under the clypeus, and not connate with the latter. Mentum (ligula) flat and nearly quadrate, apex wide and semitruncate; disc very coarsely and somewhat densely and entirely punctate, with long erect hair. Teeth of maxilla sharp and well developed. Thorax as long as wide, base evenly arcuate and completely margined; lateral margins entire and parallel in basal half, sides strongly convergent anteriorly; posterior angles sharp but not quite rectangular, the front angles produced acutely; anterior margin membranous. Elytra very coarsely and serially punctate, with 8–9 striae between the suture and humeral umbo; intervals narrow and convex; sides with a very strong membranous margin. Pygidium large and evenly convex. Abdominal segments free, 5th sternite as long as the preceding four combined. Front coxae subtransverse. Front tibia with small inner spur; tarsi incrassate and shorter than the tibia, segments 1–4 equal in length and transverse; last segment and claw very large, the claws large and very unequal, the inner with a small though strong accessory tooth before the apex, the outer claw much shorter, very much thinner, and entire. Middle tibia broad, somewhat spinous and thickened; tarsus as long as tibia, the tarsal segments similar to front tarsi in length and shape, but the large claw much more strongly and widely cleft from the apex, rather than before the apex. Hind tibia slightly longer than middle tibia, the two spurs free and small; first tarsal segment *shorter* than second and noticeably widened apically; second longer than third; the large apical segment with claws both entire and simple, the outer claw noticeably larger and longer.

Genotype: Zabacana brevinigrans, new species

Zabacana brevinigrans, new species

Male: Color completely black and rather dull; the thoracic hair and scattered body hairs brownish. Head with front and clypeus both very coarsely, cribrately and contiguously punctured; front somewhat flattened; clypeal sides narrowed basally, the apex strongly raised and reflexed, and faintly rounded, laterally very broadly and evenly rounded, without trace of angulation. Antenna black, the club subequal to funicle in length. Thorax completely, coarsely, contiguously and subcrenately punctured, with dense, rather long and erect hairs. Scutellum completely punctured as thorax, but the hairs very short. Elytra glabrous; disc with very coarse, umbilicate punctures arranged serially, those immediately adjoining sutures and those laterally less orderly; intervals narrow and convex, the interval next to the lateral margin raised into a carina reaching from the humeral umbo nearly to apex. Pygidium evenly convex; disc very densely, entirely, scabrosely punctured, a small midapical area polished and nearly impunctate, the apex ciliate; disc with very sparse, scattered, short suberect golden hairs all pointing towards the center of the disc. Abdomen highly polished; sternites 1–4 each with single transverse row of setigerous punctures; fifth impunctate in basal third, apical margin testaceous and membranous; sixth sternite glabrous and sculptured in basal half, apical margin with long cilia. Posterior femora with rather dense, long hair. Length 10.5 mm. Width 6 mm.



Zabacana brevinigrans, Type.

The unique male *Holotype*, remaining in the Saylor Collection, is from "Antigua, Guatemala, December."

The abdominal spiracles diverging behind and in the sternites, place the genus in the subfamily Melolonthinae (Tribe Melolonthini). The facies are much like the subfamily Cetoninae due mainly to the clypeal shape, but the spiracles as well as the non-conical front coxae and cleft, enlarged tarsal claws forbid its placement in that subfamily.

REPORT OF THE CORRESPONDING SECRETARY NOV. 1, 1944 TO OCT. 31, 1945.

Letters written, 102; many matters attended to informally.

Proceedings acquired, 453 (net gain in 9 numbers); plus 663 (gifts of back numbers); total 1,116. Back numbers sold, 201; 66 early numbers given a South American exchange which had sent us its back numbers (by consent of Executive Committee), and 39 recent ones to a reinstated European exchange.

Net change in stock of Proceedings, gain of 810 numbers.

Memoirs sold; No. 2, 25; No. 1, 2.

Old reprints sold, 11.

Literature sales, total, $173.09.

Membership changes of record; elected 29, resigned or dropped 5, died 3, net gain 21.

At present 5 members in armed forces have Proceedings suspended for duration and 2 members are long delinquent.

Present list, 285 members, including 17 not receiving Proceedings.

Subscribers; 1 lost, 9 added, 3 Europeans reinstated, present list 145.

American Library Association has carried 10 subscriptions for suspended European subscribers. Circulation of Proceedings, 424.

Letters of inquiry have been sent to most of the suspended European subscribers. An answer has so far been received from only 2. We have now 3 regular subscribers on the continent of Europe. It is hoped that the work of getting these reinstated as far as possible may be completed this year.

Respectfully submitted,

F. M. Wadley,
Corresponding Secretary.

REPORT OF THE TREASURER FOR YEAR 1945
GENERAL FUND

Receipts

Funds on hand January 1, 1945:	
Cash and Checks	None
Stamps held as cash	$1.00
Credit in checking account Hamilton National Bank	$557.44
From members:	
Dues for 1945	638.00
Dues in advance	30.00
Back dues	177.00
Initiation fees	26.00
Credited to account as advance deposit	12.20
From subscribers for subscription to Proceedings:	
1945 and back payments	389.25
1946 subscriptions in advance	287.75
From authors, separates and author's copies	135.74
For illustrations and cost of printing	273.76
From institutions:	
For author's separates	48.00
For cost of printing articles	19.71
From sale of back numbers	72.79
Reimbursements for payment of shipping charges	10.36
Total receipts	$2,679.00

Expenditures

To H. L. & J. B. McQueen, Inc., for printing Proceedings (No. 9, Vol. 46 and Nos. 1–8, Vol. 47) and separates	$1,705.12
For 500 clasp envelopes	8.75
To Southern and Standard Engravers for illustrations	232.93
To Charles G. Stott & Co., for 1,000 cards and envelopes	11.75
For clerical services, including duplicating programs, forms and letters	86.14
For stamps	42.17
For carrying and shipping charges for Proceedings	26.43
For miscellaneous office supplies	2.99
For charge at bank for exchanges	.75
Refund to subscribers for overpayment	6.00
Total expenditures	$2,123.03
Funds in checking account in Hamilton National Bank	555.97
Total accounted for	$2,679.00
Outstanding obligations	474.60

PUBLICATION FUND

Schwarz donation fund consisting of principal of $1,000.00 plus accumulated earnings invested with American Building Association until January 1945.

Reported 1944	$1,437.24
Dividend for 1944, credited 1945	43.11
Total	$1,480.35

As authorized by the Executive Committee at its meeting in January 1945, the Schwarz donation fund was immediately withdrawn from the American Building Association and used for the purchase of two War Savings Bonds of the F series. These bonds cost $740.00 each and have a maturity value of $1,000.00 each at the end of 12 years, that is, on January 1, 1957. They are filed for safekeeping with the Treasurer of the United States. The remainder of the earnings amounting to 35 cents was deposited in the savings account.

Total in Schwarz donation fund	$1,480.00
Knab bequest, consisting of principal of $1,400.00, plus accumulated earnings, invested with Columbia Federal Savings and Loan Association, reported 1944	$1,511.59
Dividends received in 1944, credited 1945	15.97
Dividends received 1945	19.09
Total in Knab bequest	$,1546.65
General publication fund, in savings account in Hamilton National Bank, January 1, 1945	$1,226.61
From sales of Memoir No. 1 (1 copy)	2.40
From sales of Memoir No. 2 (25 copies)	63.20
From interest on savings account	10.77
Transferred from Schwarz donation fund	.35
Total in General Publication Fund	$1,303.33
Total amount of publication fund	$4,329.98

Respectfully submitted,

L. B. Reed, *Treasurer.*

The Auditing Committee has examined the report and the accounts of the Treasurer of the Entomological Society of Washington for the calendar year ending December 31, 1945, and find them correct and in good order.

H. H. Stage

G. J. Haeussler

Auditing Committee.

MINUTES OF THE 558TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON
NOV. 1, 1945

The 558th regular meeting of the Society was held at 8 P. M., Nov. 1, 1945, in Room 43 of the National Museum. Dr. Weigel presided and there were 39 members and 13 visitors present. The minutes of the previous meeting were approved as read.

Dr. V. S. L. Pate, Department of Entomology, Cornell University, was elected to membership in the Society.

Dr. Townes reported that two more earwigs have become established in the United States, bringing the number in our fauna to sixteen species and a subspecies. Only five of the sixteen are native species, and no other large body of land has such a scant number of native earwigs. On Jan. 31, 1941, *Marava wallacei* was found infesting a bakery at Dumont, New Jersey, and in July 1942 was noticed by a householder at Summit, New Jersey. These are the only records to date. The locations of these two colonies indicate that the species came in at the port of New York and is probably widespread in the vicinity. It is a native of the East Indies and of northeastern Australia. Quarantine records show numerous interceptions in shipments from these localities. The species promises to be an occasional minor pest about warehouses and other buildings. It is very closely related to the introduced *Prolabia arachidis* but is larger and darker. The hind wings, always lacking in *arachidis*, are usually present. *Euborellia stali* was collected under the bark of a pine log near Miami, Florida in April, 1945, by Mr. I. Cornman. It is a native of the Oriental Region, but has become widely distributed in the moist tropics. Though common in Central America and the West Indies, it has not before been taken in the United States. It will probably not spread beyond the Gulf Coast strip and will be only a minor nuisance. Although very closely related to the introduced *Euborellia annulipes* it is smaller, has shorter antennal segments, and has the rudiments of the forewings present.

R. E. Snodgrass discussed the mouth parts of fleas in relation to their biting habits. Cat fleas, placed on his finger, were observed under a microscope. There are three long, slender, stylets, of which one is solidly fixed in the roof of the mouth; the other two, paired and somewhat broader, are attached by basal levers on the maxillae, of which they are the laciniae. Four rows of teeth on each lacinia, pointing upward, catch in the flesh when the stylets are thrust in. This prevents their being pulled out when the muscles contract again in preparation for the next downward thrust. The process involves a succession of rapid, little, strokes—the principle of the pneumatic drill. Mr. Snodgrass illustrated his talk with diagrams on the blackboard, and with illustrations drawn from a live, feeding, flea.

The following Nominating Committee was appointed: Dr. Fracker, Mr. Snodgrass, Mr. Wade.

The first paper on the regular program was presented by Dr. E. E. Fleck: The Chemistry of DDT.

DDT is derived basically from alcohol, salt, coal and sulfur. The alcohol is chlorinated with chlorine, obtained from salt, to give chloral. The coal furnishes the benzene which is in turn chlorinated to make chlorobenzene and the sulfur furnishes the sulfuric acid which is used to condense the chloral and the chlorobenzene to make DDT.

The technical grade of DDT, prepared by this process, contains about 75% of the active p,p -isomer and 25% of the less active o,p -isomer. To prepare the aerosol grade of DDT this o,p -isomer is removed by recrystallization.

DDT must be formulated to aid in its application as an insecticide. It may be applied as a dust, an aqueous suspension, emulsion or solution in organic solvent. For this purpose DDT is ground with inert material to form dusts and wettable sprays. To form a sprayable emulsion the DDT is first dissolved in a very good solvent that is insoluble in water, such as xylene; an oil soluble emulsifying agent is then added and the resulting solution is poured into water to produce the emulsion.

DDT is also sprayed in oil solution either by regular sprayers or in aerosol form. Since kerosene and fuel oil are not particularly good solvents for DDT, use is made of a co-solvent when high concentrations of DDT are required.

Analysis of DDT may be made by the total chlorine, hydrolyzable chlorine, or colorimetric methods. Use has also been made of dyes added to oil solution sprayed from airplanes to determine the DDT deposited. Glass plates exposed to the spray are washed with alcohol and the amount of dye in the washings is measured with a photometer. From known concentrations of dye and DDT in the original oil the amount of DDT deposited on the ground may be calculated. (Author's Abstract.)

In discussion by Bishopp, Annand, Townes, Cory, Siegler, McGovran, Capt. Jones, and Col. Worthley it was brought out that: 1) when free of interfering substances, animal tissues are as easily analyzed as plant material; 2) the effect of ultra violet light (although there is sufficient breakdown to affect toxicity) is not completely understood but is being studied; 3) it is a full day's work to analyze one ordinary sample by the colorimetric method; 4) DDT is not readily removed from fruit by washing and has a tendency to dissolve in the waxes on apples.

The next paper was presented by J. A. Hyslop: An Encyclopedia of American Economic Entomology.

Only a small number of the 80,000 recognized species of insects in America north of Mexico can be known to the thousands of workers interested in entomology, and reference to the voluminous literature concerning these species is only possible in the largest libraries. Over 30 years ago a copy of Bailey's Encyclopedia of Horticulture suggested the desirability of a similar reference book in the field of entomology. Ten years later the author was placed in charge of the newly created Insect Pest Survey in the Bureau of Entomology, and the Federal and State records collected proved a valuable aid for the commencement of the insect encyclopedia. The geographical range of the book is limited to America north of the Rio Grande in order to exclude the tropical, subtropical, and Sonoran insects of Central America and the West Indies. Material includes all insects, arachnids, and related forms of known consequence. It contains 30,000 entries (25,000 when common names, cross references, and synonyms are excluded), of which 8,000 are at present of known economic importance. The arrangement is alphabetical by genera and higher ordinals. Genera are shown in bold-faced type; the species appear in alphabetical order under each genus. Where a species name is no longer in use, a citation is given showing its place and date of publication, followed by a *See* reference to the present name. A species which has been transferred to another genus appears with a *See* reference to the new combination. Where the species name is still valid there is given, besides the citation to the original description, the common name and the nature of injury caused. If of economic importance there follows: a brief description of the various stages; the life history, distribution, food plants, known parasites or predators, and hosts. For imported insects, the time and place of introduction is given. Families are also printed in large type. Citations are given to the more important papers.

Entomological terms not found in an unabridged dictionary are included in alphabetical sequence. Illustrations of the more important insects are included and, whenever possible, the picture of at least one member of each family discussed is given. All citations to literature have been checked with the original publication; the status of each species has been approved by a well-known authority. The insect encyclopedia is not intended as a taxonomic work, but rather as a reference tool for those not familiar with taxonomic procedure. Mr. Hyslop closed his paper with expressions of appreciation for the assistance received from Mr. Muesebeck and his staff, from Miss Gertrude Myers and other members of the Insect Pest Survey staff, and from the former Library of the Bureau of Entomology and Plant Quarantine. (Secretary's Abstract.)

There was discussion by E. H. Siegler, H. K. Townes, R. E. Snodgrass, Mortimer Leonard, and Col. H. N. Worthley.

The following visitors were introduced to the Society: Col. H. N. Worthley, Capt. George D. Jones, and C. S. Carbonell of Montevideo, Uruguay.

The meeting adjourned at 9:45 P. M.

INA L. HAWES,
Recording Secretary.

MINUTES OF THE 559TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON DECEMBER 6, 1945.

The 559th regular meeting of the Society was held Thursday, December 6, 1945, at 8 P. M., in Room 43 of the National Museum. There were 38 members and 19 visitors present. The meeting was called to order by President Poos and the minutes for the previous meeting were read and approved.

New members were elected as follows:

Lt. D. W. Jenkins, Entomologist, Chemical Warfare Service, Edgewood Arsenal, Md.

Dr. Mary Talbot, Prof. of Zoology, Lindenwood College, St. Charles, Mo.

Lt. G. W. Wharton (H. S.) U. S. Naval Reserve (future address: Duke University, Durham, N. C.)

The Corresponding Secretary, Dr. F. W. Wadley, gave his report. L. B. Reed presented his report as Treasurer, and Dr. Poos announced that G. J. Hauessler and H. H. Stage would act as auditors. Informal reports were given by the Editor, Dr. Alan Stone; the Chairman of the Membership Committee, C. M. Packard; and the Chairman of the Program Committee, Dr. H. K. Townes.

Dr. Poos emphasized the importance of increased membership in order to provide funds for publication of the Proceedings, the cost of which has increased materially in the last few years.

The following names, presented by the Nominating Committee, were unanimously approved as officers for the coming year:

Honorary President....................................L. O. Howard
President..G. A. Weigel
First Vice-President...................................Austin H. Clark
Second Vice-President.................................E. H. Siegler
Recording Secretary...................................Ina L. Hawes
Corresponding Secretary...............................R. I. Sailer
Treasurer...L. B. Reed
Editor..Alan Stone
Executive Committee............ R. W. Harned, P. N. Annand, F. W. Poos
Representative to the Washington Academy of Sciences C. F. W. Muesebeck

The regular program was then resumed with the new President, Dr. Weigel, presiding.

The first paper was presented by Dr. C. H. Hoffman: Studies of the Effects of DDT on Insect Fauna.

Intensive studies were made this year to determine the effect of DDT on general insect populations in two sizable areas—one comprising 1560 acres of gypsy moth infested forest near Scranton, Pennsylvania, and the other 117 acres of deciduous bottomland forest on the Patuxent Wildlife Refuge, Bowie, Maryland, both of which were sprayed with 12% DDT oil solutions dispersed by airplanes. In addition, studies of aquatic insects were made in treated streams. These studies were carried on jointly by the Division of Forest Insect Investigations and the Division of Insect Identification in cooperation with the Division of Gypsy and Brown-Tail Moths Control (U. S. Department of Agriculture), the Pennsylvania Department of Agriculture, and the New York Conservation Commission.

The different methods employed to measure insect populations in treated and in similar untreated areas, both before and after spraying, involves the use of light traps, fly traps, cloth-bottomed trays, tree jarrings, sticky boards, box samplers, net sweepings, ground traps, Berlese funnels, stream samplers, and general observations. The tremendous number of insects collected have not all been identified and the notes summarized; therefore, only preliminary results are now available.

One square-mile within the Scranton area was treated in blocks largely at the rate of 3 to 5 pounds of DDT per acre, this dosage being at least five times greater than that necessary for the control of common defoliators of forest trees. Adjacent acres were treated with less than 3 pounds of DDT per acre. Within a few hours after the spray was applied, large numbers of insects were affected. Detailed observations were made in the square mile area. Caterpillars feeding on the foliage of trees were eliminated. Those infesting low vegetation were initially reduced in numbers, but within three months they were as abundant as in the untreated control area. There was apparently no reduction of larger moths. Smaller moths were moderately reduced. Hymenopterous parasites of arboreal hosts were greatly reduced, while those parasitic on humus-inhabiting Diptera continued to be present in considerable numbers. Ants and scale insects were relatively unaffected. Aphids increased tremendously in the sprayed area, but the outbreak was curtailed by heavy rains. Parasites and predators of aphids were reduced by the spray, but two months later several species were back in effective numbers. The calyptrate fly population as a whole remained low for at least two months. The majority of the ground-inhabiting Coleoptera were not seriously affected, nor were many Orthoptera. Spiders occurring on the ground and among stones and bark maintained normal numbers, whereas the orbweavers and other exposed web spinners were almost eliminated.

The Patuxent area was treated at the rate of 2 pounds of DDT per acre. In general the effect of the DDT was not prolonged, and most of the species studied appeared to occur in usual numbers two or three weeks later.

For experimental puposes, a three-mile section of a stream in Pennsylvania was sprayed at the rate of 1 pound of DDT per acre, the spray being released from an airplane flying directly over the water. Analyses of DDT deposition filter papers showed that about one-fourth pound per acre was actually deposited. This application caused a drastic reduction in the population of aquatic insects. (Author's Abstract).

The paper was illustrated by lantern slides. Discussion followed by Muesebeck, Townes, Poos, W. E. Hoffman, Snodgrass, Sailer, and C. H. Hoffman.

A series of papers under the general heading, "Entomological Activities in Combat Areas," was given by returned members of the armed forces.

Lt. (j. g.) J. M. Hutzel of the Bureau of Medicine and Surgery, U. S. Navy, spoke on his experiences with malaria control units in the Marshall Islands, on Iwo Jima, Okinawa, and on other islands in the South Pacific.

Maj. D. G. Hall of the Sanitary Corps, Army of the United States, told of his work in Central and South America, and later in the Pacific Area. In the American Theatre, he headed a small corps of sanitary engineers attached to the Corps of Engineers on the Construction of Army Air Bases to advise on the control of communicable diseases, including those which might be insect-borne. Malaria at these bases was kept to a rate less than that in the southern part of the United States. Major Hall also referred to the successful use of DDT in the Pacific, emphasizing the small dosages required. He spoke of his interest in developing the work of a unit organization as contrasted with his previous work as an individual entomologist.

Lt. G. W. Wharton (H.S.) U. S. Naval Reserve, spoke on: Studies on *Neoschöngastia indica* Hirst 1915. There are six stages in the life cycle of *N. indica:* egg, larva, nymphochrysalis, nymph, imagochrysalis, and imago.

The larvae are parasitic on rats. The free-living nymphs and adults use the eggs and early larval instars of small arthropods as food. (Authors Abstract).

The series was concluded by Lt. Com. K. L. Knight (H. S.), U. S. Naval Reserve. He gave an account of studies on the taxonomy of the anopheline complex in the South Pacific, and also of a mosquito survey in the Philippines. Specimens collected in the Philippines will be deposited in the U. S. National Museum.

The following visitors were presented to the Society:

Dr. Oswald Peck, Dominion Department of Agriculture, Ottawa, Canada.

Capt. S. E. Shields, formerly with the U. S. Bureau of Entomology and Plant Quarantine.

Capt. F. G. Wallace, Sanitary Corps, Army of the United States.

The meeting was adjourned at 10:15 P. M.

INA L. HAWES
Recording Secretary

Actual date of publication, March 18, 1946

VOL. 48 March, 1946 No. 3

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

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THE

ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884.

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

Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

PROCEEDINGS
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The Corresponding Secretary and Treasurer should be addressed similarly.

PROCEEDINGS OF THE

Entomological Society of Washington

VOL. 48 MARCH, 1946 No. 3

ON EUPLILOIDES, AN ORIENTAL SUBGENUS OF CROSSOCERUS (Hymenoptera: Sphecidae: Pemphilidini)

By V. S. L. Pate,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The large and complex pemphilidine genus *Crossocerus* is divisible into a large number of subgenera, as I have recently demonstrated.[1] The collection of the United States National Museum, which I have recently had the privilege of studying, contains several Oriental and Oceanic species that superficially resemble those referable to the Oriental subgenus *Apocrabro*, but these forms differ from *Apocrabro* in a number of striking features and require a new subgenus for their reception. A review of this new subgenus is presented herewith.

EUPLILOÏDES, new subgenus

Rhopalum Ashmead (nec Kirby), U. S. Natl. Mus. Proc. 28: 130, 150, 1904; Brown, Philippine Jour. Sci. 1: 687, 1906.

Genotype: *Rhopalum albocollare* Ashmead, 1904 [=*Crossocerus* (*Eupliloides*) *albocollaris* (Ashmead)].

The superficial habitus of the present group is similar to that of *Euplilis*, but the sharply carinate prepectus, the simple, obterete hind tibiae, and the four-segmented labial and six-segmented maxillary palpi indicate at once that the component species cannot be assigned to that genus. Like the members of the recently described Oriental complex *Apocrabro*, the species of *Eupliloïdes* have the abdomen petiolate, the mandibular apices evenly bidentate in both sexes, and the occipital carina terminating below in a spine or tubercle in the female sex. However, the sharply carinate anterior margin of the mesosternum, the clavate antennal scapes, and the long anal lobe of the hind wing readily distinguish *Eupliloïdes* from *Apocrabro*. Moreover, the first abdominal segment of *Apocrabro* is gradually ampliate toward the apex and perfectly sessile with the second segment, whereas in *Eupliloïdes* the petiole is very slender, elongate and cylindrical, abruptly nodose at apex, and separated by a strong constriction from the remainder of the fusiform

[1] Lloydia 6: 257–317, 1943 [1944].

abdomen. The absence of a pygidial area on the last abdominal tergite of the female is a unique characteristic of the present group and immediately differentiates *Eupliloïdes* from all other subgenera of *Crossocerus*.

Diagnostic features.—Small, slender, elongate, fulgid, impunctate, or at most finely punctate, forms with petiolate abdomen. Head somewhat broader than thorax; subquadrate to transversely subrectangular in both anterior and dorsal aspects; malar space wanting. Eyes very large, naked, inner orbits arcuate and very broad below in anterior aspect; very coarsely faceted anteriorly, finely so posteriorly. Front very narrow, shallowly concave, glabrous and nitidous on anterior vertical aspect between inner orbits; unarmed medially below; upper horizontal portion of front flat, on same plane as vertex, bisected by a deep impression running forward from anterior ocellus to the immarginate scapal sinus. Vertex flat, simple; supraorbital foveae absent; ocelli rather large, arranged in an equilateral triangle, the ocellocular line always much longer than the postocellar line; occipital carina well developed, more or less flanged, not a complete circle in extent, curving forward beneath toward, but not attaining, the posterior mandibular condyles, and terminating in a small tooth or tubercle; oral fossa transversely subelliptical, the hypostomal carinule well developed, more or less flanged, with a small lobe or protuberance on midventral line, but without lateral arcuate carinules to the inframandibular lobe as in *Apocrabro*. Temples moderate, simple, ecarinate. Antennae with scapes slender, straight, elongate-cylindrical, weakly clavate on apical third, ecarinate; pedicel suborcate; flagellum simple in both sexes, and without a fringe of hairs beneath in males. Clypeus transversely linear laterally, with a short median lobe which is denticulate or crenulate apically. Maxillary palpi with six segments; labial palpi with four segments; prementum bisected by a trenchant keel or sharp carina. Mandibles slender, elongate; apices evenly bidentate in both sexes; lower margins entire; inner margins edentate. Females without a psammophore.

Thorax narrower than head, more or less fulgid; dorsum and pleura impunctate or finely punctate at most. Pronotum short, transverse, situated almost on same level as mesonotum, not notched medially nor sharply carinate anteriorly. Mesonotum simple; axillae oblique, linear, with lateral edges bluntly margined; suture between mesonotum and scutellum broadly, deeply impressed and foveate; scutellum and postscutellum simple, the areas laterad of each deeply excavate. Propleura simple, not produced into a stout tuberculoid process at lower outer angles. Mesopleura with prepectus very sharply margined anteriorly; simple or armed with a small tubercle before middle coxae; episternal suture distinct, foveate; mesopleural pit small but distinct; lacking any indication of episternauli, mesopleurauli, hypersternauli, or sternauli. Mesosternum sharply carinate anteriorly. Propodeum nitidous, without appreciable sculpture; dorsal face without a defined trigonal enclosure but bisected by a sulcus which terminates in the deep furrow bisecting posterior face; lateral carinae present but developed only along lateral margins of posterior face, simple below.

Legs simple, slender, elongate in both sexes. All tarsi simple, but last seg-

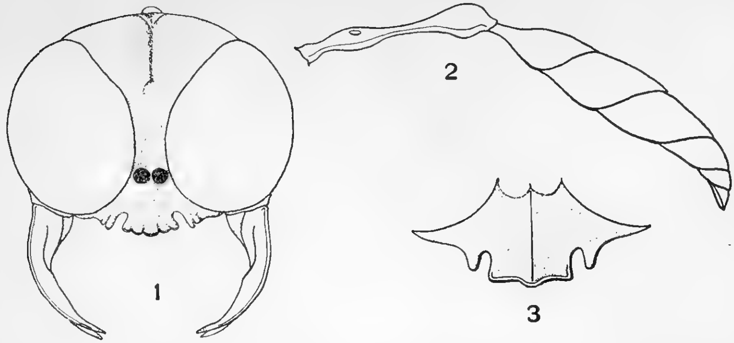

Fig. 1.—*Crossocerus* (*Eupliloïdes*) *bougainvilleae*, n. sp.: Anterior aspect of head; Fig. 2.—*Crossocerus* (*Eupliloïdes*) *leontopolites*, n. sp.: Lateral aspect of abdomen; Fig. 3.—*Crossocerus* (*Eupliloïdes*) *leontopolites*, n. sp.: Anterior aspect of clypeus.

ment large and swollen in both sexes; females without a distinct pecten on fore metatarsi. Both sexes with an apical calcar on middle tibiae, and with hind tibiae simple, obterete. Hind coxae simple, edentate beneath in males.

Forewings with marginal cell three times as long as wide, and broadly, squarely truncate at apex; radial vein with first abscissa six-tenths the length of second abscissa; transverse cubital vein straight, oblique, inclivous, one-half the length of second abscissa of cubitus which is subequal in length to the first abscissa of cubitus. Hind wing with anal lobe large, elongate-ovate, well separated off and as long as to slightly longer than the short submedian cell.

Abdomen slender, elongate, impunctate. First segment petioliform, twice the length of the second segment, slenderly subcylindrical, constricted medially, without lateral carinae, the spiracles situated one-third of the way from base, strongly nodose at apex and separated by a very strong constriction from the remainder of the slender, fusiform abdomen, which is somewhat depressed in males. Basal acarid chambers present on fourth and fifth tergites. Females with last segment conical, without a pygidial area. Males without a pygidial area on subtrigonal last tergite, the puncturation of which is no coarser than that of penult tergite; apical tergites and sternites simple, without processes; hypopygium simple, flat, apex bluntly rounded, and armed with two curved bristles.

Ethology.—The species of *Eupliloïdes* are probably xyloecetes or rubicoles and thus are referable to the Dryocrossocerotes division of the genus *Crossocerus*. The conical abdominal apex is very similar to that of *Trypoxylon* and may indicate that the members of *Eupliloïdes* nest in pre-existing cavities like the abandoned holes of wood-boring beetles or the interior of straws and grasses. The badly worn-down mandibles of a female *albocollaris* from Manila denote that the mandibles must be used to a certain extent in nest construction. The sting of these wasps is strongly recurved, and this is presumptive evidence that the prey, probably nematocerous Diptera, is carried impaled on the sting, much as it is in *Oxybelus* and certain other pemphilidine wasps.

Distribution.—The species of *Eupliloïdes* inhabit the tropical forest areas of the Orient and Oceania. The complex ranges from the Philippines southward to the Straits Settlements in Malaya and thence eastward through Sundaland and the Papuan region to the Solomon Islands. Many forms doubtless occur throughout this area, but at present only four are known which may be definitely assigned to *Eupliloïdes*. The subjoined key will serve to differentiate these.

Key to Forms of Eupliloïdes

1. Clypeal lobe armed medio-apically with a porrect spine or tubercle; mesopleura with a fine, short carinule running forward from just above middle coxae and terminating in a small tubercle 2
   Clypeal lobe simple, unarmed medio-apically 3
2. Mesonotum bisected on anterior half by a deep, broad furrow; clypeus with medio-apical prominence low, strongly compressed, tuberculoid. (Palawan) .... *albocollaris princesa*, new subspecies
   Mesonotum not deeply furrowed, at most with only a weak shallow sulcus on anterior half; clypeus with medio-apical prominence large, porrect, spinoid. (Luzon) .... *albocollaris albocollaris* (Ashmead)
3. Pronotum with humeral angles rounded; mesopleura with a fine, short carinule running forward from just above middle coxae and terminating in a small tubercle; pronotum, axillae and scutellum stramineous. (Singapore) .... *leontopolites*, new species
   Pronotum with humeral angles armed with a small spine; mesopleura simple, unarmed before middle coxae; immaculate black forms. (Solomon Islands) .... *bougainvilleae*, new species

Crossocerus (Eupliloïdes) albocollaris albocollaris (Ashmead)

Rhopalum albocollare Ashmead, 1904, U. S. Natl. Mus. Proc. 28: 130 [♀ (recte ♂): Manila, Luzon]—Brown, 1906, Philippine Jour. Sci. 1: 687.

Type.—Male; Observatory Garden, Manila, Luzon, Philippine Islands. (W. A. Stanton.) [United States National Museum, Catalogue No. 7995.]

The armed clypeus, tuberculate mesopleura, and rounded edentate pronotal humeri distinguish this Philippine Islands species from all other known forms of *Eupliloides*.

Ashmead in his original description of *albocollare* stated that the species was based upon a female, but an examination of the type in the United States National Museum reveals it to be a male.

Both sexes of the typical race of *albocollaris* have the clypeal lobe armed medio-apically with a large porrect spinoid process, which serves as an excellent recognition character for the species. The apical margin of the clypeal lobe is tridentate in the male and quinquedentate in the female. Both sexes have the mesonotum flat or at most weakly sulcate medio-anteriorly, and the dorsal face of the propodeum bisected by a very narrow immarginate groove.

Specimens examined.—One male, 2 females, as follows:

LUZON: Observatory Garden, Manila (W. A. Stanton): 1 male [type]. Manila (Robert Brown): 1 female. Mt. Makiling (C. F. Baker): 1 female. [All U. S. N. M.]

In Palawan, *albocollaris* is represented by the following distinctive race:

Crossocerus (Eupliloïdes) albocollaris princesa, new subspecies

The strongly sulcate mesonotum and small tuberculoid prominence on the apex of the clypeal lobe differentiate the Palawan subspecies *princesa* from the nominate race of *albocollaris* on Luzon.

Type.—Female; Puerta Princesa, Palawan, Philippine Islands. (C. F. Baker.) [United States National Museum, Catalogue No. 57655.]

Female.—Length, 5 mm. Similar to the typical form except in the following noteworthy features:

Livery: perfulgid black. The following stramineous: antennal scapes with a stripe lengthwise anteriorly, pronotum broadly interrupted medially, axillae, scutellum laterally, postscutellum, middle tibiae with a small spot near base, hind tibiae widely annulate at base, middle and hind metatarsi medially above. Fulvous: mandibles save red apices, palpi, scapes, fore tibiae, and all tarsi. Dark castaneous: antennal flagellum, tegulae, axillary sclerites; veins and stigma of wings.

Head with clypeal prominence low, strongly compressed, tuberculoid.

Thorax with mesonotum with a relatively wide and deep rounded sulcus on anterior half. Propodeum with dorsal face bisected by a wide, shallow, submarginate groove or furrow.

This form is known at present from only the unique female described above.

Crossocerus (Eupliloïdes) leontopolites,[2] new species

The present species is somewhat intermediate in character between the preceding and following forms, agreeing with *albocollaris* in the maculated pronotum, axillae, and scutellum, the rounded humeral angles of the pronotum, and the spined mesopleura; and with *bougainvilleae* in the simple, nontuberculate clypeal lobe.

[2] λεοντοπολιτης "dweller in the City of the Lion," i. e., Singapore.

Type.—Male; Singapore, Straits Settlements. (C. F. Baker.) [United States National Museum, Catalogue No. 57656.]

Male.—Length, 5 mm. Perfulgid; head and apical five segments of abdomen black; thorax, legs, and first two abdominal segments very dark castaneous. Following stramineous: pronotum dorsally except for a brief interruption medially, axillae, scutellum, and middle and hind tibiae broadly annulate at base. Fulvous: mandibles save for red apices, palpi, antennae, and forelegs. Wings clear hyaline; veins and stigma dark castaneous.

Head perfulgid; clypeus with moderate vestiture of appressed silvery pubescence; front glabrous; vertex with a very thin and sparse clothing of erect hairs; temples thinly clad with light decumbent hairs. Front very narrow, shallowly concave, polite, impunctate; frontal impression moderately deep; vertex perfulgid, impunctate save for sparse and fine, scattered, setigerous acupunctures; ocellocular line twice the postocellar distance; post-temporal and gular regions nitidous; occipital carina well developed, very finely foveolate anteriorly, curving forward below but not ending in a distinct spine or tubercle. Antennae with scapes elongate, gently clavate apically, about one-half (0.53) the vertical eye length; pedicel suborcate, subequal in length to first flagellar article; flagellum with first two segments subequal in length, ultimate article simple, obterete, one and a half times the length of the penult segment. Clypeus with median length one-fourth the vertical eye length; flat, bisected by a low carinule; median length one-fourth the vertical eye length; flat, bisected by a low carinule median lobe with apical width about one and a quarter (1.23) the median clypeal length, simple and unarmed medio-apically, apical margin truncate and with a small median tooth, laterally on each side of lobe with a large strong tooth.

Thorax perfulgid; dorsally with a thin clothing of long, erect, light hair, pleura with a more noticeable vestiture of decumbent silvery pubescence. Pronotum impunctate; flat, ecarinate anteriorly, humeri bluntly rounded. Mesonotum polite, impunctate, bisected on anterior two-thirds by a broad, rounded, moderately deep furrow; suture between mesonotum and scutellum broadly, deeply impressed, coarsely foveate; axillae oblique, linear, lateral edges bluntly margined; scutellum and postscutellum flat, polite, impunctate; suture between scutellum and postscutellum deeply impressed, coarsely foveolate. Mesopleura nitidous, impunctate save for minute setigerous acupunctures; episternal suture impressed, foveate; with a fine, short horizontal carinule running forward from just above articulation of middle coxae and ending in a small tubercle. Metapleura glabrous, polite. Propodeum polite, impunctate, glabrous; dorsal face bisected by a narrow submarginate groove which passes into the broad, deep, immarginate sulcus bisecting posterior face which is finely rugulose in valvular region.

Legs with femora thinly clad with rather long, suberect hair; tibiae with more noticeable decumbent silvery pubescence; tarsi hairy. Longer hind tibial calcar two-thirds length of hind metatarsi.

Abdomen fulgid; first two segments polite, glabrous, impunctate; remaining segments with a very thin vestitute of short, decumbent, subaeneous hair. Sternites impunctate; sixth with caudal margin broadly, shallowly excised;

seventh with a small, low and weak tubercle on each side of median line; hypopygium elongate, flat, broadly rounded at apex, each latero-apical corner armed with a stout curved bristle.

Female.—Unknown.

In addition to the type, I have examined three topotypic males (paratypes) which agree with the type in all essential features of livery and structural detail.

Crossocerus (Eupliloïdes) bougainvilleae, new species

The immaculate black habitus, dentate pronotal humeri, and simple unarmed clypeus and mesopleura readily differentiate this large and handsome Solomon Islands species from the other known forms of *Eupliloïdes.*

Type.—Female; Bougainville Island, Solomon Islands. July 1 to September 15, 1944. (Ashley Buell Gurney.) [United States National Museum, Catalogue No. 57657.]

Female.—Length, 7 mm. Fulgid black. Eburneous: metatarsi above, and all tibiae narrowly annulate at base. Fulvous: Mandibles, palpi, antennal scapes, and first four tarsal segments. Wings clear hyaline, iridescent; veins and stigma black.

Head perfulgid; clypeus clothed with appressed silvery pubescence; front along inner orbits and above with a thin vestiture of short silvery hair; vertex sparsely clad with rather long, suberect dark hair; temples with decumbent silvery pubescence. Front very narrow, strongly concave between inner orbits, with fine setigerous acupuncturation laterally and above; frontal impression strong and deep; vertex with scattered, fine, setigerous acupunctures; ocellocular line twice the postocellar distance; occipital carina well developed, finely foveolate anteriorly, terminating below in a strong tubercle. Antennae with scapes slender, elongate-cylindrical, gently clavate apically, five-ninths (0.55) the vertical eye length; pedicel suborcate, about seven-tenths (0.718) the length of first flagellar article; flagellum with second segment almost seven-eighths (0.856) the length of first, the third five-sixths (0.83) the length of second, penult article two-thirds the length of simple, obterete last segment. Clypeus with median length one-fifth the vertical eye length; flat laterally to weakly tectate (but not carinate) discally; median lobe with apical width one and three-tenths the median clypeal length, apical margin quinque-crenulate, the median tooth the largest, not armed medio-apically with a porrect spine or tubercle, laterad of lobe on each side with a blunt bidenticulate process. Mandibles elongate; lower margins and inner faces with elongate setae.

Thorax perfulgid; dorsally with a thin vestiture of erect subaeneous hair; pleura more noticeably clad with decumbent silvery hair. Pronotum with dorsal surface flat, posterior margin weakly impressed, each humeral angle with a sharp spinoid tubercle behind which is another small blunt one. Mesonotum with sparse and scattered, fine, setigerous acupunctures, the anterior half bisected by a very broad and shallow furrow; suture between mesonotum and scutellum broadly, deeply impressed and coarsely foveate; axillae oblique, linear, lateral edges bluntly margined; scutellum and postscutellum gently tumid, with a few fine, scattered setigerous acupunctures. Mesopleura nitidous save for fine scattered setigerous acupunctures; episternal suture impressed, foveate; with vestiges of a fine short carinule running forward from just above middle coxal articulation but without tubercle or spine. Metapleura glabrous, polite. Propodeum perfulgid; dorsal and posterior faces glabrous, posterior face with a thin vestiture of erect silvery hair; dorsal face with barest vestiges of an impression delimiting a trigonal enclosure, polite, bisected by a narrow submarginate furrow which terminates in the broad and deep immarginate groove bisecting posterior face; lateral faces polite.

Legs simple; sparsely clad with shaggy silvery hair, none of the tibiae spinose, but with long declivent silvery setulae or bristles particularly on outer faces; tarsi hairy. Longer hind tibial calcar subequal in length to hind metatarsus.

Abdomen fulgid; petiole and second tergite glabrous save for a few scattered erect hairs. Second sternite discally and apical margins of following sternites with erect hairs. Third to sixth segments impunctate, with a thin vestiture of decumbent light hair; last segment conical, without a pygidial area.

Male.—Unknown.

This interesting Solomon Islands form is known only from the unique female described above.

JOHN DINWIDDIE MAPLE III

John Dinwiddie Maple III, Lieutenant (s. g.), U. S. Naval Reserve was killed in an airplane crash April 11, 1945, on the Island of Okinawa while observing the spraying of DDT from the air. While serving as an entomologist at the Bureau's laboratory at Orlando, Florida, prior to gaining his commission April 4, 1944, he was closely associated with the development of DDT for the control of malaria-carrying mosquitoes. His paper, "The Larvicidal Action of DDT on *Anopheles quadrimaculatus*" (Jour. Econ. Ent. 38 (4): 437–439) which appeared posthumously, has received considerable comment both in popular and scientific fields. Lt. Maple began his career with the Bureau of Entomology and Plant Quarantine in March, 1938. From 1938 he served in the Foreign Parasite Division in Japan and was interned in that country at the beginning of World War II. He was included in the first exchange of prisoners and returned to the United States on the Gripsholm's first trip in June 1942. He was soon detailed to the Orlando, Fla., laboratory of the Bureau where he remained until receiving his commission in the Navy.

H. H. STAGE.

REVISION OF THE SCARAB BEETLES OF THE DYNASTINE GENUS ERIOSCELIS

By Lawrence W. Saylor,
Research Associate, Dept. of Entomology, California Academy Sciences

The three known species of this genus are very poorly known, both from a generic and specific standpoint. The genotype, *Apagonia emarginata* Mannerheim, was described in 1829, and was placed in *Erioscelis* by Burmeister in 1847, who erected the genus for it. The remaining two species were added as recently as 1914 and 1921. One new species from Peru is described herein, and the opportunity is taken to review the generic characters, discuss the species, and figure the essential characters.

ERIOSCELIS Burmeister

Erioscelis Burmeister 1847, Hand. Entom. 5:72; Lacordaire 1856, Gen. Coleop., 3:401; Prell 1914, Ent. Mitteil., p. 197, t. 3, f. 1–2; Casey 1915, Mem. Coleop., 6:113; Hohne 1921, Deut. ent. Zeit., p. 108; Arrow 1937, Junk Coleop. Cat., 156: 19; Blackwelder 1944, Bull. U. S. Nat'l. Museum 185: 254.

Apagonia Mannerheim 1829, Nouv. Mem. Moscou, 1: 54.

The genus is closely related to *Cyclocephala* Latreille (as represented by such more typical species such as *immaculata* Oliver and *lucida* Burmeister) and may best be characterized by citing the generic characters as compared to *Cyclocephala: Male front claws not enlarged;* clypeus flat (or nearly so), nonreflexed apically and trapezoidal, the sides parallel or very slightly convergent apically; the clypeus one and one-half to two or more times as broad as long, the apex truncate and varying from non-emarginate to shallowly but broadly and arcuately-emarginate; anterior tibia bidentate (*emarginata*), or tridentate, but similar in both sexes of each species; labrum entirely hidden from above or in frontal view; labrum free from clypeus and hung underneath it by muscular attachments (in dissection).

When compared with such species as *Cyclocephala* (*Stigmalia*) *maffafa* Burmeister, or *C.* (*Aclinidia*) *castanea* (Fabricius), the only character definitely to separate *Erioscelis* is the unenlarged front tarsal claws of both sexes.

Monidia nigerrima (Bates), and related large and nigropiceous or piceocastaneous species resemble *E. emarginata* closely but are more piceous and the front male claws are enlarged; this *nigerrima* was described as a *Cyclocephala* and separated by Casey on the broad head, color, and large and flat clypeus into the new genus *Monidia*, which might be valid but must await a restudy of all Casey's proposed genera based on the much larger number of species known today.

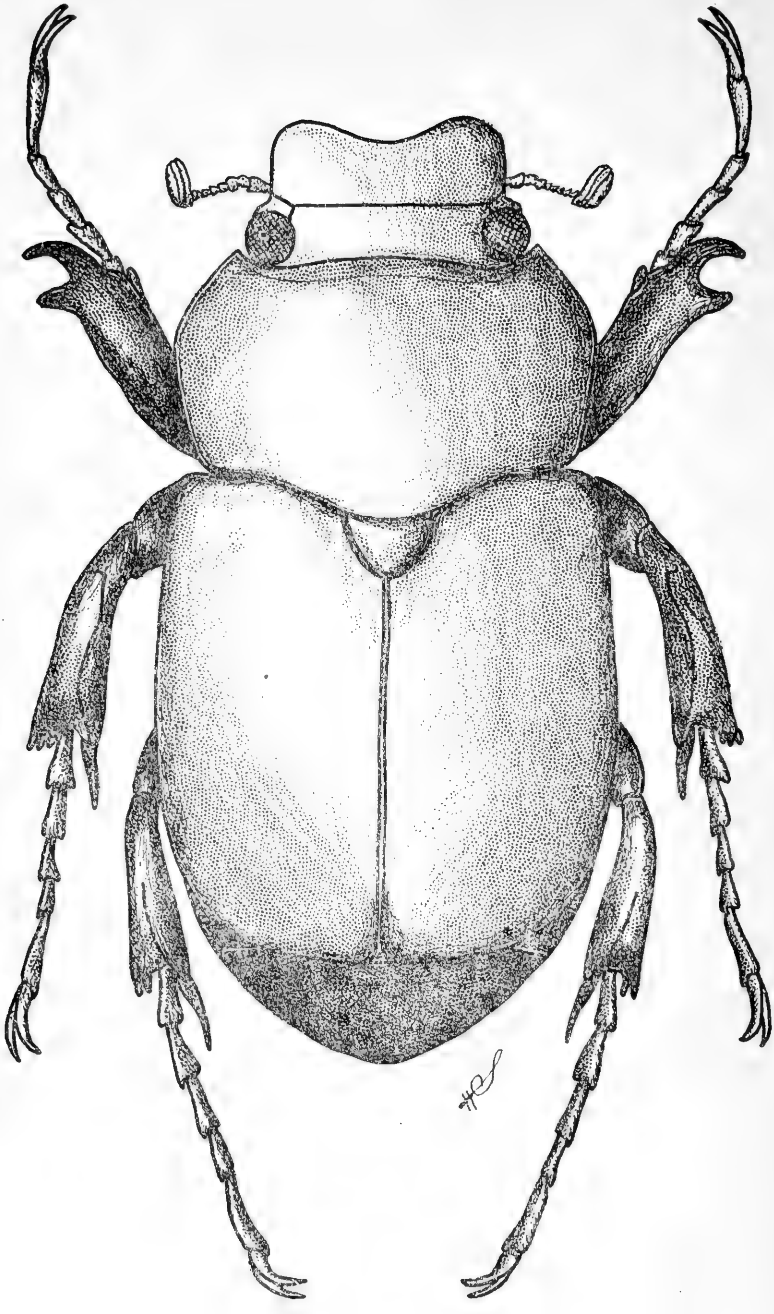

Fig. 1. *Erioscelis emarginata* (Mann.), ♂.

Casey mentioned *Erioscelis* in his key to the genera of the Tribe Cyclocephalini, but I am unable to guess what genus he really had before him, since he mentioned that the anterior male tarsal claw was very large, whereas it is not enlarged in either sex of this genus.

The sexes are remarkably similar in this genus in nearly all essential characters, and the only real difference is in the 6th abdominal sternite: in the male this is transversely carinate at about the apical third and the carina bears a single row of long cilia, and the carinate row is also usually bisinuate in most examples (Fig. 2, f); this sternite in the female is ciliate nearly *at* and *along* the apical margin of the sternite, and the ciliate row is thus arcuately rounded (Fig. 2, g).

Key to the Species

1. Clypeus noticeably sinuate apically; fore tibia bidentate; entire dorsal surface smooth and without obvious sculpturing or puncturation except for rare and small punctures on elytra and sometimes on front; pygidium impunctate or minutely punctate in basal two-thirds, apical third in male coarsely punctate and ciliate. (Paraguay, Argentina, and Brazil.) .... *emarginata* (Mannerheim)

   Clypeus truncate, or nearly so; fore tibia tridentate; dorsal surface and pygidium coarsely punctate *2*

2. Color black; thorax with central third usually entirely impunctate; center of front less densely punctate and punctures somewhat finer at the middle; male genitalia Fig. 2, b. (Peru, Bolivia and Brazil)... *obtusa* Prell

   Color castaneous; central third of thorax always obviously punctate but the punctures may be minute *3*

3. Male genitalia, Fig. 2, d; elytral punctures unusually coarse. (Venezuela) .... *sobrina* Hohne

   Male genitalia, Fig. 2, c; elytral punctures and those of thorax much finer. (Peru) .... *peruana* new species

Erioscelis peruana, new species

Male: Castaneous; dorsally highly polished; glabrous above. The small antenna 10-segmented, club equal to funicle but ovate and relatively minute. Head half as wide as thorax. Clypeus faintly but evenly convex, twice wider than long, sides nearly parallel, but faintly convergent apically; apex not reflexed, faintly emarginate, the angles narrowly rounded; entire clypeus strongly margined; clypeal suture faint but definite and nearly straight; disc of clypeus and front coarsely, moderately-densely punctured. Eyes very large, but only one-fourth exposed from above. Thorax twice wider than long, base entirely unmargined, sides and front edges strongly margined, the margins entire and not ciliate; sides roundly dilated at middle and convergent and straight both apically and basally; base faintly sinuate each side of middle; front angles semi-

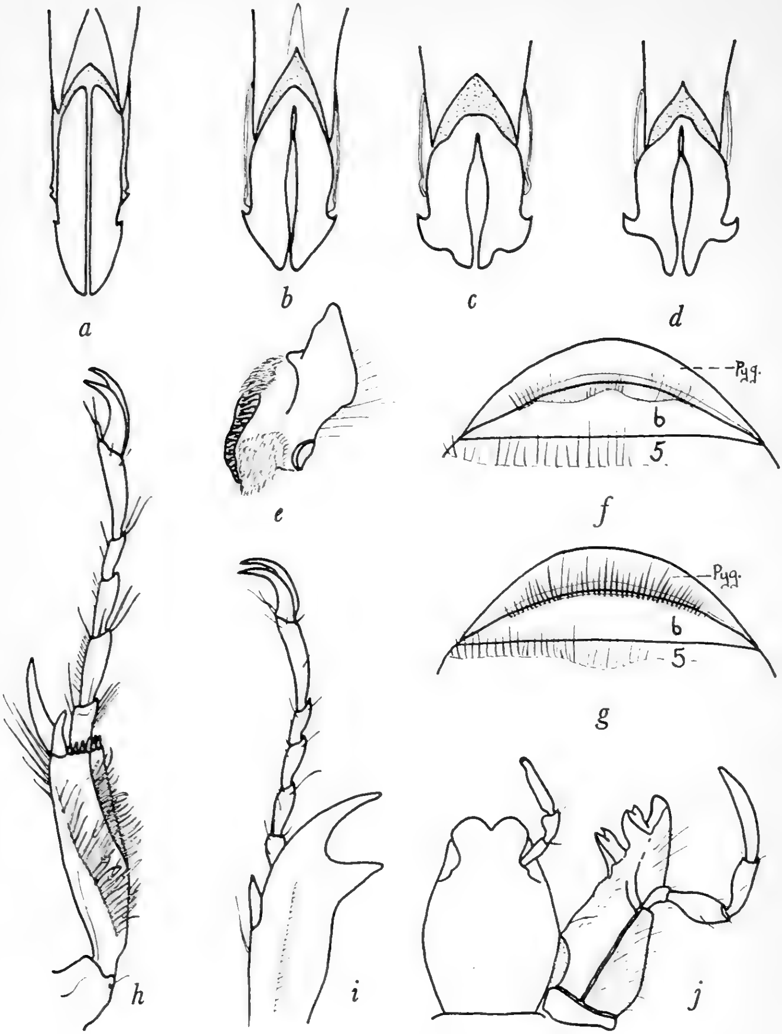

Fig. 2. *Erioscelis emarginata* (Mann.). *a.* ♂ genitalia, *e.* mandible; *f.* apical sternites of ♂; *g.* apical sternites of ♀; *h.* posterior tibia and tarsus of ♂; *i.* anterior tibia and tarsus of ♂; *j.* mouthparts.

Erioscelis obtusa Prell. *b.* ♂ genitalia.

Erioscelis peruana Saylor, *c.* ♂ genitalia.

Eroscelis sobrina Hohne, *d.* ♂ genitalia.

rectangular but bluntly so, hind angles broadly rounded, disc at center with very minute and sparse punctures, the punctures near edges and sides much larger and not very dense, separated by 2–3 times their diameters. Scutellum smooth, with half a dozen minute punctures. Elytra serially striate, the punctures in the rows moderately coarse and separated by once to twice their diameters. Propygidium very densely, finely, contiguously, and subrugosely punctate, the punctures much coarser right at the angles. Pygidium large, two and one-half times wider than long, highly polished, smooth; disc with very coarse, moderately-densely, somewhat irregularly placed punctures, a few punctures at middle with minute erect hairs (high magnification), apex non-ciliate. Abdomen polished, smooth, except for a single, transverse, subapical row of setigerous punctures on each sternite (ciliate row on 5th in male is widely interrupted at middle, but entire in female); sternites 2–4 equal, 5th one and one-half times longer than 4th and smooth at center; 6th shorter than 5th and slightly transversely impressed along basal margin. Hind tibia with two oblique rows of setae (Fig. 2, h) running nearly the entire length of the tibia; first segment of hind tarsi twice longer than width at apex, and only slightly longer than either the 2nd or 3rd, none of them triangular in shape. Front tibia tridentate. Length 19 mm. Width 9.5 mm.

The unique male holotype in the Saylor Collection is from "Rio Abujao, Peru." The genitalia are distinctive (Fig. 2, c) but it is very difficult to separate on external characters from *sobrina* other than on locality and the less coarse dorsal puncturation, although the genitalia of the two species will readily distinguish them.

Erioscelis sobrina Hohne

E. sobrina Hohne 1921, Deut. ent. Zeit., p. 108.

Male: Very close to *peruana* Saylor in color and all respects except as follows: puncturation of sides of thorax and elytra much coarser and better marked, the subapical ciliate carina of 6th sternite distinctly bisinuate, and the male genitalia different (Fig. 2, d). Length 17–20 mm. Width 9–10.5 mm.

Described from Valencia in Venezuela, and I have seen it only from that country.

Erioscelis obtusa Prell

E. obtusa Prell 1914, Ent. Mitteil., 3:197, t. 3, f. 1–2.

Male: Very close to *peruana* Saylor, except as follows: Color black rather than castaneous or rufocastaneous, the central thoracic area usually entirely impunctate and the male genitalia different (Fig. 2, b).

Female: Very similar to male except as follows: fore tibia a little stouter; pygidium less densely punctate apically; 6th sternite with a complete, arcuate, marginal row of cilia along the subapex. Length, 17–18 mm. Width, 9.5–10.5 mm.

The species was described from two pairs from Chanchamago, Peru. I have seen a female from "Bolivia," and examples of both sexes from various Peruvian areas: "Near Sani-Beni, Lima, Peru; 1935, Felix Woytkowski Collector" ("an area at 840 elevation, in a tropical, still hilly region of forests, 8 km. E. of Satipo, in Dept. of Junin"); and "Peru-Brazil Frontier, February".

Erioscelis emarginata (Mannerheim)

Apagonia emarginata Mannerheim 1829, Nouv. Mem. Moscou, 1:54. *Erioscelis emarginata* (Mann.), Burmeister 1847, Hand. Entom. 5:73.

Male: Similar to *peruana* Saylor, except as follows: Dark castaneous to piceocastaneous; front tibia bidentate; clypeus very distinctly and widely emarginate apically; hind angles of thorax a little more obvious; base of thorax margined at sides and nearly to the middle; head and thorax usually entirely impunctate; elytra smooth, with a few punctures visible near sides; pygidium very convex, very smooth and usually entirely impunctate except for a few punctures before apex, transverse lines of cilia on sternites complete, not interrupted at middle; genitalia very different (Fig. 2, 2).

Female: Similar to male in all respects except as follows: large subapical pygidial punctures reduced to only several; ciliate line of 6th sternite arcuate and nearly apical in position (Fig. 2, g). Length, 19–24 mm. Width, 10.5–12 mm.

I have seen specimens from BRAZIL: "Nova Teutonia, Nov. and Dec., Fritz Plaumann," and "Ypiranga, Sao Paula, Nov.," and "Brazil"; from PARAGUAY: "Horqueta, Alberto Schultz Collector," and "Ipane River, March, A. Schultz Coll.". Recorded also from ARGENTINA by Hohne. The general facies of this insect are very distinctive and it may be readily picked out of miscellaneous lots of neotropical scarab beetles.

THE LARVA AND PUPA OF URANOTAENIA BIMACULATA LEICESTER ON OKINAWA SHIMA, RYUKYU RETTO (Diptera: Culicidae)

By LOUIS ROTH[1]

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According to Barraud,[2] the larva and pupa of *Uranotaenia bimaculata* Leicester are unknown. Several adult females of this species were first collected on Okinawa Shima (Taira, Haneji-Mura) in 1945, by Major W. G. Downs, Medical Corps, AUS. Larvae were later collected on this island in a variety of habitats by Captains Carl T. Parsons and Frank N. Young, Sanitary Corps, AUS, and by the writer.

Uranotaenia bimaculata Leicester[3]

Larva:—Fourth Stage (Figs. 1, a-j; 2, a, b). Length, 4–5.5 mm.

Head: About as wide as or a little wider than long with a distinct but often variable bulge near eyes (Fig. 1, a–d); not uniformly pigmented, the posterior median portion often more darkly pigmented than the area around eyes and the region near front margin of clypeus; antenna smooth, darkly pigmented, a little less than one-fifth length of head; antennal hair usually triple, sometimes double, and originating a little more than four-fifths from base (Fig. 1, e); two terminal antennal spines plus a rod, and two preterminal spines placed ventrally in a lightly pigmented area (Fig. 1, e, f); anteantennal hair (A) multiple (usually six-branched); postclypeal hair (d) multiple, its branches more numerous, slender and usually shorter than those of hair A; hair d placed posterior and mesad to hair B; lower head hair (B) simple (not thickened); upper head hair (C) simple (not thickened; rarely one or both doubled), longer than and in line with B, arising posterior to hair d; sutural hair (e) very fine, simple or branched near tip; transutural hair (f) with a few fine branches arising near tip; ocular hair fine, usually branched near tip, rarely simple; hairs A, B, C and d originating well forward on the fronto-clypeus (Fig. 1, a); mentum more or less triangular with a deep basal indentation and toothed, as shown in Fig. 1, j. *Thorax:* Prothoracic hairs variable; hairs I–III (submedian) on a common tubercle consisting of two long and 2 to 6 shorter branches; hair IV multiple, the branches (about 10 to 15) short (in some larvae this hair was difficult to see); hair V with 3 to 6 branches; hairs VI and VII single (VII rarely double); hair VIII with 2 to 4 branches (rarely single); hairs VI and VIII longer than hairs V and VII. *Abdomen:* Upper and lower lateral abdominal hairs on segments I and II single (rarely with the upper or lower double), long, the upper slightly longer

[1] Formerly First Lieutenant, Sanitary Corps, Army of the United States.

[2] Barraud, P. J., 1934. The Fauna of British India, including Ceylon and Burma. Diptera, Vol. V, Family Culicidae, Tribes Megarhinini and Culicini. London: Taylor and Francis. pp. 78–79.

[3] Leicester, G. F., 1908. "The Culicidae of Malaya." *Studies from Inst. Med. Res. F. M. S.*, p. 226.

than the lower; these hairs on segment II longer than those on I; lateral hairs on segments III to V often triple, on VI double or triple, but these hairs may vary from simple to four-branched (Table V); lateral hair on segment VII simple, rarely branched near tip (Fig. 2, a, b); all lateral abdominal hairs finely frayed. Lateral plate of eighth abdominal segment large, irregular in outline and not continuous dorsally; the comb of 6 to 12 scales (usually 8 or 9; Table IV) arising from lower half of posterior margin of plate (Fig. 1, g); individual comb scale (Fig. 1, i) elongate, the sides appearing smooth although under higher magnification very fine serrations may be present (teeth always present and more noticeable near base of scale); usually all the comb scales are approximately the same size although the terminal ones may sometimes be smaller than the others or an occasional minute scale may be placed among the larger ones; first pentad hair small and multiple; second pentad hair with a few fine branches near tip; third pentad hair multiple, the branches very long and frayed; fourth pentad hair about the same size as second and either simple or with one or more fine branches near tip; fifth pentad hair small, multiple. Siphon (Fig. 1, g) darkly pigmented, the sides gradually tapering towards apex, the region near the ventral tuft slightly bulging; index about 2.5; acus present; pecten of 13 to 28 teeth (Table II) extending three-fifths or more the length of the tube; pecten teeth more or less evenly spaced throughout, or one or more terminal ones widely separated (occasionally one or more teeth may be crowded together out of line); usually two or more basal teeth distinctly smaller than those following; individual teeth short, broad or pointed at the apex and fringed (Fig. 1, h); ventral tuft with two to six frayed branches (usually three or four; Table I) and originating within the pecten. Anal segment completely ringed, the hind margin curved and indented below the middle so that the dorsal length is about twice that of the ventral length (Fig. 1, g); ring with fine spicules arranged in a definite ridge-like pattern, the spicules near posterior upper half larger and extending beyond margin; lateral hair with three to eight long frayed branches (Table III); dorsal brush consisting of two pairs of long stout hairs, the dorsal subcaudal tuft double, the ventral subcaudal pair single; ventral brush of several tufts placed posteriorly to anal ring, the anterior and posterior pairs of tufts shorter than the medial ones; four anal gills, rounded, shorter than length of anal segment.

The first larvae (which will be called Form A) to be collected were comparatively small with a slight bulging of the sides of the head (Fig. 1, c, d) and with the lateral abdominal hairs on segments III to V triple and on segment VI double or triple (Fig. 2, a). Later, larger, more robust larvae (which will be called Form B) with a more decided bulge in the eye region (Fig. 1, b), greatly enlarged thorax and with the lateral abdominal hairs on segments III to VI usually simple (Fig. 2, b) were found. The two forms appeared to be distinct species yet reared adults were identical in markings although those resulting from Form B larvae were, in general, larger than those reared from Form A larvae. Reared adult males and females from both types of larvae were cleared in KOH, dehydrated,

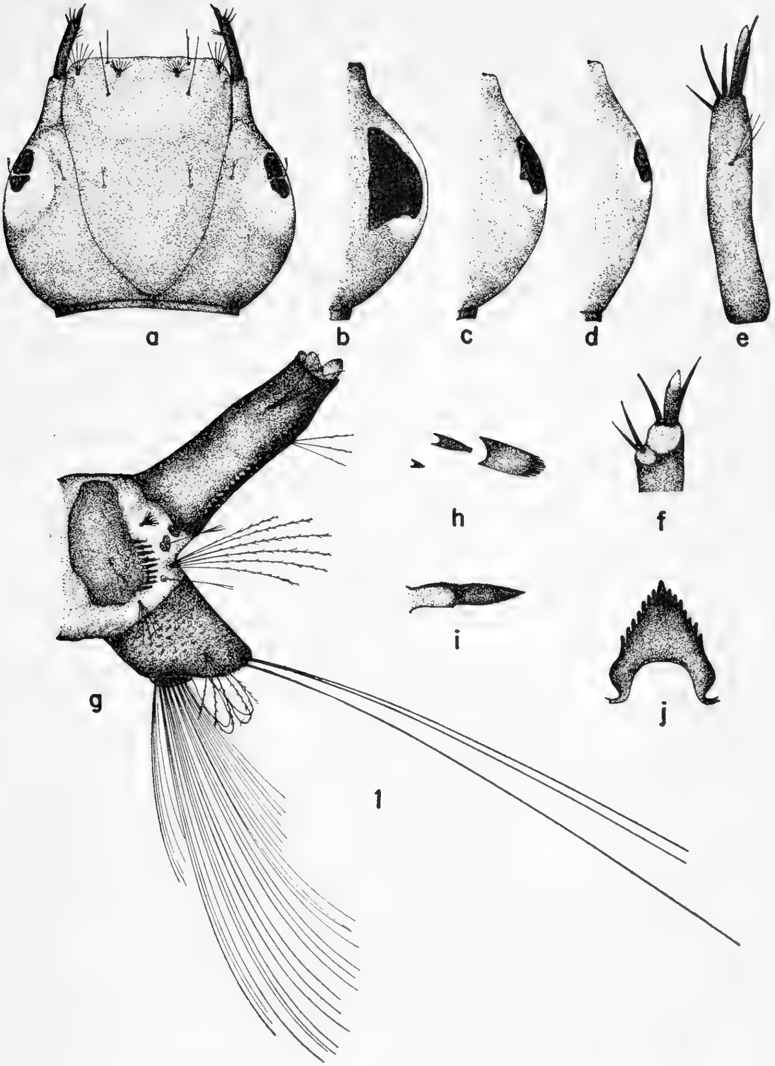

Fig. 1. *Uranotaenia bimaculata* Leic. fourth instar larva: a—head; b, c, d,—side of head showing variations in bulge and eye size (size of eye is variable in both forms of larvae); e—antenna (dorsal view); f—apex of antenna (ventral view); g—8th and 9th abdominal segments; h—pecten teeth (the smaller teeth are found at base of pecten); i—comb scale; j—mentum.

mounted in balsam and studied under a compound microscope and compared for structural differences. As far as could be determined, male and female genitalia, mouthparts and antennae (both sexes) of Form A adults were identical to the corresponding structures in Form B adults.

Apparently, the most striking differences between the two larval forms are size, head shape and branching of the lateral abdominal hairs. A study of a large series of larvae of both types shows that these differences are variable. Form A larvae were found with the head bulge almost as great as that of Form B larvae. A series of Form B larvae can be arranged whereby the lateral abdominal hairs on segments III to VI vary from all single to some double or triple to all triple. Generally, the submedian prothoracic hair group (hairs I–III) in Form B larvae have fewer branches than the same hairs in Form A. Also the prothoracic hair IV in Form A is usually larger and more easily discernible than the same hair in Form B larvae (one collection of Form A larvae from Shido, however, had these hairs (I–IV) much like those in B larvae). The overall size of the individual (fourth instar) is apparently quite variable and undoubtedly depends on age, temperature and conditions within the breeding medium (food, crowding, etc.). The containers in which the larvae are found have leaves and,or other debris. Only one collection of large robust Form B larvae was made in a vessel containing water which had become fouled by decaying organic matter.

The branching of the ventral tuft of the siphon, the lateral hair of the anal segment, the number of teeth comprising the pecten and the number of scales in the comb are very similar in both types of larvae. These characters are not only variable between specimens but often differ on either side of the same larva. The following paragraphs and Tables I to V show the results of a study of these structures in a series of Form A and Form B larvae.

The ventral tuft may consist of from two to six branches and the variation in this hair is shown in Table I.

Table I. Showing the variation in the number of branches comprising the ventral tuft in 55 specimens of *Uranotaenia bimaculata*. The fraction indicates the number of branches of the tuft on the two sides of the specimen.

Branching		2/2	2/3	2/4	3/3	4/3	4/4	4/5	4/6	5/5	5/6	6/6
Number of Specimens	Form A Larvae	0	1	1	6	1	3	6	1	3	2	1
	Form B Larvae	2	3	0	12	6	5	1	0	1	0	0
	Total	2	4	1	18	7	8	7	1	4	2	1

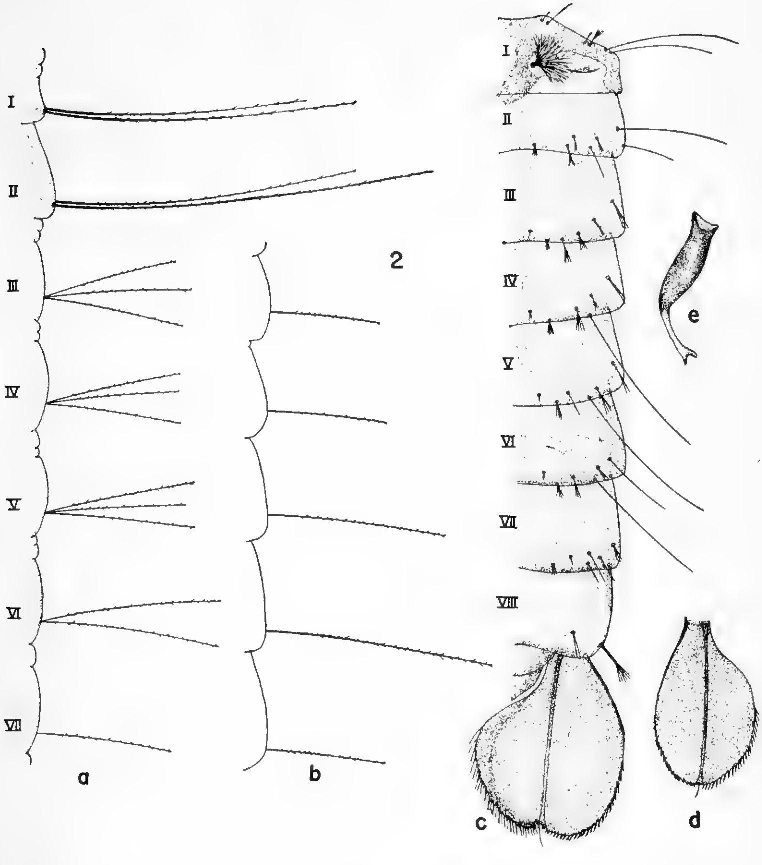

Fig. 2. *Uranotaenia bimaculata* Leic. fourth instar larva and pupa; a—larval abdominal segments I to VII showing branching of the lateral abdominal hairs; b—variation in the lateral abdominal hairs on segments III to VI; c—pupal structures showing dorsal chaetotaxy of abdominal segments I–VIII, and paddle (flattened preparation; pupal skin); d—variation in shape of paddle; e—respiratory trumpet.

Of 29 Form A larvae checked only six had the same number of pecten teeth on both sides (one specimen with 16, two with 20, one with 21, one with 23 and one with 25 teeth). Five of 31 Form B larvae had the same number of teeth on each side (one with 18, two with 19 and two with 21 teeth). The number of pecten teeth in the 23 Form A and 26 Form B asymmetrical larvae is shown in Table II.

TABLE II. Showing the variation in the number of teeth comprising the pecten in 49 larvae of *Uranotaenia bimaculata.*

No. of Teeth		13	14	15	16	17	18	19	20	21	22	23	24	25	26	28
No. of Pectens	Form A Larvae	0	0	0	2	2	2	4	9	6	8	6	2	2	1	2
	Form B Larvae	1	1	1	6	7	4	10	6	8	1	2	3	2	0	0
Total		1	1	1	8	9	6	14	15	14	9	8	5	4	1	2

The lateral hair of the anal segment is also highly variable and of 23 Form A larvae examined 10 specimens had the same number of branches on the right and left sides (one with 3, two with 4, three with 5 and four with 6 branches). Of 33 Form B larvae examined 15 had the same number of branches on each side (three with 4, eight with 5 and four with 6 branches). The branching of the asymmetrical larvae (13 Form A and 18 Form B) is shown in Table III.

TABLE III. Showing the number of branches comprising the lateral hair of the anal segment of 31 larvae of *Uranotaenia bimaculata.*

No. of branches		3	4	5	6	7	8
No. of Lateral Hairs	Form A Larvae	3	7	10	5	0	1
	Form B Larvae	4	11	12	7	2	0
Total		7	18	22	12	2	1

The number of scales comprising the comb is as variable a structure as those previously described. Of 24 Form A larvae only seven had the same number of scales on each side (three with 8, three with 9 and one specimen with 10 scales). Six of 34 Form B larvae had the same number of scales on both combs (two with 8, three with 9 and one with 10 scales). Table IV shows the variation in the 17 Form A and 28 Form B larvae which possessed different numbers of scales on the right and left sides of the same specimen.

TABLE IV. Showing the number of scales comprising the comb in 45 specimens of *Uranotaenia bimaculata.*

Number of Comb Scales		6	7	8	9	10	11	12
Number of Combs	Form A Larvae	1	3	9	14	6	1	0
	Form B Larvae	0	9	17	20	8	1	1
Total		1	12	26	34	14	2	1

Table V shows the variation in the lateral abdominal hairs of Form A and Form B larvae. It will be noted that no Form A larvae were found with all hairs simple on Segments III to V. Form B larvae were collected with these lateral hairs triple on segments III to V (typical for Form A).

Some specimens were difficult to identify as either Form A or Form B larvae because of the overlapping of characters. The larval description given on the preceding pages is a combination of the variable characters found in both forms.

Pupa (Fig. 2, c, d, e):—Respiratory horn moderately long, constricted at base and near apex, slightly swollen medially (Fig. 2, l); dendritic tufts on first abdominal segment well developed; one of the five submedian hairs on tergites IV, V and VI long and single (rarely branched near the tip); tufted lateral hair on segment VIII long and stout as compared with the same hair on the other segments (Fig. 2, c); paddle somewhat variable in shape, sometimes slightly elongate (Fig. 2, d) or wide and rounded (Fig. 2, c); margin along basal half serrated, the teeth on the inner surface longer than those on the outer; midrib well developed, extending the entire length of paddle (in their normal position the paddles overlap so that the midribs cross one another to form an X); a small terminal paddle hair (usually single, rarely double) arises from near apex of midrib; apical margin of paddle rounded or slightly indented; pigmentation (based on pupal skins) light brown to dark yellow brown; branching of various hairs on segments I to VIII (Fig. 2, c) sometimes variable.

Often the pupae resulting from Form B larvae are larger and darker (yellowish brown) than the usual light brown Form A pupae (pupal skins). However, some yellow-brown pupal skins have been obtained from Form A larvae.

Habitat.—Earthenware containers, tin cans, tree holes, cut bamboo, pottery (tea pots, saucers, etc.). Occasionally larvae were found to feed on smaller *Uranotaenia* larvae and other immature Diptera in the laboratory. In their normal resting position the larvae hang down at an angle from the surface of the water.

TABLE V. Branching of the lateral abdominal hairs on segments III to VII in 119 specimens of *Uranotaenia bimaculata.* The fraction indicates the number of branches on each side of the specimen (i. e.: 3/3 means that both hairs

Abdominal Segment	III						IV							
Branching of Lateral Hairs	1/1	1/2	2/2	2/3	3/3	4/3	1/1	1/2	1/3	2/2	2/3	3/3	4/3	4/4
Form A Larvae (Fig. 2 a; 85 specimens)	0	0	0	8	66	4	0	0	2	0	3	69	7	1
Form B Larvae (Fig. 2b; 34 specimens)	13	5	2	5	6	0	9	4	4	2	4	9	0	0
Total	13	5	2	13	72	4	9	4	6	2	7	78	7	1

Locality Records.—Ikebaru (Mizato-Mura) VIII–20–45; Metaniku (Mizato-Mura) VII–19–45; Shido (Chatan-Mura) VIII–21–45, IX–20–45; Sobaru (Onna-Mura) VII–29–45. A large series of specimens have been deposited in the United States National Museum.

SUMMARY

The larva and pupa of *Uranotaenia bimaculata* Leicester is described. The taxonomic characters of this species are highly variable and specimens with characters at opposite extremes of the variable structures may appear as two distinct species. That larval characters may be highly variable has recently been shown in the genus *Anopheles*.[4] It is quite possible that by selective breeding of individuals resulting from larvae showing the extreme variable characters, two distinct strains of *Uranotaenia* could be isolated and maintained. Coggeshall [5] has shown that by mass selection it was possible to obtain two colonies of *Anopheles quadrimaculatus* whose adults appeared morphologically identical but whose larvae and pupal offspring maintained distinctly different color patterns (a broad white stripe on the dorsal surfaces of larvae and pupae).

The importance of studying a large series of specimens before describing a species, has been well summarized by Mayr [6] and it

[4] Roth, Louis M., 1945. Aberrations and variations in anopheline larvae of the southeastern United States. Proc. Ent. Soc. Wash. 47:257–278.

[5] Coggeshall, L. T., 1941. Strains of *Anopheles quadrimaculatus.* Inheritance of color patterns in the larvae of *A. quadrimaculatus.* Amer. Jour. Trop. Med. 21:755–765.

[6] Mayr, Ernst, 1942. Systematics and the origin of species. Columbia University press, pp. 22, 30, 31.

were three-branched while 3/2 indicates that one of these hairs was three-branched, the other two-branched; if a hair was broken off on one side, the segment was omitted from the count). * = branching near the tip only.

V							VI					VII			
1/1	1/2	1/3	2/2	2/3	3/3	3/4	1/1	1/2	2/2	2/3	3/3	1/1	3*/1	4*/1	2*/3*
0	0	0	3	6	68	3	6	8	26	13	20	74	1	1	1
11	6	3	3	6	2	0	21	4	3	0	1	30	0	0	0
11	6	3	6	12	70	3	27	12	29	13	21	104	1	1	1

may be fitting to close this summary by quoting from his book; "A careful analysis of natural populations will show that there is a considerable degree of variability, grouped around a mean which is typical for the particular taxonomic category. It is obvious that no single individual can represent at the same time, the minimum, the maximum, and the mean of such variation, but it is possible to represent this variation fairly accurately, if an adequate sample of the population is available. This is the reason that a representative series, a sample of the population, has replaced the individual as the working unit of the systematist and this is also the reason that the collecting of adequate material is such an important part of his activities . . . no two individuals are ever identical, no matter how similar they may appear. The differences are in general slight . . . Sometimes rather distinct variants are observed, which may be confusing . . . The important practical lesson is that confusing situations can be disentangled only by the study of a large series of specimens. The larger the series available from a certain locality, the greater is the chance that it includes all of the major variants and the extremes of size and coloration."

MINUTES OF THE 560TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JAN. 3, 1946

The 560th regular meeting of the Society was held at 8:10 P. M., January 3, 1946, in Room 43 of the National Museum. There were 29 members and 10 visitors present. President Weigel was unable to attend the meeting and Dr. E. H. Siegler presided. The minutes of the previous meeting were approved as read.

Dr. Siegler announced that the Auditing Committee would report at a later date. He also reminded the members that dues for the coming year are now payable.

The first paper on the regular program was presented by Sam C. Munson: The Physiology of DDT in the Cockroach.

Aside from casual observations made on the intact insect, the effects of DDT on the nervous system of the cockroach may be studied by localizing its application, by cauterizing the roach's heart to retard circulation of the haemolymph, or by use of preparations consisting of: (1) an isolated thoracic segment with its ganglion intact and with either one or both of its legs still appended; (2) by use of an isolated leg. By such preparations it was shown that high concentrations of DDT can act on the motor fiber somewhere between its origin in the central nervous system and its termination at the neuromuscular junction. This conclusion was strengthened further by comparison with nicotine, which has been shown to exert an effect on ganglia. The conclusion that DDT could act on the motor fibers was not considered to exclude other possible sites of action. It was shown further that low concentrations of DDT which produced general symptoms in the intact roach could do so without necessarily acting on the motor fibers. If low concentrations were used it was shown that severing the crural nerve might, and usually did, stop the tremors; but efforts to produce DDT effects by its direct application to the crural nerve met with consistent failure. The experiments described above were carried out by Dr. J. F. Yeager and Sam C. Munson. (Author's Abstract.)

Mr. Munson illustrated his talk with diagrams drawn on the blackboard. There was discussion by McGovran, Snodgrass, and Bishopp.

The next paper was given by Dr. E. R. McGovran: Report on the Eastern Branch Meeting of the American Association of Economic Entomologists.

A brief report of the business meeting was given. Dr. H. F. Dietz was elected chairman of the Eastern Branch for the coming year. Some of the papers which were read at the meeting were discussed very briefly. These included discussion of diatomaceous diluents for dusts, repellents, benzene hexachloride as an insecticide for vegetable insects, azobenzene as a greenhouse fumigant, liquefied gas aerosols, thermal aerosols, and others. (Author's Abstract.)

A Report on the Dallas Meeting of the American Association of Economic Entomologists was presented by G. J. Haeussler and Dr. F. C. Bishopp. M. P. Jones, who was scheduled to speak, was not able to be present and his report was included in the report given by Mr. Haeussler.

Mr. Haeussler reported on the general program of the 57th annual meeting of the American Association of Economic Entomologists held jointly at Dallas, Texas, December 3–6, 1945, with the Texas Entomological Society and the

Cotton States Branch. The four morning sessions were given over to addresses by the presidents of the three associations and to the presentation of ten invitation papers. Approximately fifty regularly scheduled papers were presented during the four afternoon and one of the evening sessions. The entomologists' dinner was held on the evening of December 4 with Dr. S. W. Geiser of the Southern Methodist University as guest speaker. The sessions of the sections of Apiculture and Teaching were held concurrently on the afternoon of December 4 and that of the section of Extension was held on the evening of December 5. Invitation papers included a discussion of the insecticide situation by Dr. F. C. Bishopp and illustrated discussion on recent developments in cooperative insect control programs by W. L. Popham. The program on December 5 was devoted largely to a discussion of cotton insect control with invitation papers on international aspects of pink bollworm control and on cotton insect control and commercial interests by representatives of the Mexican Department of Agriculture and of the cotton industry respectively. An invitation paper by a representative of the National Livestock Loss Prevention Board, showing how livestock gains from reduced insect losses result in increased profits, was also received with much interest. The final day of the meeting was devoted almost entirely to discussions on DDT. Of especial interest was a paper presented by members of the Fish and Wildlife Service reporting on the studies of the effects of DDT upon wildlife.

Mr. Haeussler also presented a report prepared by M. P. Jones covering the program of the section of Extension in connection with the Dallas meeting. This program dealt chiefly with four major topics: "Extension Entomology in the South and West"; "Livestock Insect Control in an Extension Program"; "DDT in Extension Work"; and "Miscellaneous Items"; General Discussion of New Problems, New Methods, New Programs. Mention was also made of the considerable discussion concerning ways in which the use of color plates can be more readily made available to Extension agencies for educational purposes. (Author's Abstract.)

Dr. Bishopp confined his report to the transactions at the business session. The new President of the American Association of Economic Entomologists is Dr. Clay Lyle of Mississippi, and the new Vice President is H. G. Crawford of Canada. A committee had been appointed at the 1945 meeting to study means of making election procedures more democratic. They recommended that, in future, the President and Vice President be elected by the members on a ballot vote. An amendment to the Constitution was adopted which provided for such procedure, and the recommendation of the committee was then accepted. The financial report showed a balance of $26,000 in the Association treasury. This included a $500 gift for a publication fund. A new section, to deal with insecticide problems relating to chemistry and equipment for application, was favorably discussed and a tentative organization established. No definite time was set for the next meeting of the Association, but the committee in charge was instructed to correlate the meeting with that of the American Association for the Advancement of Science.

There was discussion by McIndoo, Orr, McGovran, and Poos in regard to the purpose of maintaining so large a balance in the Association's treasury. (Secretary's Abstract.)

The following visitors were introduced to the Society:

Dr. S. Leefmans, Department of Agriculture, Holland
Capt. F. G. Wallace, Army of the United States
Lt. Com. J. S. Yuill H(S), U. S. Naval Reserve

Dr. Leefmans addressed the Society. He said that he had been sent by his Government to note the progress in applied entomology and plant pathology made here during Holland's five years of isolation. During the first years of the German invasion all scientific work was not stopped, but became increasingly difficult until finally all students and professors who refused to support the Nazi regime were either deported or forced into hiding. During 1943 all teaching at the University of Wageningen came to a standstill. Publication had at first been possible, but by and by became difficult for lack of paper, and in the latter years practically ceased. Work has begun again but is seriously hampered by damaged buildings, lack of equipment, and in the East Indies by a shortage of trained personnel. In Wageningen all microscopes have been stolen, the buildings were used as barracks, libraries suffered greatly, and the plant pathology catalogues and collections were destroyed. It will be many years before work can proceed in a normal manner. Dr. Leefmans also referred to the important role played by the Netherlands East Indies in the National economy of Holland, and to the difficulties resulting from the present confused situation in Java, by which the native population, after all, suffers most. (Secretary's Abstract, revised by Dr. Leefmans.)

Dr. Siegler expressed the sympathy of the Society and its desire to cooperate in Dr. Leefman's mission.

Dr. T. E. Snyder, who has recently returned to Washington after an absence of ten years, was requested to "report on himself" and spoke of his pleasure in being with the Society again. He also referred to the Catalogue of Termites of the World on which he is now working in collaboration with Dr. Emerson.

The meeting adjourned at 10 P. M.

INA L. HAWES,
Recording Secretary.

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PROCEEDINGS OF THE

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A REVIEW OF THE TACHINID GENERA SIPHOPHYTO AND CORONIMYIA (Diptera)[1]

By H. J. REINHARD, *College Station, Texas*

The genera here under consideration were described by Townsend (1892, pp. 127-130) from a single specimen in each case, which he received from Chas. Robertson. The descriptions are well detailed and above the average but each applies to the male not the female sex as was originally indicated with an element of doubt.

Coquillett (1897, p. 75; 1910, pp. 528, 539) considered both genera to be synonyms of *Epigrimyia,* as also, did Aldrich (1905, p. 443). Although Townsend (1891, p. 375; 1892, p. 127-28) assigned *Epigrimyia, Siphophyto,* and *Coronimyia* to the same subfamily, viz., Phytoinae, none was mentioned in comparison with the other to indicate his belief of any closer relationship. More recently Townsend (1938, p. 109; 1940, pp. 263, 277) redescribed each genus and indicated his revised conclusions regarding their relationship by referring *Epigrimyia* to the tribe Cylindromyiini in the family Gymnostomatidae; *Siphophyto* and *Coronimyia* to the tribes Actiini and Siphonini, respectively; both in the family Exoristidae.

On external adult characters the last two mentioned genera appear allied closely enough to be included in the same tribe but the question may be left open pending a more complete study of the immature stages. The generic characters are listed more fully below but it may be noted here that together *Siphophyto* and *Coronimyia* show well marked differences from *Epigrimyia* in head-shape, genitalia and wing characters, among others.

The species of *Siphophyto* and *Coronimyia,* although widely distributed in North America, are not abundantly represented in most collections. In all 213 specimens, including all types except two, were available for study. I am especially indebted to Dr. R. H. Beamer for the loan of types and other material; to C. F. W. Muesebeck and A. R. Brooks for the loan of specimens, which included one new form and added considerably to the distribution of others. The types of the three new species

[1]Contribution No. 939, Division of Entomology, Texas Agricultural Experiment Station.

described below are in the Canadian National Collection and the U. S. National Museum.

Genus **SIPHOPHYTO** Townsend

Siphophyto Townsend, Trans. Am. Ent. Soc., 19, 1892, 127: Manual of Myiology, pt. 10, 1940, 263.

Epigrimyia of authors (nec Townsend).—Coquillett (partim) Revis. Tachin., 1897, 75; Proc. U. S. Nat. Mus., 37, 1910, 539, 606.—Aldrich (partim) Catalogue N. A. Diptera, 1905, 443.

The genus as now constituted includes six species; all are small in build and uniform in many of their characters, including chaetotaxy and genitalia. The principal items which distinguish the species are listed in the accompanying key, after which each is described only so far as the characters seem important to distinguish it from the genotype, *floridensis*.

Generic characters.—Head one-fourth wider than high, subquadrate in profile; antennal axis one-half to three-fifths head height and high above eye middle; frontal profile subhorizontal, three-fifths length of facial, latter barely receding downward; back of head flattened with lower edge at middle bulged backward prolonging oral cavity to nearly length of elongated rostrum; clypeus moderately sunk, equibroad, twice longer than wide; epistoma short, not narrowed, with margin at middle slightly bowed forward and oral membrane sometimes inflated subnasutely; facial ridges obliquely flattened, bare except two or three bristly hairs next to vibrissae; latter on oral margin, rather short, not decussate; vertex in both sexes about two-fifths head width and widening but slightly toward antennal base; one vertical (inner) and two small proclinate orbital bristles in both sexes; ocellars proclinate; frontals in a single row, two beneath antennal base and two reclinate preverticals; frontal vitta wider than parafrontal; antennae subequal length of face, first segment short, third moderately broad, five to six times second; arista micropubescent, thickened to apical fourth, middle segment straight to arcuate, three or more times longer than wide; parafacial bare, narrow; cheek one-fourth eye height; proboscis moderately elongate, haustellum slender but slightly shorter than head height, labella very small; palpi slender, gently thickened apically; eye bare, nearly straight, reaching almost to vibrissal level. Thoracic chaetotaxy: acrostichal 2, 1 (anterior one small); dorsocentral 2, 3; humeral 2; posthumeral 1; presutural 1 (outer); intraalar 3; supraalar 3; notopleural 2; postalar 2; intrapostalar not differentiated; sternopleural 3-5 (usually 4 but intermediate 2 small); pteropleural 1 (smaller than anterior sternopleural); scutellum with 2 lateral and 1 small discal pair, no apicals; prosternum, propleura and sides of postnotum beneath calypters bare; infrascutellum normally developed. Wings rather broad at base but extending beyond tip of abdomen; first vein bare, third setulose nearly halfway to small cross vein; first posterior cell closed at costa slightly before extreme wing tip; hind cross vein a trifle nearer small cross vein than bend;

latter near hind margin of wing, broadly rounded without stump or fold; last section of fifth vein two-fifths length of preceding; costal spine shorter than small cross vein. Legs moderately long, weakly bristled; fore tarsi longer than tibiae, slightly thickened in female with basal segment equal combined length of three following ones; claws and pulvilli short in both sexes; hind tibiae subciliate. Abdomen ovate, scarcely as wide as thorax, more flattened above in female; first segment without second with one pair of median marginals, third and fourth each with marginal row; sternites covered; male genitalia small, retracted; inner forceps short, united, weakly keeled near base behind, tapering to an acute slightly bowed tip; outer forceps very short, narrowed apically to a rounded tip; fifth sternite incised apically, not prominent; female genitalia retracted, without piercer. Length 3-5.5 mm.

KEY TO SPECIES OF SIPHOPHYTO AND CORONIMYIA

1. Three postsutural dorsocentrals; third abdominal segment with complete row of marginal bristles; outer verticals absent; haustellum straight or nearly so .... *Siphophyto* 2
   Four postsuturals or at least spaced for four (front two small and anterior one sometimes absent); third abdominal segment at most with one pair of median marginals; outer verticals differentiated; haustellum usually strongly bowed backward apically .... *Coronimyia* 7
2. Haustellum shorter than head height 3
   Haustellum at least equal head height, usually distinctly longer........ 4
3. Abdomen wholly black or if venter on basal half tinged with red then pollen on last three segments sharply limited on basal fourth or less and second segment with pair of median marginals .... *floridensis* Townsend
   Abdomen bicolored or if sides and venter on basal half largely black then pollen not in sharply limited basal bands on all segments and second without median marginal bristles
   neomexicana Townsend
4. Parafrontals heavily pollinose to vertex........ 5
   Parafrontals subshiny black; last three abdominal segments with pollen limited to basal fifth, second with strong erect median marginals .... *politura*, n. sp.
5. Last section of fifth vein at most one-third length of preceding section 6
   Last section of fifth vein at least one-half length of preceding; middle segment of arista elongate; second abdominal segment with pair of median marginals .... *setigera Coquillett*
6. Abdominal segments two to four shining black on apical half or more, pollen on second rather sharply defined on narrow basal margin above but extending thinly toward middle on two following ones; third vein with three or four hairs near base
   turmalis, n. sp.

Abdomen wholly gray pollinose above, but narrow hind margin of last three segments appearing darker and subshiny in some angles and usually a reflecting triangular spot on either side of median line on intermediate segments; third vein setulose halfway or more to small cross vein .... *opaca* Coquillett.

7. Haustellum not over head height, gently bowed apically; last three abdominal segments shining black above, with bluish white pollen in well defined cross bands on each, which occupy basal fourth to third at sides but extend nearly to middle on median line .... *melitarae*, n. sp.

Haustellum obviously exceeding head height and usually strongly bowed backward apically; abdomen wholly gray pollinose above with two reflecting triangular spots on intermediate segments *geniculata* Townsend

Siphophyto floridensis Townsend

Siphophyto floridensis Townsend, Trans. Am. Ent. Soc., 19, 1892, 128; Manual of Myiology, Part 4, 1936, 139; *Ibid.*, Part 10, 1940, 263.—West, N. Y. State List, 1928, 811.—Brimley, Insects of N. C., 1938, 360.

Epigrimyia floridensis (Townsend), Coquillett, Revis. Tachin., 1897, 75; Proc. U. S. Nat. Mus., 1910, 539, 606.—Aldrich, Catalogue N. A. Dipt., 1905, 443.—Allen, Ann. Ent. Soc. Am., 22, 1929, 684.

To the items given under the foregoing generic description the following may be added: Parafrontals, parafacials and cheeks with dense whitish pollen, back of head cinereous; frontal vitta, basal segments of antennae and palpi reddish yellow. Thorax black, with moderately heavy gray pollen above which shows four narrow dark vittae well defined before suture; scutellum more thinly pollinose, subshiny black in rear view; calypters glassy white. Abdomen usually wholly black but sometimes with slight reddish tinge in ground color of venter near base; last three segments with silvery pollen in sharply limited bands on basal fourth or less, remainder of segments shining black.

Type locality.—Inverness, Florida.

Distribution.—Material examined comprises the following: 8 males and 1 female (including type specimen) Inverness, Florida, 1891 and February 1892 (Chas. Robertson); 1 male, Dickinson, Texas, May 14, 1931 (H. J. Reinhard); 1 male, Douglas Co., Kansas, 900 ft. (F. H. Snow) and 1 female, Lyons Co., Kansas, June 16, 1923 (R. H. Beamer); 1 female, Carlinville, Illinois (Chas. Robertson); 1 female, Goshen, Utah, August 16, 1940 (R. H. Beamer); 1 male, Spokane, Washington, June 16, 1932 (J. M. Aldrich); and 1 female, Fish Lake, Summerland, British Columbia, June 26, 1931 (A. N. Gartrell).

Holotype.—Male, in the Kansas University Collection.

The species as here considered is quite uniform in color pattern and in having well differentiated, though sometimes depressed, median marginals on the second abdominal segment. The host relationships are not known. For the two host records published under this species see notes under *neomexicana* and *turmalis.*

Siphophyto neomexicana Townsend

Siphophyto neomexicana Townsend, Trans. Am. Ent. Soc., 19, 1892, 128.
Epigrimyia floridensis (Townsend), Coquillett (partim), Revis. Tachin., 1897, 75.—Aldrich (partim), Catalogue N. A. Dipt., 1905, 443.

The species was described from a single female, which I have compared with the type male specimen of *floridensis.* Aside from sexual characters, the differences between the type specimens are slight. The primary distinctions are mainly as follows: *neomexicana* lacks median marginals on the second abdominal segment; pollen on base of third segment not in a sharply limited cross band but extends thinly towards middle above; venter reddish on basal half. Of these items, however, only the first mentioned appears constant throughout the material here associated with the species. Males from New Mexico (type locality), Texas, and Kansas all have the sides of the abdomen broadly red and the pollen on the last three abdominal segments restricted to the basal fourth or less. In most females the abdomen shows little or no red color on the sides and sometimes the pollen on the third segment is disposed in a well defined basal cross band. Although *neomexicana* as here constituted is still a variable form none of the differences noted in the material available for study seem sufficiently constant to recognize any additional specific segregates.

Type locality.—Las Cruces, New Mexico.

Distribution and hosts.—The following records are based upon material examined: 3 females, Las Cruces, New Mexico, August 30 and September 3, on flowers of *Solidago arizonica* and September 21 (type), all collected by C. H. T. Townsend; 2 males, La Cueva, New Mexico, Organ Mts., about 5,300 ft., on flowers of *Lippia wrightii* (Townsend); 1 female, "CM. 156 (3), Mesilla, N. M., bred from *Plodia,* (Cockerell)"; 1 female, Raton, N. M., Oct. 18, bred from nest of *Bombus fervidus,* Coll. W. P. Ckll.; 1 male, College Station, Texas, May 22, 1943 (H. J. Reinhard); 8 males and 11 females, Cherokee Co., Kansas, September 14-15, 1942, reared from *Plodia interpunctella* by R. H. Beamer; 1 male and 2 females, Fresno, California, September 15 and October 25, 1925, reared from *Plodia interpunctella* (J. C. Hamlin); 1 female, "Stan. U., Cal., Feb.

9, 1905, from bottle of *Balaninus* larvae, acorn (Burke)"; and 1 female, "Hopk. 15604b^2, reared Aug. 17-18."

Holotype.—Female, in the Kansas University Collection.

The Mesilla specimen reared from *Plodia* sp. by Dr. Cockerell was determined as *Epigrimyia floridensis* by Coquillett and was so recorded by Aldrich (1905, p. 443) and by Essig (1929, p. 579). It appears doubtful that the specimen reared from the *Bombus nest* parasitized a larva of that species. Likewise the *Balaninus* host record is subject to confirmation. It may be stated that the specimen so recorded, as well as the one bearing the Hopkins accession number, is more robust in build and may eventually prove a distinct species. Both specimens are in the U. S. National Museum; neither is very well preserved.

Siphophyto setigera Coquillett

Siphophyto setigera Coquillett, Can. Ent., 27, 1895, 127.—Brimley, Insects of N. C., 1938, 360.

Epigrimyia setigera (Coquillett), Revis. Tachin., 1897, 75.—Aldrich, Catalogue N. A. Dipt., 1905, 443.—West, N. Y. State List, 1928, 811.

This species was also based upon a single type (male) specimen, which I have not seen. However, a specimen in the U. S. National Museum selected by Dr. M. T. James as closely approximating the type was kindly loaned to me for study.

Setigera is readily distinguished from all known related forms in having the hind cross vein retracted so that the last section of the fifth vein equals one-half or more the length of the preceding section. In most other respects the species is similar to the genotype, *floridensis,* but the haustellum is more slender and exceeds the head height. Also, the abdomen in the male, less frequently in the female, shows considerable red color on the sides of the two basal segments. Length, 2.5-5 mm.

Type locality.—Southern California.

Distribution.—Records based upon material examined are as follows: 8 males and 4 females, British Columbia: Saanich, September 19, 1930 (W. H. Preece); Seaton Lake, Lillooet, June 2, 1926 (J. McDunnough) and June 3, 1917 (A. W. A. Phair); Oliver, June 16, 1923 (E. R. Bucknell); Fitzgerald, August 21, 1921 (A. R. Carter); Vaseaux L., June 12, 1919 (E. R. Bucknell); Vernon, July 16, 1920 (N. I. Cutler); and Lytton, August 2, 1931 (J. Nottingham); 1 male, "California," without precise locality; 1 male and 6 females, Missoula, Montana, August 11-12, 1931 (J. Nottingham); 1 male, Viola, Idaho, June 26, 1912 (J. M. Aldrich); 1 male, Yellowstone National Park, August 11, 1921 (J. M. Aldrich); 1 male, Logan, Utah, July 22, 1940 (G. F. Knowlton); 1 male, "Milwaukee, Wisconsin"; 1 male and 1 female, Carlinville, Illinois (Chas. Robertson); 2 females, Norway Park, Lake of Bays, Ontario, July 28-30, 1919 (J. McDunnough); 2 females, Long Island, New York, Selden, September 1, 1934 and Huntington, August 5, 1934 (Blanton & Borders); 1 male and 1 female, North Carolina, Raleigh, July 14, 1943 (C. S. Brimley) and Mitchell, August 20-22, 1926 (R. W. Leiby); 2 males, Plummer's Island, Maryland, May 20, 1903 (W. V. Warner) and August, 1918 (August Busck); and 1 female, "Opelousas, Louisiana, March, 1897" without collector's label.

Holotype.—Male, in the U. S. National Museum.

The host relationships of the species are not known. There is considerable variation in the length of the haustellum; it ranges from slightly over to nearly one and one-half times the head height. Also, it may be mentioned that the last section of the fifth vein, though always one-half the length of the preceding one, at times exceeds three-fourths the length of same. Considering the characters involved, these extremes perhaps sound more convincing than they appear upon examination in the presence of intermediate forms.

Siphophyto politura, new species

This species like the three preceding has sharply limited pollen bands on the last three abdominal segments, but is larger in build and more shining black in general aspect.

Male.—Front at vertex 0.38 and at antennal base 0.50 of head width; parafrontal subshiny black, with thin gray pollen near vertex becoming heavier downward, more silvery on parafacial and cheek; frontal vitta deep velvety red, wider than parafrontal; antennae mostly black, third segment broad to rounded tip, about six times length of second; arista black, middle segment straight to arcuate, usually not over one-fifth length of apical; haustellum equal to slightly over head height; palpi red, sparsely beset with stubby black hairs; cheek one-third eye height; back of head cinereous, subshiny black above.

Thorax black, notum moderately shining, with thin grayish pollen which is heavier at sides from humeri to suture and on pleura; scutellum concolorous with thorax, without any pollen on entire surface above; chaetotaxy as in *floridensis.*

Wings gray hyaline; third vein setulose over halfway to small cross vein; first posterior cell narrowly open to closed at costa slightly before wing tip; hind cross vein a trifle nearer small cross vein than bend of fourth; last section of fifth vein at most two-fifths length of preceding; costal spine longer than small cross vein; epaulets and subepaulets black; calypters white to pale tawny.

Legs black, rather long but not very slender; mid tibia with one anterodorsal bristle, hind tibia with a row of uneven widely spaced bristles on outer posterior side; tarsi moderately slender, distinctly longer than tibiae; claws and pulvilli very short.

Abdomen narrower than thorax and considerably longer than same, shining black with sides and venter of basal segments usually contrasting red in ground color; silvery pollen bands on last three segments above, very narrow on second but occupying basal fifth on last two; median marginal pair on second segment nearly as large as bristles in marginal row on third and fourth; hypopygium black, moderately large, retracted.

Female.—Front at vertex 0.37 of head width increasing to 0.49 of same at antennal base; proximal antennal segments red, third rather slender and slightly concave on front edge; abdomen broader, with red color at sides much more limited than in male; fore tarsus smooth, about as thick as tibia with intermediate segments slightly flattened, black pubescent beneath with median line pale cinereous.

Length, 4-6 mm.

Holotype.—Male, Laniel, Quebec, July 5, 1944 (A. R. Brooks) in the Canadian National Collection.

Allotype.—Female, "Custer, South Dakota" (J. M. Aldrich), in the U. S. National Museum.

Paratypes.—Twelve males and 1 female, same data as holotype, in the Canadian National Collection; 2 males and 1 female, Isle Royal, Michigan, August 8, 1936 (C. Sabrosky & R. R. Dreisbach) and 6 males, same data as holotype, in my collection; 6 males and 3 females, New Brunswick-McGivney, Fredericton, and Bolestown, July 12-13, 1931 (J. M. Aldrich); and 2 females, "White Mts." (Morrison), all in the U. S. Nation Museum.

Siphophyto turmalis, new species

Allied to *neomexicana*, but the haustellum is longer and the last three abdominal segments are more extensively pollinose.

Male.—Front at vertex 0.40 of head width (average of two specimens), widening evenly forward into facial angle; face rather deeply impressed, whitish pollinose on pale ground color, parafacial and cheek more silvery; parafrontal opaque gray to vertex; frontal vitta red, wider than parafrontal; antennae reaching to oral margin, proximal segments obscurely reddish, third wholly back about four times longer than wide; arista thickened nearly to tip, middle segment straight, about one-fifth length of apical; facial ridges weakly bristled on lowest fourth or less; haustellum slightly over head height; palpi yellow, slender with tips barely thickened; cheek one-fourth height of eye, latter descending about to vibrissal level; back of head opaque gray pollinose.

Thorax black, gray pollinose, marked dorsally with four narrow dark vittae before suture but extending only shortly behind; scutellum black subshiny with disk showing thin pollen in most views; chaetotaxy as in *floridensis*.

Wings subhyaline; first posterior cell usually closed at costa shortly before wing tip; hind cross vein midway to slightly nearer small cross vein than bend; third vein with three to six hairs near base; last section of fifth vein two-fifths length of preceding; costal spine small but distinct; epaulets and subepaulets reddish; calypters white with yellow tinge on margin of hind lobe.

Legs black, longish but not slender; mid tibia with one good-sized bristle on outer front side near middle; hind tibia subciliate; fore tarsus slender, distinctly longer than tibia; claws and pulvilli minute.

Abdomen ovate, about as wide as thorax, black with sides and venter of basal segments more or less reddish in ground color; last three segments with gray pollen, which is usually confined to the narrow basal margin on second but extends thinly towards middle above on third and fourth, latter subshiny black on apical three-fifths; second segment without median marginals, last two each with marginal row; hypopygium black, basal segment convex behind, with a marginal row of bristly hairs; sternites covered.

Female.—Front at vertex 0.40 of head width (average of five specimens); proclinate orbitals about as large as average frontal; third antennal segment narrower, with front edge slightly concave below arista; cheek nearly one-third eye height; abdomen broadly ovate, wholly black in ground color; fore tarsi slender as in male.

Length, 4.5-5 mm.

Holotype.—Female, Babylon, L. I., N. Y., June 9, 1935 (Blanton & Borders), in the U. S. National Museum.

Allotype.—Male, same data as type, in my collection.

Paratypes: 11 females, Carlinville, Illinois (Chas. Robertson) in the Illinois State Natural History Survey Collection; 3 females, Jordan, Ontario, July 22, 1914 (W. A. Ross), Covey Hill, Quebec, June 28, 1923 (C. H. Curran), and Melrose Highlands, Massachusetts, September 12, 1909 (W. R. Thompson), in the Canadian National Collection; 1 male and 4 females, same data as type and 1 female, Dane County, Wisconsin, June 5, 1938 (Fred Snyder) all in my collection; 1 female, Pineola, North Carolina, June 26, 1943 (D. L. Wray) in the North Carolina State Collection; 1 female, "Virginia," 1 male and 1 female, Grove Hill, Maryland, September 2 and October 30, on flowers of aster (C. H. T. Townsend), and 1 male, "Canobie Lake, N. H., No. 963A," reared from *Tephroclystis absynthiata* by George Dimmock, all in the U. S. National Museum; 1 female, "Great Smoky M., N. P., May 24" (R. C. Osburn) in the Ohio State University Collection.

The Canobie Lake specimen was recorded as *Siphophyto floridensis* by Aldrich (1932, p. 2). Although the pollen on the abdomen is more restricted on the bases of the last three segments than in the average run of the *turmalis* specimens, it agrees with the latter species in having the haustellum longer than head height and in lacking median marginals on the second abdominal segment.

Siphophyto opaca Coquillett

Siphophyto opaca Coquillett, Can. Ent., 27, 1895, 128.

Epigrimyia opaca (Coquillett), Revis. Tachin., 1897, 74.—Aldrich, Catalogue N. A. Dipt., 1905, 444.

The species was briefly described from a female specimen, which I have not seen. No additional material has been recorded hitherto and a more complete description appears in order.

Male.—Front at vertex 0.42 and at antennal base 0.52 of head width; sides of front and face including cheeks white to subsilvery pollinose on pale ground color; face broad and rather deeply impressed, its lateral ridges raised slightly above parafacial in profile, weakly bristled on lowest fourth or less; parafacial nearly one-half width of third antennal segment; frontal vitta red, at middle distinctly wider than parafrontal; third antennal segment wholly black, reaching to oral margin, three and one-half to four times longer than wide, two basal segments reddish, very short; arista rather short, thickened to tapering tip, middle segment slightly arcuate, not over one-fifth length of apical; eye nearly vertical, not reaching to vibrissal level; cheek nearly one-third eye height; palpi slender, reddish yellow; haustellum distinctly exceeding head height.

Thorax and scutellum black, rather densely gray pollinose, notum marked with four narrow dark vittae, which are fairly well defined before suture but fade out shortly behind same; chaetotaxy as in *floridensis*.

Wings hyaline; veins yellow, third setulose halfway or more to small cross vein; first posterior cell very short petiolate to closed at costa near wing tip; hind cross vein midway to slightly nearer bend of fourth; last section of fifth vein at most one-third length of preceding; epaulets red; costal spine small but distinct; calypters white with pale yellow tinge.

Legs black, moderately long and slender, weakly bristled; mid tibia with one anterodorsal bristle, hind tibia with a row of uneven widely spaced bristles on outer posterior edge; fore tarsus about one-third longer than tibia; claws and pulvilli small.

Abdomen considerably longer than thorax but nearly as wide as same, black with sides on basal half broadly yellow, this color extending on venter and somewhat obscured above by rather heavy gray pollen, which becomes thinner near hind margin on last three segments and shows reflecting triangular spots on the two intermediate ones; second segment usually without differentiated median marginals and last two each with marginal row; hypopygium shiny black; inner forceps short, united, keeled near base behind, tapering to a sharp tip; outer forceps triangular, base broad, reddish; sternites covered. Length, 5-6 mm.

Female.—Front at vertex 0.42 of head width; face less deeply impressed; third antennal segment moderately slender about five times longer than wide; palpi stouter with tips thickened; abdomen usually showing little or no red color on sides, with heavier and more extensive pollen above than in male, second segment sometimes with well developed median marginals; fore tarsi rather slender, elongate.

Type locality.—Southern California.

Distribution and hosts.—Material examined includes the following: 7 males and 6 females, Bexar Co., Texas, January to June (H. B. Parks), 1 male and 4 females, College Station, Texas, March to November (H. J. Reinhard), 1 male, Chillicothe, Texas, July 16, 1941, reared from *Homoesoma electellum* in safflower, all in my collection; 1 male, Plano, Texas, October (E. S. Tucker), 1 male, Rio Benito, New Mexico, October 17, on flowers of aster (Townsend), 1 male and 1 female, Wellington, Kansas, "Webster No. 5428" (E. G. Kelley), 1 male, "Claremont, Calif." (Baker), Collection J. M. Aldrich, all in the U. S. National Museum; and 1 female, White Sands, New Mexico, July 14, 1926 (D. R. Lindsay), in the Kansas University Collection.

Holotype.—Female, in the U. S. National Museum.

The female specimen from Wellington, Kansas, bears Dr. Townsend's determination label, "*Siphophyto* prob. *neomexicana.*" There seems little doubt that it belongs to the present form, which, particularly in the female sex, is readily distinguished by the almost wholly opaque gray abdomen. The unusually short second aristal segment and three sternopleurals which Coquillett mentioned for the type are evidently not normal. The middle segment of the arista averages at least three times longer than wide and the number of sternopleurals is normally four but the two intermediate ones are always smaller with one occasionally vestigial or entirely lacking.

Genus **CORONIMYIA** Townsend

Coronimyia Townsend, Trans. Am. Ent. Soc., 1892, 128; Smithsonian Misc. Coll., 51, 1908, 84; Manual of Myiology, Part 4, 1936, 151; *Ibid.*, Part 10, 1940, 277.

Epigrimyia of authors (nec Townsend).—Coquillett (partim) Revis. Tachin., 1897, 74; Proc. U. S. Nat. Mus., 37, 1910, 528, 539.—Aldrich (partim) Catalogue N. A. Dipt., 1905, 443.

The type and sole original species is *C. geniculata* Townsend. It was described from a single male specimen (mistaken for a female) collected by Chas. Robertson at Carlinville, Illinois.

Coronimyia and *Siphophyto* are quite similar in many respects. From the foregoing description of the latter, the type species of *Coronimyia* differs mainly as follows:

Length 4.5-7 mm. Outer vertical small but distinct and only one proclinate orbital in both sexes; arista slightly to distinctly geniculate, middle segment about one-fifth length of apical; haustellum very slender, variable in length ranging from a little over to nearly one and three-fourths times head height and usually strongly bowed backward toward tip; palpi claviform; eye vertical, reaching to vibrissal level; cheek hardly one-fourth eye height. Thoracic chaetotaxy as in *floridensis*, but with only 2 intraalars (anterior one absent), and dorsocentrals 3, 4 (two immediately behind suture small, the anterior one frequently lacking); pteropleural as long as smallest sternopleural. Costal spine vestigial; third vein with two or three small hairs near base; hind cross vein midway to slightly nearer bend than small cross vein; last section of fifth vein about one-third length of preceding; first posterior cell closed and normally short petiolate. Legs rather slender and nearly equal body length; hind tibiae with row of weak but nearly even bristles on outer posterior edge, one near middle slightly stouter; fore tarsi slender in both sexes, about one-half longer than tibiae. Abdomen considerably flattened above in both sexes, as wide as thorax; two basal segments without median marginals, third without complete marginal row, usually two stoutish pairs at sides and sometimes a median marginal pair differentiated in either sex; anal segment with marginal row, no discals; male hypopygium moderately large curved forward under tip of abdomen; genitalia about as in *S. floridensis.*

Coronimyia geniculata Townsend

Coronimyia geniculata Townsend, Trans. Am. Ent. Soc., 19, 1892, 129; Manual of Myiology, Part 4, 1936, 151; *Ibid.*, Part 10, 1940, 277.

Epigrimyia geniculata (Townsend), Coquillett, Revis., Tachin., 1897, 75; Proc. U. S. Nat. Mus., 37, 1910, 528.—Aldrich, Catalogue N. A. Dipt., 1905, 443.—West, N. Y. State List, 1928, 811.—Allen, Ann. Ent. Soc. Am., 22, 1929, 684.

Male.—Front at vertex 0.41 of head width, diverging gradually toward antennal base; parafrontals pale yellowish, sparsely beset with short black hairs; face, cheeks and posterior orbits white to subsilvery, back of head cinereous; frontal vitta red, wider than parafrontal; basal segments of antennae red, third wholly black; palpi yellow. Thorax with gray pollen on which are two pairs of dark vittae that fade out considerably before base of scutellum. Legs blackish, weakly bristled; mid tibia with one anterodorsal bristle; claws and pulvilli short. Wings hyaline, veins including costa yellow; calypters glassy white. Abdomen reddish on broad sides and venter of three basal segments, fourth and narrow hind margin of third darker, with gray pollen above which appears thickest along median line and on outer basal margins of last three segments when viewed in a flat rear angle; hairs on entire upper surface fine and depressed.

Female.—Similar to male but the abdomen is more broadly ovate and considerably darker on last three tergites above.

Type locality.—Carlinville, Illinois.

Distribution and hosts.—Records based upon material examined are as follows: 12 males (including type specimen) and 11 females, Carlinville, Illinois (Chas. Robertson); 1 male and 2 females, Opelousas, Louisiana, March 1897, without collector's label; 1 male, A. & M. College, Mississippi, February 12, 1922, reared from an undetermined pyralid or tortricid larva by H. W. Allen; 2 males, "7822[01] Par: on phycid in dried peach, Southern Pine, N. C., iss. 9am, 10-98"; and 2 males, Wilmington Notch, Adirondacks, New York, June 29 and July 1 (J. M. Aldrich); 5 males and 3 females, "ex *Moodna ostrinella*, March 31-April 9, 1945, F. I. Survey, Ont., Kemptville, Ont., No. 044-1904," all in the Canadian National Museum.

Holotype.—Male, in the Kansas University Collection.

The reared Mississippi specimen listed above was recorded by Allen as *Epigrimyia geniculata* (Annals, 22, 684); it is teneral and in poor condition but undoubtedly belongs here, although the haustellum is considerably shorter than in the remainder of the material here included.

Coronimyia melitarae, new species

Female.—Front at vertex 0.45 of head width (average of two specimens), widening evenly downward into facial angle; head pale in ground color except parafrontals on upper half, ocellar triangle and occiput which are black, pollen pale (considerably discolored in both specimens); frontal vitta pale reddish yellow, barely as wide as parafrontal; outer verticals small, sometimes absent; two weak proclinate and one stouter reclinate orbital; postocellars four in transverse row, nearly as long as proclinate ocellars; antennae subequal length of face, proximal segments including basal part of third red, remainder of latter segment black; arista bare, thickened to apical third, middle segment slightly arcuate, one-fifth length of apical; facial ridges obliquely flattened, bearing two or three bristly hairs next to vibrissae; latter on oral margin, short, not decussate; parafacial bare, narrower than third antennal segment; eye bare, extending about to vibrissal level; cheek sparsely black-haired, one-third eye height; haustellum about equal head height; palpi yellow, clavate; occiput gray pollinose, clothed with sparse short hairs.

Thorax with rather heavy pale gray pollen (discolored on pleura and at sides above), notum marked with four vittae which are well defined at least before suture; scutellum black, with thinner changeable gray pollen; acrostichal 1, 1 or 2; dorsocentral 3, 4; intraalar 3; supraalar 3; pteropleural 1 (small); sternopleural 4; scutellum with 2 lateral and 1 small depressed discal pair, no apicals; prosternum, propleura and sides of postnotum beneath calypters bare.

Wings whitish hyaline; first posterior cell closed, with short petiole reaching costa slightly before wing tip; third vein with three or four hairs near base; hind cross vein nearly halfway from small cross vein to bend, latter broadly rounded, without stump or fold; last section of fifth vein about one-third preceding; costal spine vestigial; calypters opaque white.

Legs black, moderately long, weakly bristled; hind tibiae ciliate, middle pair with one anterodorsal bristle; fore tarsi slender, basal segment subequal combined length of three intermediate ones; claws and pulvilli short.

Abdomen long ovate, shiny black with sides and venter of two basal segments red in ground color, pollen bluish white, in rather sharply limited cross bands which occupy basal third or less at sides of segments two to four but extending nearly to middle of each on median line; two basal segments without third with one pair of median marginals, fourth bearing a marginal row; genitalia retracted blackish; sternites covered.

Length, 6 mm.

Holotype.—Female, Oceanside, California, August 1924, ex. *Melitara* sp. (A. P. Dodd) and 1 paratype, female, same data as type, in the U. S. National Museum.

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SYNCHRONOUS SINGING OF 17-YEAR CICADAS

By H. A. Allard
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During collecting trips in May and June, 1945, to study the plant life of Bull Run Mountain, Virginia, I was afforded an opportunity to observe some of the activities of brood II of the 17-year cicada occurring here. In this area this brood appeared to be concentrated in the forests of the Bull Run and Pond Mountain ridges, as well as in the swamp woods along the banks and flood plain of Broad Run, at least for a distance of five miles down stream from Thorofare Gap.

The adults were beginning to emerge and a few were seen clinging to the herbage and shrubs on the lower east slope of Pond Mountain on May 13, but there was no singing at this time. On May 20, the grand chorus of their music had reached almost full volume everywhere. Owing to cold east winds and rain, I did not visit this locality on May 27 but on June 3, a clear, sunny day, I again visited the area. These interesting cicadas at this time appeared to be at the peak of their abundance and activity. They were ovipositing everywhere on the lowest shrubs and in the tallest trees. Dead, weakened or dying individuals were frequently met with.

It has long been known that these cicadas occur in two forms, one form being very much smaller than the other. This is known as forma *cassinii*. The typical song of the larger insect is a low-toned, mellow, droning note, which falls to a lower key by muting and released tension on the tympanum as it seems, by dropping the abdomen and closing the ventral drum chambers. This up and down tonal swing is continued rhythmically and leisurely with attendant up and down abdominal movements by every individual, until the forests fairly breathe with low, hollow, blending murmurous sound for mile upon mile as one traverses the ridges. It is an incessant chorus in which the individual notes or the variations which characterize them are no longer distinguishable. From dawn till dark, and sometimes even at night on occasions, the songs of millions of busy cicadas hang in the trees, soft and soothing, with a hollow, murmurous quality somewhat like the sounds one hears when a big sea shell is held to one's ear.

On the higher ridges, the larger form is dominant, and in many localities here, the smaller form is not present at all, or its numbers are very few. In the lowland forests along Broad Run, the smaller form in some localities was almost the only one heard, and it too occurred here in countless myriads. Its song bears no resemblance whatever to that of the larger form; it is a loud, insistent, hissing, or lisp-like note recalling the pulsating, sizzling, hissing of escaping steam.

During an entire day spent in the heavy forests along about five miles of the course of Broad Run below Thorofare Gap, I was impressed with a peculiar characteristic in the singing behavior of this smaller form. In these localities where great colonies had built up until one was immersed in an almost deafening, seething din of hissing sound, it was noted that the sounds swelled and subsided very regularly in a definite rhythm. This was so evident that others who were with me remarked about the phenomenon. Careful counts revealed nine to ten, usually ten pulsations per minute. The sounds never entirely ceased but subsided to weak volume, then swelled rapidly to maximum deafening volume, to die away again.

If a strong wind swept over the trees, this rhythm became broken but was quickly restored as soon as the gust passed. I noted these pulsations of synchronous singing in several distinct colonies, and every one sang with about ten pulsations per minute, sustaining this behavior for indefinite periods, or until winds or other disturbances interrupted the chorus.

It would appear that these great aggregations of the smaller form were singing more or less in synchronous time at regular intervals so that there were impressive crests and troughs of sound produced in regular rhythm, but no such rhythmic singing behavior appears to characterize the singing of the larger form on the highland areas. This is the first instance in my experience when I have noted any tendency toward synchronal singing among cicadas at regular intervals.

In the paper of R. E. Snodgrass, The Seventeen-year Locust, Ann. Report of the Smithsonian for 1919: 381-409, he says of the song of the *cassinii* form on page 397, that "It was common out of doors, but always heard as a solo, never in chorus." Nothing could be more impressive than the great rhythmic choral singing of these insects in the Bull Run area.

The typical individual song of the *cassinii* form is somewhat locust-like, with the pattern of that of a meadow grasshopper (*Orchelimum*). It begins with a series of very rapidly delivered staccato lisps, *tsippi-tsippi-tsippi-tsippi*, which terminate with the syllable *zeee-u u u u u*. This entire song is repeated at the rate of about 18 deliveries per minute. The final *zeee-u u u* shows a drop in tone and a muted ending of the syllable *u u u u*. There is considerable variation in individual songs. Sometimes an insect singer often slows down its song, but continues the short, staccato lisps, *zit-zit-zit*, or *tip-tsip-tsip,* as some interpret it, for an indefinite period. One cicada continued to sing thus for 1¾ minutes.

From a study of the chorus singing of the larger form, the impression of which is a steady, hollow murmur of sound in the trees from morning till night, I am of the opinion that this is the resultant blending of the two pharaoh notes, which one hears the individual sing ordinarily. I was given exceptional opportunities to hear these notes in chorus by studying them from the tops of the high cliffs on the ridges, where one was virtually in the tree tops themselves from this vantage point.

All in all it is a wonderful experience to be present during the grand exodus of these cicada broods, and to hear their millions in voice, as if the leaves of the forests themselves were breathing aloud or indulging in an audible murmur of sound. Wonderful is it that the mysterious designs of life should have originated such an anomalous and interesting insect, to spend 17 years in dark, underground burrows, and but a few weeks in the air and sunshine, merely to sing and to reproduce for a few short hours. Let us hope that the race will survive as long as life itself graces the surface of our planet with its marvellous expressions.

THREE NEW SPECIES OF AEDES FROM NETHERLANDS NEW GUINEA

By WILLARD V. KING, *Lieut. Colonel,* and HARRY HOOGSTRAAL, *Captain, Sanitary Corps, AUS**

Three new species of the lesser subgenera of *Aedes* (*Pseudoskusea, Leptosomatomyia,* and *Skusea*), taken by members of this laboratory in the Hollandia sector of Netherlands New Guinea are described in the following paragraphs. Each of the three species is apparently an uncommon one in the area.

Aedes (Pseudoskusea) lunulatus, new species

MALE.—*Head:* Proboscis entirely dark, slightly longer than fore femur. Antennae about two-thirds length of proboscis, densely plumose with long pale hairs directed mostly in two planes. Palpi almost as long as probocis, last two segments bristly, turned slightly downwards; tip of long segment and apical segments slightly swollen. Clypeus dark, bare. Vertex and lateral surface with broad, creamy white scales covering entire surface, patch of yellowish upright forked scales posteriorly. *Thorax:* Scutal integument brownish, covered with narrow dark scales and with long, dark bristles, a few narrow yellow scales along anterior margin. Scutellum with narrow black scales and long bristles on all lobes. Postnotum dark brown, bordered by yellow. Anterior pronotum

*From the 19th Medical General Laboratory, U. S. Army, of which Colonel Dwight M. Kuhns, Medical Corps, is Commanding Officer. Contribution Number Six from the Entomology-Mammalogy Department.

with long, dark bristles and yellowish hairs. Pleura and posterior pronotum with pale yellow integument spotted with black (Pl. 11, A). Posterior pronotum with a dark, crescentic spot on upper half with scattered, dark hair-like scales; a group of long, dark hairs just below dark spot; a row of about six yellowish bristles posteriorly. Postspiracular area dark, with numerous yellowish bristles, the dark color extending forward as a stripe to propleuron. Prealar knob dark, with a group of dark bristles. Sternopleuron with an upper dark spot and patch of bristles, a large patch of broad white scales centrally, a large dark area anteriorly below, and a row of long, pale hairs along posterior border. Mesepimeron with numerous long yellowish hairs along upper border, a patch of white scales centrally, and at least 6 long, pale lower posterior hairs. Propleuron dark, covered with numerous fine, yellowish bristles. Wings with all scales dark, outstanding (plume) scales of fork of vein 2 slightly broadened (scales of vein 3 and 4 rubbed in holotype, but male paratypes show slightly broadened scales on tip of veins 3 and fork of vein 4); upper fork cell about equal in length to stem, its base slightly nearer tip of wing than that of lower; posterior cross vein more than its own length closer to base of wing than anterior. Length of wing 2.5 millimeters. Coxae with pale bristles and a few white scales. Remainder of legs uniformly clothed with dark scales. Fore tarsal claws nearly equal, the larger one toothed; mid claws sub-equal, simple; hind claws small, simple. *Abdomen:* Dorsal and lateral surface clothed with black scales, segments IV to VII with complete narrow basal bands of yellowish scales broadening into lateral spots (paratype males show basal bands on II and III as well, but these segments are obscured in holotype); sternites with basal bands of yellowish scales and apical bands of black scales. *Hypopygium* (Plate 12): Ninth tergite lightly sclerotized, widely divided medianly, each lobe bearing five stout bristles. Paraproct a pair of simple prongs, tips heavily sclerotized and slightly curved. Phallosome simple, smooth, bullet shaped. Coxite about three times as long as width at apical third, basal half narrower than apical half, the tip bluntly rounded; bearing some scales and scattered bristles; inner margin of basal two-fifths with a dense longitudinal row of long drooping bristles. Style slender, about two-thirds as long as coxite, strongly curved apically, with a single short, subapical bristle; apical appendage slender, nearly a third as long as style.

FEMALE.—Differs from male as follows: Antennae almost as long as proboscis, dark with scattered pale hairs, 3 to 6 long dark bristles radiating from the base of each flagellar segment, a group of shorter bristles near the apex of the first three flagellar segments; palpi dark, about one-sixth length of proboscis; scutum with a pair of submedian bare lines anteriorly; wings with outstanding scales of veins 2 to 4 long, linear, slightly broadened at tip of vein 2; halteres (not visible in holotype) pale yellow at base of stem, apex of stem and bulb dark; tarsal claws not toothed; abdominal segments II to VI with complete narrow basal bands, VII entirely black scaled; VIII retractile, triangular, latterly appressed, scaleless, yellowish; cerci yellowish, fairly long.

LARVA.—(Plate 11, B, C,) *Head:* Antenna slender, more than half as long as head, with few but prominent spicules on median and apical part of shaft; antennal hair single, lightly plumose, arising at about middle of shaft. Preclypeal spines slender, straight, almost half as long as antenna. Head hair A (preantennal) with 10 plumose branches, arising just posterior of base of antenna; B considerably longer than head, single, thick at base and tapered to a point apically, plumose, arising well posterior and interior of A; C about a third as long as B, with 3 plumose branches; arising just interior and posterior of B; *d* not found; *e* single; outer sutural 6 branched. *Abdomen:* Lateral comb of segment VIII a large dense triangular patch of narrow, elongate, bluntly rounded scales each with several small terminal denticles; apical scales distinctly longer than basal ones. Pentad hairs long, 1, 3, and 5 plumose, 1 with 8 branches, 2 with 3 branches, 3 with 6 branches, 4 single or double, 5 with 7 or 8 branches. Siphon darkly pigmented; ratio about 2.5; apical half strongly tapered; apex less than half as wide as base; surface covered with short rows of minute denticles; prominent acus present; from 12 to 15 pecten teeth not quite reaching middle of siphon, each tooth with 1, 2, or 3 basal or sub-basal denticles; ventro-lateral hair tuft arising about level with apex of terminal pecten tooth, almost half as long as siphon, from 3 to 5 branched. Saddle covering about half of anal segment, saddle hair single (divided apically on one side of one specimen). Dorsal sub-caudal hair tuft 8 branched, ventral one single. Ventral brush of 12 thickly branched but rather short hair tufts, all arising from a grid. Anal gills about as long as saddle, gently tapered to a rounded point apically.

Holotype.—Male (459), reared from larva taken from crayfish hole in shaded rain forest, 250 feet elevation, Hollandia, Netherlands New Guinea; 22 January 1945, W. T. Nailon, collector. *Allotype.*—Female, same data as above. *Paratypes.*—2 males and 2 females, same data as above; 1 male (459A) taken from the crayfish hole at the time the larvae recorded above were collected; 8 males and 2 females taken by the authors in a light trap at th edge of rain forest, elevation 250 feet, Hollandia, on the following dates: 19 and 22 March 1945, 3, 4, 8, 16, and 22 April 1945. Holotype, allotype, paratypes, larva, and larval exuviae deposited in the United States National Museum; others in the Museum of the Division of Economic Entomology, Council for Scientific and Industrial Research, Canberra, A. C. T., Australia.

This is a distinctive species which we readily distinguished while sorting large numbers of light trap specimens by the small size, the contrasting dark scutum and pale pleura, the distinctive dark spots on the pleura, especially the dark crescent on the posterior pronotum for which the species is named, and by the banded abdomen.

Few other Pseudoskuseas are known from Australasia. The present species is presumed to be distinct from *A.* (?*P.*) *culiciformis* (Theobald 1905, p. 77) since no mention is made of the characteristic pleural spots in Theobald's description of his species. Moreover, he described the wing scales as "*taeniorhynchus*-like but small," which is believed to mean broadened, as contrasted with the long narrow scales in *lunulatus*. The type of *culiciformis* was a female from Paumomu River, New Guinea, and is presumably in the Hungarian National Museum. The male is unknown. From other species of *Pseudoskusea* of the Australasian Region (Theobald 1905, p. 78, Edwards, 1924), *lunulatus* is quite readily distinguishable by the combination of banded abdomen, simple tarsal claws of the female, and unadorned scutum.

Aedes (Leptosomatomyia) variepictus, new species

FEMALE.—*Head:* Proboscis distinctly longer than fore femur, curved downwards near apex, clothed with flat black scales and with a few, fine yellowish hairs; several long dark bristles arising ventrally at base; labellae yellowish. Palpi about one-fifth length of proboscis, clothed with flat black scales and a broad row of flat yellowish scales along the inner dorsal border except at tip. Antennae about three-fourths as long as proboscis, dark, with fine pale hairs and 5 or 6 bristles radiating from the base of each flagellar segment; torus and first flagellar segment covered on inner sides with yellowish scales. Clypeus dark, devoid of scales. Vertex with a wide central area of narrow golden scales and pale yellow upright forked scales, bordered by an area of broad black scales and dark upright ones; laterally with two stripes of flat creamy-white scales separated by a stripe of dark scales; eyes bordered by several long, black bristles and a very narrow line of fine yellow scales. *Thorax:* Scutum with fine black scales liberally sprinkled with fine yellowish scales; a narrow median line of yellow scales forked around the antescutellar disk; a broad border of similar scales anteriorly and laterally, curved partway around posterior part of fossae and extending as a pair of submedian lines nearly to tip of scutum; long golden bristles around margins (none dorsally). Scutellum with long, narrow yellowish scales on each lobe and a few scattered dark scales; long pale bristles from the posterior border. Postnotum with black integument, bare. Anterior pronotal lobe with narrow golden yellow scales on anterior half and broad white scales on posterior half, long yellow bristles arising from both halves. Posterior pronotum nearly covered with narrow golden scales, a few lanceolate and broad ones below and about 5 pale bristles along posterior border. Postspiracular area with long yellow bristles and a large patch of moderately broad white scales; anterior to this a v-shaped patch of broad white scales. A stripe of moderately broad white scales just below the border of the mesonotum between the wing root and spiracle. Prealar knob with a dense patch of long yellow bristles and a patch of broad white scales. Sternopleuron with a large patch of broad white scales on upper half, a smaller patch posteriorly on lower half, and a row of long yellowish scales along posterior margin. Mesepimeron with a conspicuous stripe of broad white scales that curves from upper margin to the anterior margin and then crosses the sclerite horizontally just above the long lower mesepimeral bristle. Propleuron with broad white scales and about 10 long yellow bristles. Wings with dark scales on all veins except for a conspicuous line of white scales near the base of vein 1; outstanding (plume) scales of veins 2 to 4 long and narrow; anterior fork cell slightly longer than its stem; posterior cell arising slightly closer to the base of the wing than the anterior; posterior cross vein arising almost twice its own length more basal than mid cross vein; subcosta with a patch of black scales and 2 short bristles near base on under side of wing. Halteres with pale integument, a few dark scales at base of knob, light scales on knob. Coxae with separate patches of broad white and black scales and rows of long yellow bristles. Fore and mid femora with narrow basal yellow bands, outer surface clothed with black scales sprinkled with yellow some of which are grouped into small spots; inner surface with yellow and scattered black scales on basal two-thirds, apex chiefly black scaled; an irregular sub-apical band of yellow scales and a short apical longitudinal yellow line on each. Hind femur with only yellow scales on basal three-fourths of inner surface, apex black scaled; outer surface chiefly yellow scaled on basal two-thirds, black apex interrupted subbasally by a narrow transverse line of creamy white scales, the outer and inner black apices divided by a narrow posterior longitudinal line of yellow scales. Fore and mid tibiae with narrow inner and outer basal white patches, otherwise black scaled; hind tibia with a conspicuous narrow basal white band elongated into patches on inner and outer surfaces; all tibiae with scattered yellow bristles. Fore and mid tarsi with a small basal white patch on segments 1 and 2, and a very narrow ring on 3; segment 1 of hind tarsus with a narrow basal white ring extending on upper side as a line about one-fifth length of segment; segments 2 to 5 each with a narrow basal white ring. Tarsal claws simple. *Abdomen:* Dorsum black scaled except for wide median basal patch of white scales on II to VI and an enlarged triangular patch on VII reaching almost to apex of segment; wide lateral lines of white scales arise basally and extend subapically for a short distance onto the dorsum of each segment. Venter mostly yellow scaled. Tergite VIII small, nearly covered by white scales and numerous yellowish bristles. Cerci fairly short and broad.

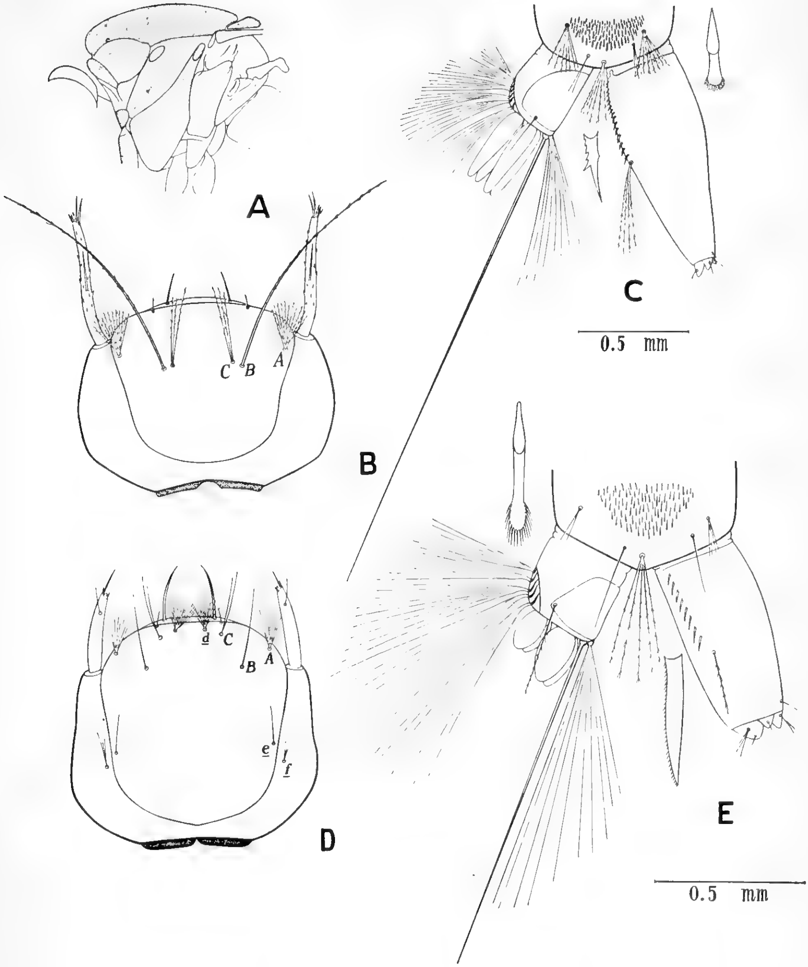
Holotype.—Female (1012) taken while trying to bite at 4:30 p.m. in mossy forest at about 4,700 feet elevation, Mount Dafonsero, Cyclops range, Hollandia area, Netherlands New Guinea, 20 April 1945, W. E. Brewer, collector. *Paratype.*—

Female (1014) same data except that it was taken at noon 21 April at about 2,500 feet elevation; 2 females labeled "Dutch New Guinea, Cyclops Mts. 3400-4500 ft. iii, 1936. L. E. Cheesman B. M. 1936—271." (Two additional specimens from the same location are probably the same species but are in very poor conditon. These specimens were examined in the U. S. National Museum through the kindness of Dr. Alan Stone.) Holotype and paratype deposited in the United States National Museum. The other two paratypes are to be returned to the British Museum.

These specimens resembled, *Aedes* (L.) *medialis* as described by Brug (1932) but differ from it in the following respects: scutellar scales almost all golden instead of almost all dark; the presence of the conspicuous sub-basal line of white scales on wing vein I, anterior fork cell not twice as long as its stem; the broad white scales on the anterior pronotal lobe; the conspicuous yellow ornamentation of the palpi; lateral white lines of abdominal tergites not reaching the apex of the segments; the white patch on each tibia, and white line on the hind tibia, etc. The species differs greatly from the third member of this subgenus, *A.* (*L.*) *aurimargo* Edwards, the most striking differences being that all scutellar scales are narrow (instead of flat); occiput with a wide median area of narrow scales; pale scales present at base of vein 1 and on palpi; ornamentation of pleura, legs, etc.

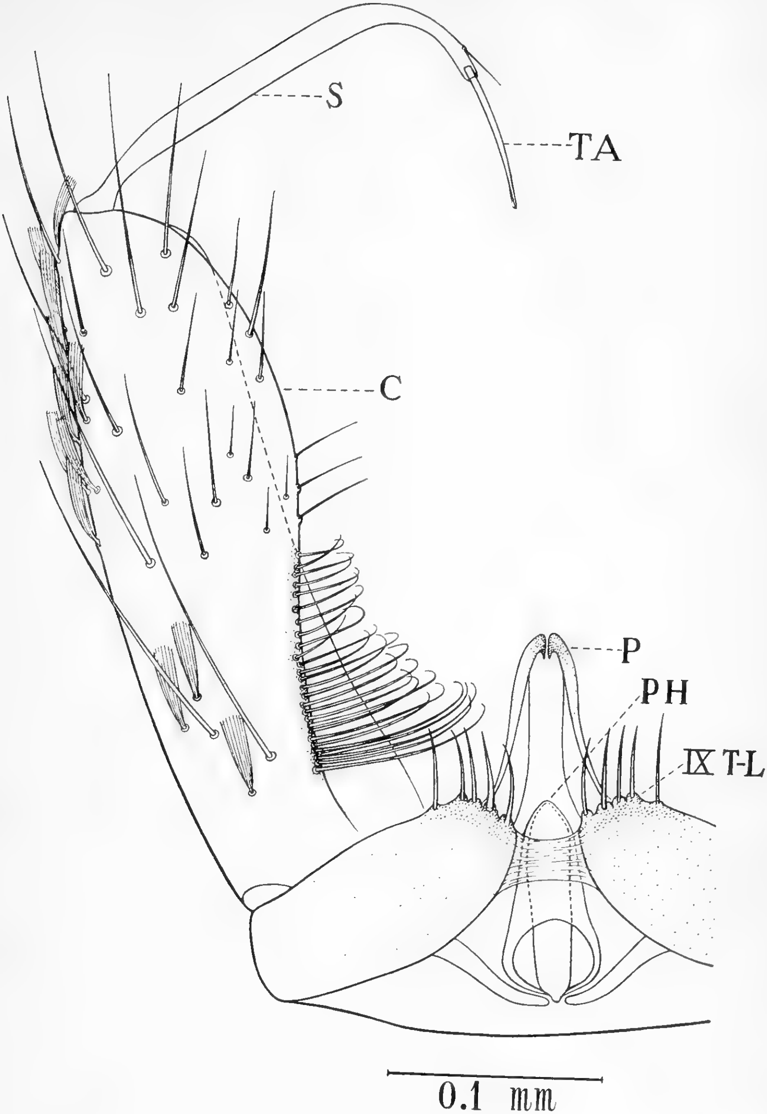
Aedes (Skusea) dasyorrhus, new species

MALE.—*Head:* Proboscis about equal to fore femur, straight, dark-brown scaled, with scattered, short, forward-pointing bristles. Palpus slender, four-fifths length of proboscis, dark-brown scaled, straight, with few bristles except for 3 long ones apically. Clypeus dark, nude. Antenna about as long as proboscis, the flagellum pale, with a whorl of long dark hairs arising from middle of each segment; torus dark. Vertex and lateral surface of head covered with broad, imbricated scales, dark with bronzy to metallic blue-green reflection, except for a small patch of broad white scales dorsolaterally; long, heavy, dark bristles present along eye margins; (nape hidden in type, but paratypes show a small patch of dark upright forked scales). *Thorax:* Scutum with integument brown, clothed with rather coarse lanceolate golden-brown scales; long, dark, heavy bristles arising from the disc and from the anterior and lateral margins. Scutellum clothed with broad dark scales with bronzy to metallic blue-green reflection (a few of which extend onto posterior margin of scutum); long, dark bristles arising from the posterior border. Postnotum dark, bare. Anterior pronotal lobe small, with long, dark bristles and broad dingy white scales; posterior pronotal lobe dark with a few dusky, semi-broad appressed scales with metallic blue-green reflection on upper half and a row of 4 long bristles along posterior



A. Pigmentation of the thoracic integument (diagrammatic) of *Aedes* (*Pseudoskusea*) *lunulatus*, n. sp.; *B*. Head of larva of *A* (*P.*) *lunulatus;* C. Caudal segments of larva of *A.* (*P.*) *lunulatus;* D. Head of larva of *Aedes* (*Skusea*) *dasyorrhus*, n. sp.; *E*. caudal segments of larva of *A.* (*S.*) *dasyorrhus*.

border. Propleuron with a patch of broad silvery white scales and 4 long dark bristles. Pleural integument dark, with 3 large conspicuous patches of broad silvery white scales, these on the upper and lower sternopleuron and the upper mesepimeron; a row of dark bristles of various lengths along posterior margin of sternopleuron; mesepimeron with a patch of hair-like bristles on the upper posterior portion, not arising from the patch of broad scales, lower bristles absent; postspiracular area with a group of about 6 dark bristles. Wing length about two and one-half millimeters; all scales dark, outstanding (plume) scales of veins 2 to 4 elongate, narrow, those at tips of fork cells slightly shorter and denser; anterior fork cell twice as long as its base and arising about level with posterior fork cell; posterior cross vein more basal than medial by a distance of almost 3 times its own length. Haltere stem pale, knob dusky. Mid and hind coxae with conspicuous patches of broad, silvery white scales, fore coxa with white patch interrupted by central patch of dark scales. Legs dark scaled with bronzy to metallic blue-green reflection, the femora paler on inner surfaces for about half their length; tarsal claws simple, subequal. *Abdomen:* Tergites dark scaled with bronzy to metallic blue-green reflection, except for basal lateral white spots extending nearly the whole length of segment on I and II, not more than half length of the segment on III to VII; sternites pale scaled basally, becoming dark apically. *Hypipygium* (Plate 13): Ninth tergite (IX-T) a narrow, weakly chitinized band, lacking lobes or setae; ninth sternite with a patch of about 11 short setae medio-posteriorly (not illustrated). Paraprocts (P) well developed, heavily sclerotized apically. Phallosome (PH) with basal third constricted, the remainder bulbous, abruptly tapered to a point at apex; closed dorsally at apical fourth, the closed portion with a medio-dorsal carina; open ventrally. Coxite (C) about three and a half times as long as mid-width, the outer and ventral aspects densely clothed with large scales and with scattered long, strong setae; a conspicuous row of setae along the full length of the inner margin. Basal lobe very large, divided into 3 sublobes as follows: a dorsal fleshy, thumblike sublobe (BLD) directed toward the coxite and clothed with slender hairs laterally and a few heavy, long setae apically; a medial sublobe (BLM) with 4 heavy, flattened, graduated filaments arising from contiguous bases and with 3 short spines arising near these bases; and a stout ventral pedicel-like sublobe (BLV) bearing 2 heavy, flattened filaments reaching the apex of the coxite. Coxite prolonged apically into a narrowly rounded tip beyond base of style and bearing numerous long setae; a small, finger-like apical lobe (AL) bearing slender hairs. A drooping appedange arising from the inner surface of the coxite and extending downward about to middle of coxite and terminating in a dense tail of long, mesally-directed hairs. Style (S) arising sub-apically, slightly less than half as long as coxite, straight, nearly parallel-sided, bluntly rounded apically, finely and sparsely pilose, scaled on outer surfaces, with a few rather long setae on outer margin beyond middle, as well as 1 or 2 pairs of smaller subapical hairs



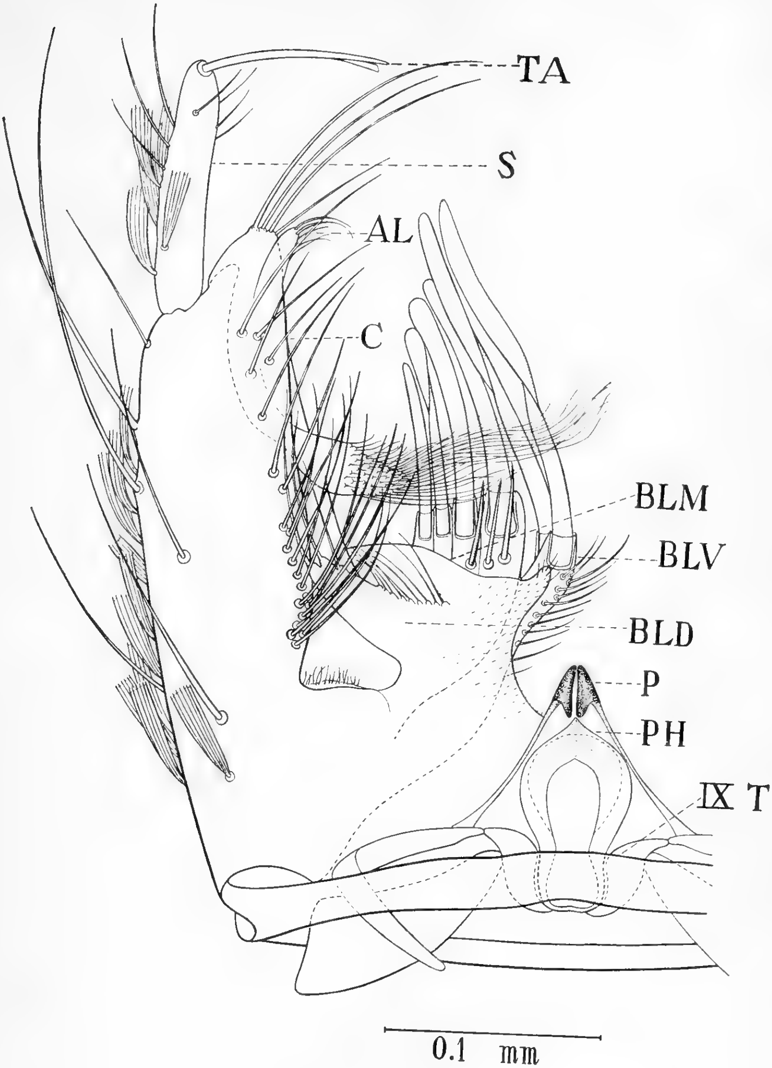
Hypopygium of *A.* (*P.*) *lunulatus*

dorsally and ventrally. Terminal appendage (TA) about three-fourths as long as style, slightly bowed, slender, split apically.

FEMALE.—Similar to male except as follows: Palpus about one-fifth as long as proboscis, dark scaled; antenna dark with pale pubescence, a whorl of about 5 long bristles arising from the base of each flagellar segment, wing scales at the tips of veins 2 and 4 short and broad; eighth segment and cerci retracted.

LARVA (Plate 11, D and E).—*Head*: About as long as wide. Antenna less than half as long as head, nearly straight, glabrous; shaft hair single, arising on apical third and extending beyond apex. Preclypeal spines slender, curved apically, almost as long as antenna; a slender single hair about one fourth length of preclypeal spines arising on front of head near base of each spine. Head hair A arising slightly anterior to base of antenna, with from 6 to 12 branches; B arising either slightly posterior or level with antennal base and extending well beyond front of head, single; C inserted near preclypeus, shorter than B, double; *d* slightly anterior to C and about half as long, with from 16 to 18 branches; inner sutural hair (*e*) single, outer sutural hair (*f*) double or triple. Mentum broadly triangular with about 14 lateral teeth and a larger, blunt apical tooth. *Thorax:* Metapleural hair tuft with about 8 branches, the base with two short spines. *Abdomen:* Lateral abdominal hairs of segments I and II with from 5 to 8 branches, III and IV with 3 or 4 branches, V with 2 or 3 branches. Lateral comb of segment VIII a dense triangular patch of about 100 small, narrow, apically rounded and finely fringed scales; pentad hair 1 with from 3 to 5 branches, hairs 2 and 4 single, hair 3 with 4 or 5 lightly plumose branches, hair 5 double, very lightly plumose. Siphon ratio about 2:1, tapered only slightly apically; acus absent; 8 to 11 pecten teeth extending about to middle, each tooth blade-like, very finely fringed to the tip along one side; hair single, inserted just beyond apical pecten tooth, about as long as width of siphon, very finely plumose; dorsal preapical spine longer than apical pecten tooth. Saddle small, the lateral hair single and finely plumose; dorsal subcaudal hair tuft about 10-branched, ventral one single (one of the Biak specimens with a fine fraying at base of ventral hair); ventral brush with 4 or 5 pairs of branched hairs on a grid; anal gills bulbous, dorsal pair about as long as saddle, ventral pair not so wide and about three-fourths as long.

Holotype.—Male (660A), reared from larva taken from cans at edge of mangrove swamp, possibly with partially salt water, on Cape Tjeweri, Jatufa Bay, Hollandia, Netherlands New Guinea, 4 February 1945, W. V. King, collector. *Allotype.*—Female (660A) same data as above. *Paratypes.*—(660A) Three males, 2 females (with 2 larvae and 6 larval exuviae), same data as above; 1 male, 1 female (with 2 larval exuviae), from larvae in metal container, Biak, Shouten Islands, off the north coast of Netherlands New Guinea, October, 1944, collected by members of the 17th Malaria Survey Unit. Holotype,



Hypopygium of *A.* (*S.*) *dasyorrhus*

allotype, paratypes, and larval material, deposited in the United States National Museum; others in the Museum of the Division of Economic Entomology, Council for Scientific and Industrial Research, Canberra, A. C. T., Australia.

The hypoygium of this species differs from that of the most closely related species, *Aedes* (*Skusea*) *amesii* (Ludlow) of the Philippines as follows: phallosome abruptly tapered apically rather than gradually tapered, the medio-dorsal carina somewhat weaker; coxite with fewer long setae, dorsobasal sublobe not bulbous and of different vestiture, the mediobasal sublobe with 3 spines and 4 graduated filaments from contiguous bases rather than with no spines and seven subequal filaments; from separated elongate bases; the presence of drooping tail-like appendage; the absence of apical filaments and the presence of a small apical lobe; style parallel sided rather than bulbous basally; terminal appendage longer and distinctly spit apically.

Externally the male is nearly identical with that of *A. amesii* except that the palpi are four-fifths the length of the proboscis, rather than equal to the proboscis, and the scutal scales are distinctly coarser and of a golden brown rather than dark brown shade. The scutal differences also apply to the female. The larva can be distinguished from that of *amesii* by the shorter siphon, the short, bulbous, unequal anal gills, and the position of *d* head hair which is anterior rather than posterior of C. In the series at hand, the *d* head hair also has a greater number of branches and there are more lateral comb scales than on *amesii*.

This species derives its name (Gk. *dasy*, hairy; *orrhos*, tail) from the distinctive drooping, hairy appendage of the coxite.

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MINUTES OF THE 561ST REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON FEB. 7, 1946

The 561st regular meeting of the Society was held at 8 P.M., Thursday, February 7, 1946, in Room 43 of the National Museum. President Weigel presided and there were 49 members and 20 visitors present. The minutes of the previous meeting were read and approved.

G. J. Haeussler presented the report of the Auditing Committee which stated that the report of the Treasurer had been examined and found correct. The Committee was much impressed by the efficient and conscientious manner in which the Society's financial records had been maintained, and Mr. Haeussler offered a motion that a vote of thanks be given to Mr. Reed. The motion was put to a vote and carried unanimously.

New members were elected as follows:

Ross H. Arnett, Jr., Department of Entomology, Cornell University, Ithaca, N. Y.

Lt. (j.g.) Roger W. Williams, U. S. Naval Reserve.

President Weigel appointed the following committees:

Program Committee: W. E. Hoffman, Chairman; Randall Latta; Frank Todd; E. W. Baker.

Membership Committee: W. H. Anderson, Chairman; E. R. McGovran; Floyd Andre; Elizabeth Haviland.

He also announced that Carl Heinrich, D. L. Van Dine, and R. W. Harned had been requested to prepare an obituary of U. C. Loftin for publication in the Proceedings.

As the Society's representative to the Washington Academy of Sciences, Mr. Muesebeck discussed the awards conferred by the Academy each year in the Biological, Physical, and Mathematical Sciences. These citations are carefully considered and constitute a real honor for the recipients. He was pleased to inform the Society that Dr. H. K. Townes had received this year's award in the field of Biological Sciences. Formal presentation will be made at the Cosmos Club on March 21st.

W. H. Hoffman stated that the Program Committee would welcome suggestions for papers from the members, and would like to be informed of any visitors who might be requested to speak. W. H. Anderson pointed out how difficult it is for the Membership Committee to contact all people who might wish to join the Society, and asked the cooperation of the membership in bringing possible candidates to the attention of the Committee.

Lt. G. E. Bohart, USNR, presented a note on wingless phorid flies observed by him in the course of studies on filth-inhabiting flies in Guam. He exhibited vials containing two species of wingless phorids and also a winged species. Special attention was called to the winged specimen for which a new genus is being erected. The unusual larvae are ornamented with lateral processes and bear a striking resemblance to those of the muscoid genus *Fannia*.

Dr. Sailer discussed results obtained from one population sampling method used in connection with DDT studies conducted in the vicinity of Moosic, Pa., during the past summer. Modified Berlese funnels were used to sample the fauna of the forest floor. The primary objective was determination of possible effects of DDT as applied under the conditions of that project. As a result of this work some statistically reliable figures were obtained from which the variety and number of individuals living in the litter, leaf mold and soil of the forest floor could be expressed in averages for a sq. ft. A count of all worms and arthropods from 56, ½-sq. ft. samples taken from 8 stations during a period of 4 months provides an average figure of 9,759 individuals per sq. ft., or about 272,000,000,000 when projected to a square mile. Mites and Collembola are the predominate forms and constitute approximately 95 per cent of the total number. The only appreciable difference between the treated and untreated areas was a significant increase in numbers of Collembola in the treated area during the third and fourth months following treatment. A box containing specimens was circulated and also a chart on which the collections were analyzed by Phyla, classes, and orders. (Author's Abstract.)

The first paper on the regular program was the address of the retiring President, F. W. Poos: Some Cereal and Forage Insect Studies.

Various research projects of the laboratory of the Division of Cereal and Forage Insect Investigations of the Bureau of Entomology and Plant Quarantine at the Agricultural Research Center, Beltsville, Md. (located at Arlington Experiment Farm, Arlington, Va., prior to December, 1941), were discussed. Progress made and further objectives to be attained were discussed with the aid of lantern slides. The following projects were included:

Development of strains of field corn resistant to the corn earworm; entomogenous fungi; development of wheats and barleys resistant to the hessian fly and wheat sawflies; insect vectors of bacterial wilt (Stewart's disease) of corn; potato leafhopper injury to alfalfa and peanuts; thrips injury to seedling peanuts; and the lespedeza webworm. (Author's Abstract.)

Various points in the address were illustrated by lantern slides. Mr. Muesebeck asked for further data on the tobacco thrips on peanuts.

The second paper was given by B. A. Porter: The Milky Disease of the Japanese Beetle Grubs.

The grubs of the Japanese beetle have been found affected by disease from time to time since the study of this pest was initiated in 1917. About 1930, certain of the diseases assumed somewhat greater importance and appeared to be, to a considerable extent, responsible for reductions in beetle populations in the older infested areas. Studies made by the late G. F. White, from 1933 to 1935, showed that the most important disease was one caused by unknown bacteria which produce a milky condition in the body fluids of the grubs. Two species of bacteria causing this disease have since been described. They are strongly pathogenic and produce spores that are extremely resistant to drying, cold, heat, and moisture. This type of disease apparently existed originally among some of our native white grubs; when the Japanese beetle reached the area in which this disease was present, the grubs proved to be unusually susceptible to it.

The milky disease was found attacking Japanese beetles in rather limited areas, and after several years of study a distribution program was undertaken, in order to accelerate the natural spread of the disease, which was lagging behind that of the beetle. The spore material for distribution is produced by inoculating Japanese beetle grubs, since no artificial culture medium has been developed. With cooperation on the part of several States, especially Maryland, more than 100,000 pounds of milky disease spore dust, containing 100 million spores per gram, have been placed at 66,000 different sites in various eastern States. Government reservations in Washington have been thoroughly treated and the beetle population has dropped to a very low point. After the disease is once introduced and established there is little more that can be done since it will develop to its fullest capacity as soon as sufficient Japanese beetle grub infestation is present. The spores remain in the soil for many years in a viable condition. The Bureau is continuing the distribution of this disease in the hope of ultimately reducing the Japanese beetle to the status of a minor pest over most of its range. (Author's Abstract.)

Dr. Porter used lantern slides to illusrtate his paper, and also exhibited a model of the injection apparatus for inoculating beetle larvae and a vial containing spore dust. There was discussion by C. C. Hill, H. K. Townes, S. Leefmans, and B. A. Porter.

Visitors were introduced to the Society as follows:

Col. Cornelius B. Philip, Army of the United States.

Major Glenn M. Kohls, Army of the United States.

Lt. D. D. Milspaugh, Army of the United States.

Dr. W. T. M. Forbes, Cornell University.

Dr. H. H. Schwardt, Cornell University.

T. P. Cassidy, Cotton Insect Investigations, U. S. Bureau of Entomology and Plant Quarantine.

L. D. Christenson, Forest Insect Investigations, U. S. Bureau of Entomology and Plant Quarantine.

Lt. Col. W. V. King, Army of the United States, and Mrs. King.

Dr. J. W. Chapman, Silliman Institute, Dumaguete, Philippine Islands.

The meeting adjourned at 10 o'clock.

INA L. HAWES,
Recording Secretary.

THE PROCEEDINGS CHANGES PRINTERS—AND INCREASES COSTS

With the March issue of these PROCEEDINGS, the business relations of this Society were terminated with the printing establishment of H. L., and J. B. McQueen, which for more than a score of years had printed them. This change became necessary owing to the retirement of Mr. J. B. McQueen who had been conducting the business.

In my former capacity as editor of the PROCEEDINGS for some 17 years, my admiration grew for the efficiency, courtesy and unfailing spirit of cooperation exhibited by Mr. McQueen.

The present printers, viz: The Monumental Printing Company, of Baltimore and Washington, are not new to the Society as they printed, quite acceptably, the existing volumes of its memoirs, two of which have thus far appeared. Coincidentally with this change in printers, an improved quality of paper has been adopted which is suitable for the reproduction of half-tone illustrations. It may also be noted that the pages are saddle stapled instead of being side stapled as heretofore.

No change of format or typography is contemplated at present but, owing to the steadily increasing costs of labor and materials, an increase in the expense for publication has been found unavoidable. This is unfortunate because, for years, there has been little if any reserve income available for printing the PROCEEDING. In point of fact, during my connection with them, frequently it became necessary to limit sharply the amount of matter published in any one year because of lack of funds.

Unless some method of increasing the ordinary income of the Society can be discovered further curtailment of matter printed will now become inevitable. Appeal therefore is made to the membership for an effort to obtain new members and subscribers.—W. R. WALTON.

Actual date of publication, June 19, 1946

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 48 MAY, 1946 No. 5

SEVEN NEW SPECIES OF WEST INDIAN CHRYSOMELIDAE (Coleoptera)

By Doris H. Blake

This paper consists of the description of seven new species and one new genus of Chrysomelidae, all from the West Indies. Four of these were collected by P. J. Darlington. Two others were collected by S. C. Bruner and A. R. Otero.

Dicoelotrachelus cubensis, new species
(Fig. 2)

About 4.5 mm. in length, elongate oblong, somewhat shiny beneath the long white pubescence of the elytra; head, thorax, scutellum, undersurface and legs yellow brown, elytra violaceous, antennae piceous, the apical joint a little paler; thorax with a deep depression on either side, elytra densely and coarsely punctate.

Head long with a tapering lower front, the frontal tubercles distinctly marked but not prominent, antennal sockets crowded together without any interantennal area; occiput densely and coarsely punctate. Antennae extending well below humeri but not reaching middle of elytra, rather heavy, second joint a little shorter than third, fourth longer, remainder about equal, all except the last deep piceous. Prothorax not twice as wide as long, with rounded sides, a tiny tooth at each corner, and a very narrowly impressed marginal line all around, on either side a transverse depression ending on the outside in a small pit; surface otherwise smooth, nearly impunctate, a few punctures near base on side, and shining yellow brown. Scutellum yellow brown. Elytra shining violaceous, very densely and somewhat coarsely punctate, and covered with long white hairs not so dense as to conceal the surface below and easily rubbed off; elytra rather depressed with a long shallow, inward curving intrahumeral depression; epipleura yellow brown, broad, and gradually narrowing and disappearing just before apex. Body beneath pale, lightly pubescent, tibiae a little darkened at apex, claws toothed, nearly bifid. Length 4.4 mm.; width 1.5 mm.

Type female, Museum of Comparative Zoology Type No. 27358.

Type locality.—Loma del Gato, Cobre Range, ca. 3000 ft. altitude, Oriente Prov., Cuba, collected July 3-7, 1936, by P. J. Darlington.

Remarks.—This closely resembles *D. brevicollis,* described by the writer from the Dominican Republic, but is a little more slender with entirely dark elytra and dark antennae and nearly impunctate pronotum. Two other species of *Dicoelotrachelus* previously described from the Dominican Republic have a quite differently shaped prothorax, although the prothorax in all of them is marked by a peculiar depression or pit on either side.

Dicoelotrachelus sulcatus, new species
(Fig. 1)

About 3.5 mm. in length, elongate oblong, shining, head, thorax, scutellum and undersurface and legs reddish brown, antennae piceous except for the two paler apical joints. Elytra violaceous and with pale silky pubescence. Head and elytra densely and coarsely punctate, prothorax with a deep transverse median sulcus on either side, limited at each end by a pit or large puncture.

Head long and tapering to the labrum, yellow brown; on either side of occiput dense, coarse punctures with a smoother area in the middle; between tubercles a short deep groove. Antennae stout, piceous, except for two paler distal joints. Third joint shorter than fourth, fourth longest, remainder subequal. Prothorax not quite twice as broad as long, shining, reddish brown with almost angulate, sharply curved sides, a small seta bearing tooth at each corner, and narrowly lined margin all around, disc with a deep median sulcus, having at each outer end a coarse puncture or small pit, and several coarse punctures in the middle, also a few scattered punctures about apex and base of pronotum. Scutellum pale and pubescent. Elytra bright shining violet, densely and coarsely punctate, and covered with long white silky pubescence, this pubescence easily rubbed off and not so dense as to hide the elytral punctation. Humeri prominent, a deep, inwardly curving intrahumeral depression. Epipleura yellow brown tinged with violet, and extending almost to apex. Body beneath pale, lightly pubescent; legs with tibiae slightly darkened at apex, claws toothed. Length 3.6 mm; width 1.8 mm.

Type male, Museum of Comparative Zoology Type No. 27351.

Type locality.—Mountains north of Imias, eastern Oriente Province, 3-4000 ft. altitude, Cuba, collected July 25-28, 1936, by P. J. Darlington.

Remarks.—This species closely resembles *D. cubensis,* but is a little smaller with more deeply sulcate thorax. It is also reddish brown on the head and thorax rather than yellowish brown and the elytra are reddish violet, while in *D. cubensis* they are violet blue. Both species are closely related to *D. brevicollis* Blake from the Dominican Republic. *D. brevicollis* is paler, with entirely pale antennae and a pale margin about the elytra and has a different aedeagus.

Dicoelotrachelus glaber, new species
(Fig. 7)

About 3 mm. in length, oblong oval, shining, head and thorax lightly punctate, elytra with coarser, denser punctation becoming indistinct at apex; head, thorax and legs pale yellow or reddish brown, antennae and undersurface, except prosternum, deep brown; elytra shining dark aeneous; thorax with sulcus on either side.

Head with broadly rounded, smooth occiput and vertex, very finely and not densely punctate, interocular space more than half width of head, frontal tubercles distinctly marked, a line above them running transversely across vertex from eye to eye, antennal sockets widely spaced. Antennae not extending much below humeri, dark brown, fourth joint longer than third. Prothorax twice as broad as long, with sides sharply curved, a tiny seta bearing tooth at each corner, and a narrow line running inside margin all about pronotum; surface shining, nearly smooth, with a group of coarse punctures at apical angles, yellow brown, and on each side a pronounced transverse sulcus. Scutellum dark, polished. Elytra lustrous dark green, rather coarsely and densely but not contiguously punctate, the punctures becoming fine and indistinct at apex. Humeri well marked, with a deep intrahumeral sulcus. Epipleura not extending much below the middle. Undersurface except for pale prosternum, deep shining brown, lightly pubescent. Legs pale, claws toothed. Length 2.9 mm.; width 1.5 mm.

Type female, Museum of Comparative Zoology, Type No. 27360.

Type locality.—Trou Caiman, Haiti, collected Nov. 20, 1934, by P. J. Darlington.

Remarks.—This entirely glabrous species resembles the others of the genus in general coloration, having a pale head and prothorax and metallic colored elytra, and in having depressions on either side of the prothorax. But in the shape of the head and the entire lack of elytral pilosity, it is quite different. The head does not taper so much towards the labrum as in the other species, and the antennal sockets are widely spaced, with the vertex smooth and polished. Otherwise it fits into this group.

Chthoneis insulana, new species
(Fig. 3)

Between 4 and 5 mm. in length, oblong, somewhat shining, densely punctate above, head dark except for the front, prothorax pale, elytra except for margin dark piceous, undersurface dark, legs pale; elytra faintly costate.

Head with interocular space half its width, deeply impressed, almost pitted above tubercles, finely punctate about median depression; tubercles well defined with a depressed line of punctures on inner side of eye; interantennal region not much produced and with a short lower front;

except for the front, head dark. Antennae extending to the middle of the elytra, three basal joints pale, remainder dark, first joint long, second a little shorter than third, fourth about equal to first, and longer than remainder, these subequal, not becoming enlarged. Prothorax about twice as wide as long, wider anteriorly with rounded sides; at each angle a thickened, seta bearing blunt tooth, surface densely and moderately coarsely punctate, entirely pale. Elytra wider than prothorax, dark piceous except for the narrow pale margin; densely punctate, somewhat shining, with traces of costate especially in the apical half; intrahumeral sulcus short, humeri not prominent, epipleura wide, pale, disappearing at apical narrowing. Body beneath dark, shiny, lightly pubescent. Legs pale, anterior coxal cavities not closed, femora rather slender, tibiae slender, not much enlarged towards apex, without spurs, first hind tarsal joint longer than next two together; claws appendiculate. Length 3.6-4.9 mm.; width 1.7-2.3 mm.

Type male and 2 paratypes, 1 male, 1 female, U.S.N.M. Cat. No. 57762.

Type locality.—Santiago de la Vegas, Cuba, collected by Angel Otero, July 21, 1932, on *Cordia globosa*.

Other localities.—Camaguey, Cuba (A. Acuña), Aug. 20, 1924, and July 30, 1923; Omaja, Cuba (S. C. Bruner), July 24, 1927.

Remarks.—This is the first species of the genus to be reported from the West Indies. Baly described the first species from Colombia. Except for the antennae, which in his species are long and compressed at the apex, the descripiton agrees in its essentials very well with this West Indian species. The open coxal cavities, the long first tarsal joint, the shape of the prothorax, with it thickened angles, and the confusedly punctate elytra, seem to indicate that this species is closely related to others described by Baly, Jacoby, and Weise from Central and South America.

EXOCHOGNATHUS, new genus

A single male beetle collected at Las Animas in the Sierra Rangel mountains of Cuba (altitude 1,500 feet., Pinar del Rio Province), by Bruner and Otero, has baffled me for ten years as to its generic place. Although it does not run down there in Lefèvre's key[1] because of the rounded margin of the thorax which altogether lacks any undulation or toothing, it undoubtedly belongs to the *Colaspis* group. To one eager to find it, there may be a very faint suggestion of angularity in the rounded sides of the prothorax. Besides lacking the thoracic toothing, it also differs from *Colaspis* in the irregular elytral punctation, although here again there is a hint of striate punc-

[1]LeFèvre, Eumolpidarum. . . . Catalogus, Mem. Soc. Liege, (2) XI, no 16, p. 42, 1885.

tation at the very apex of the elytra. The robust legs with thick tibiae correspond to Lefèvre's original description[2] of the legs in *Rhabdopterus,* but unlike that are not curved in the male. His description, however, of the canaliculation of the tibiae and their gradual dilation towards the apex fits precisely. This character, however, is not confined to *Rhabdopterus,* but appears in other Eumolpid genera. Quite unlike any characters found in *Colaspis* or *Rhabdopterus* or other eumolpid of related groups are two peculiarities,—the heavy jaws projecting at a little less than a right angle from the head, and the pronounced fold of the elytra which forms, when viewed from the side, a veritable keel, and from above completely conceals the elytral margin. Another feature not found in either of these genera is the short first tarsal joint. Because of these striking characters I do not feel justified in crowding it into either of these already over-burdened genera, and am therefore proposing a new genus for it,—*Exochognathus,* ἔξοχος jutting out, γνᾶδος jaw.

Oblong oval, coarsely and confusedly punctate except at tip of elytra, the punctures here becoming striate. Head with heavy jaws produced forward at an angle from the face, front wide with sunken area about antennal sockets and above, a row of depressed punctures weakly separating clypeus from upper front; eyes distinctly emarginate on inner margin near antennal sockets and widely separated, the interocular space measured from above being nearly half the width of the head. Antennae extending to the middle of the elytra, slender, not noticeably enlarged at apex, first joint much inflated, second shorter than third, and third shorter than fourth, distal ones gradually lengthened. Prothorax not twice as wide as long, with arcuate sides contracted at base, distinctly margined, the anterior margin produced outwardly into an acute tooth, a tooth also at posterior angle; basal margin somewhat sinuate. Elytra not much wider than prothorax, with weakly developed humeri, a slight depression on the outer half of the elytron below the humerus; the elytral margin not visible from above but broadly overhung by a creased fold forming a keel, this extending from before the middle almost to the apex, shortly before apex disappearing; at apex the punctures becoming striate near the suture. Epipleura disappearing before the apex. Body beneath —the prosternum everywhere coarsely punctate, even the first two pairs of coxae somewhat punctate on the outside. Space between coxae wide and punctate. Anterior margin of prosternum not produced but concave. Legs fairly robust, the femora with coarse obsolete punctation near the apex, the tibiae widening at apex and angulate with grooves on all sides; these grooves being sculptured with coarse obsolete punctation, first tarsal joint thick and short, not much longer than second; claws appendiculate.

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[2]Lefèvre, Mittheil. d. Munchener Ent. Ver., p. 126, 127, 1878.

Exochognathus limbatus, new species
(Fig. 4)

7 mm. in length, shining black with a faint bluish or purplish lustre, coarsely and densely punctate. Head with jaws produced forward. Prothorax with arcuate sides, prosternum not produced, elytra with a prominent lateral crease, concealing the margin when viewed from above, femora untoothed, tibiae entire, longitudinally grooved and angulate.

Head coarsely and densely punctate, shiny, eyes widely separated, on inner side distinctly emarginate, the antennal sockets deep and broad, area between sockets broad, somewhat depressed below and above with a transverse row of punctures a little depressed; jaws heavy and prominently produced forward at a wide angle from the front. Antennae slender and not noticely enlarged distally, extending to the middle of the elytra; first joint inflated, second and third shorter than the remainder, the apices of the first six joint pale, rest dark. Prothorax not twice as broad as long with very arcuate sides and a prominent anterior and posterior tooth, narrowly margined; disc coarsely and densely punctate. Elytra not much wider than thorax, coarsely and densely punctate, punctures not confluent although very close, and irregularly placed, at tip, near the suture, becoming striate, a little suggestion of geminate punctation there. A light depression below the humerus on lateral half; margin of elytra from below the humerus gradually becoming widely overshadowed by a lateral folding over of the elytra, this crease extending almost to the apex, but shortly before it, disappearing; epipleura narrow and vanishing before the apex. Body beneath entirely dark, the prosternum as densely and coarsely punctate as the pronotum, anterior coxal cavities closed, space between coxae wide. Abdomen alutaceous, the first segment with coarse, scattered, not dense punctures, finely pubescent. Legs dark, the femora untoothed, with coarse, obsolete punctation becoming stronger near the joint, tibiae grooved, angulate, coarsely punctate in the grooves, not emarginate but becoming thicker towards apex; first tarsal joint not as long as the next two together. Claws appendiculate. Length 7 mm.; width 3.2 mm.

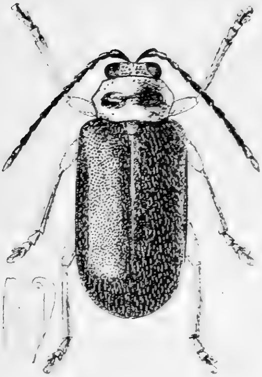
Type male U.S.N.M. Cat. No. 57763.

Type locality.—Las Animas, Sierra Rangel, Cuba, alt. 1,500 ft., collected April 28, 1933, by S. C. Bruner and A .R. Otero.

Alethaxius puertoricensis Blake
(Fig. 5)

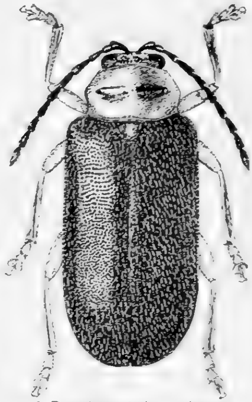
Alethaxius puertoricensis Blake, Jour. Wash. Acad. Sci., 35 (10): 327, 1945.

At the time the description of this species was published, the writer had not examined any male specimens, having entirely overlooked them when picking out specimens in the collection at the Museum of Comparative Zoology because of their dissimilarity to the females. Since the male is without elytral warts and rugosities, although the interstices are some-

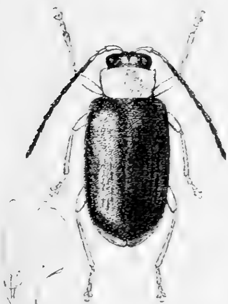


1. Dicoelotrachelus sulcatus

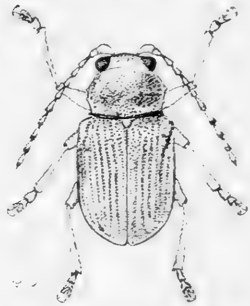
4 Exochognathus limbatus



2 Dicoelotrachelus cubensis

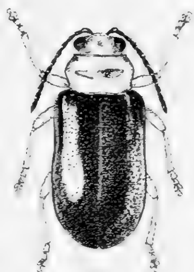


3. Chthoneis insulana

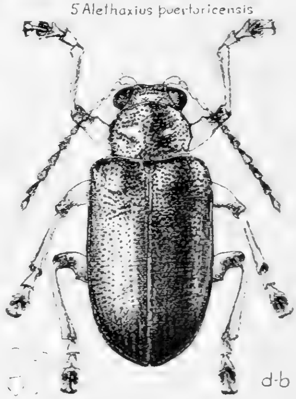


5 Alethaxius puertoricensis

6 Alethaxius semicostatus



7. Dicoelotrachelus glaber



8. Alethaxius yunquensis

what costate, and is hence quite different in appearance from the females, a drawing is given. A series of five males from the same locality (El Yunque, Puerto Rico) as the type are in the Museum of Comparative Zoology.

Alethaxius semicostatus, new species
(Fig. 6)

Female. About 6 mm. in length, oblong, shining cupreous, with slightly paler brown upper thighs and paler basal and distal antennal joints. Prothorax uneven and with toothed margin, elytra with small raised warts below the humerus, and a strong basal costa for a short distance near the humerus, and raised semicostate interstices between the striate punctures on the apical half, the basal half being confusedly punctate. All femora strongly toothed.

Head covered with dense, contingent, coarse punctures, eyes widely separated, a slight depression in the middle of the front, otherwise flat; entirely dark coppery except the yellow brown labrum. Antennae (incomplete) with the 4 basal joints pale yellow brown, 5, 6, 7, dark, remainder widened, flattened and pale. Prothorax about a third wider than long with distinct apical and basal and two median teeth on the margin; surface very densely and coarsely punctate, with two small smooth places on either side before the middle and below them a depression. Elytra very densely and confusedly punctate in basal half, and more striately punctate in apical half, with strongly developed humeri and with a short distinct costa next to the humeral prominence, and a smaller, indistinct one between that and the scutellum; below the humeri small warty elevations extending down the sides; in the apical half the spaces between the striae tending to become costate. Body beneath smooth, shining, deep brown, lightly pubescent, a few coarse punctures about anterior coxae, femora punctate at apices, and darkened, all strongly toothed, tibiae with a shallow sulcus. Length 5.9 mm.; width 2.6 mm.

Type female U.S.N.M. Cat. No. 57764.

Type locality.—Puerto Rico, collected by E. A. Waginer (?spelling).

Remarks.—This is by far the largest species yet known from the West Indies, and approaches in size some described by Jacoby from Central America.

Alethaxius yunquensis, new species
(Fig. 8)

Male. 4 mm. in length, oblong, shining cupreous with a greenish lustre above and with pale yellow brown abdomen, antennae and legs, the outer antennal joints and apices of femora darkened; coarsely but not very densely punctate, the pronotum uneven with depressions on the sides and with angulate margin; the elytra with well marked basal callosities and prominent humeri; the punctation in basal half denser and confused, in apical half, striate; all femora weakly toothed.

Head deep coppery with greenish lustre and paler yellow brown mouthparts; eyes widely separated, area between with a slight median depression; coarsely punctate, the punctures tending to be in lines radiating from the middle depression, on occiput smoother. Antennae (incomplete) with the five basal joints pale, distal joints darkened and wider. Prothorax not quite a third wider than long with angulate margin and a depression on either side below the middle; on either side of this depression a smooth roundish area without punctures, punctation coarse but not very dense elsewhere; surface very shiny, greenish or coppery. Elytra lustrous, the humeri prominent, and a sulcus running down from within the humerus to below the basal callosity. Punctation coarse, confused and not very dense in basal half, becoming striate towards the apex. Body beneath coppery, abdomen and legs yellow brown with the apices of the femora and the last tarsal joints darker; tibiae shallowly grooved. All femora weakly toothed. Length 4 mm.; width 1.7 mm.

Type, male, Museum of Comparative Zoology Type No. 27361.

Type locality.—El Yunque, ca. 3,000 ft. altitude, Puerto Rico, collected in May 1938 by P. J. Darlington.

Remarks.—Although no female has been examined, it is probable that it will be found to be larger and with warty elytral elevations such as occur in related species of *Alethaxius*. This species is larger and darker than *A. meliae*, which also occurs in Puerto Rico, and has less dense punctation and an angulate, not toothed prothorax. It differs from all the other coppery or aeneous West Indian species thus far described in the depressions on the prothorax. A similar sort of depression occurs in the small pale yellow brown species, *A. puertoricenis*.

THREE NEW SPECIES OF NEOHAEMATOPINUS (Anoplura, Haematopinidae)

By G. J. Rubin

Department of Entomology, Cornell University

Enderlein (1904) divided the family Haematopinidae into three subfamilies; Haematopininae, Trichaulinae and Euhaematopininae. Ewing (1929) divides this family into the six subfamilies Haematopininae, Enderleinellinae, Hybophthirinae, Linognathinae and Neolinognathinae and places the genus *Neohaematopinus* in the subfamily Hoplopleurinae.

Specimens of *Neohaematopinus* were sent to Dr. Robert Matheson of Cornell University by Robert Traub and were loaned for study. These specimens are all closely related to

Neohaematopinus laeviusculus (Grube) and are here described as new species.

Neohaematopinus traubi, new species

Female (Fig. 3). Stout bodied species; length 2.1-2.7 mm., average length 2.5 mm. Head very blunt in front with a blunt spine on the pre-antennal region. Antennae close to anterior margin of head. Postantennal angles almost absent, and sides of head nearly parallel. Antenna without a modified seta on the first segment.

Thorax about as long as head; thoracic spiracles small; sternal plate one and one half times as wide as long (Fig. 6) with an anterior and posterior median prolongation. First pair of legs about half length of posterior pair.

Ninth tergite and genital plate of abdomen well developed; all other tergal and sternal plates lacking. Second to seventh pleural plates each with posterior angles prolonged into long points, and the posterior margins with 4 to 6 setae. Seventh pleural plate as large as second, eighth small and bearing three long setae. Genital plate (Fig. 9) almost square in outline and heavily chitinized. Three rows of setae to each normal abdominal segment, 25 to 30 setae to a row extending entirely across abdomen.

Male. Length 1.65-1.8 mm., average 1.7 mm. Antenna (Fig. 4) with third segment bearing a short blunt seta. Tergal and sternal plates of abdomen narrow, and second tergal plate almost vestigial except for lateral remnants. Rows of setae arranged both dorsally and ventrally in median and lateral groups, the dorsal median groups with 25 setae and lateral groups with 5 to 6 normal setae. The ventral median groups have 10 to 13 setae, and the lateral groups 4 to 5 fine setae.

Genitalia (Fig. 13) with the basal plate short and moderately broad; parameres shorter than basal plate, heavy and broad posteriorly with lateral posterior prolongations. The parameres enclose a U-shaped endomeral piece, a circular penis, and pseudopenis. The latter broadly V-shaped, with arms expandeded and slightly serrate laterally.

Holotype: Female; paratypes, 11 females and 8 males. Host, *Citellus adocetus* (Merriam); collected at Michoacan, Mexico, August 3, 1941, by Robert Traub. Type and 4 paratypes in the United States National Museum (Cat. No. 57684) and paratypes in the collection of the Department of Entomology, Cornell University.

According to Ewing (1929) *N. traubi* would not fall in *Neohaematopinus* but probably in *Ferrisella* Ewing. This separation would be made on the basis of the three rows of setae on each abdominal segment. According to the description of the genus *Neohaematopinus* Mjöberg by Ferris (1923) there are usually two rows of setae but exceptionally three. Because of the general similarity of *N. traubi* to other species in the genus *Neohaematopinus* I feel that it belongs here.

Neohaematopinus mathesoni, new species

Female (Fig. 1). Length 1.8-2.3 mm., average length 2.1 mm. Head acutely rounded in front with the antennae set well back from apex. Blunt spine on preantennal region absent; antenna without modified setae on first segment. Postantennal angles broadly rounded, and the sides of head tend to converge posteriorly.

Thorax not as long as head; the sternal plate (Fig. 8) roughly circular, almost as long as wide; the posterior median point slight and the postero-lateral corners prolonged. Thoracic spiracles much larger than in *N. traubi.* First pair of legs more than half as long as posterior pair.

Abdomen with tergal and sternal plates lacking except for the genital plate and ninth tergite. Two rows of setae to each normal abdominal segment arranged in four groups; the dorsal group contains from 7 to 10 setae, the dorsal lateral group has about 4 setae. The ventral group contains from 6 to 10 setae, and the ventral lateral group has from 2 to 3 setae. Lateral margins of genital plate (Fig. 10) produced posteriorly and a clump of 6 fine setae on its middle. Second to sixth pleural plates normal, seventh and eighth reduced. Posterior margins with 2 to 3 normal setae and eighth with 2 long setae.

Male. Length 1.5-1.6 mm., average 1.54 mm. Antenna with third segment bearing a short blunt seta.

Tergal and sternal plates of abdomen narrow. Lateral ends of second tergal plate rounded posteriorly and 4 heavy spines on these lobes. Rows of setae arranged both dorsally and ventrally in median and lateral groups; dorsal groups with about 9 setae, the lateral groups with 3. Ventral groups with about 6 setae, the lateral groups usually with 4.

Genitalia (Fig. 12) with basal plate short and not very broad; parameres nearly as long as basal plate, heavy, widening posteriorly then coming to a blunt point. The parameres enclose a U-shaped endomeral piece, the penis, which is almost cylindrical, and the pseudopenis which is straight and serrate externally.

Holotype. Female: paratypes, 5 females and 4 males. Host, *Citellus v. couchi* (Baird): collected at Nuevo Leon, Mexico, August 12, 1938, by H. Hoogstraal. Type and 2 paratypes in the United States National Museum (Cat. No. 57685) and paratypes in the collection of the Department of Entomology, Cornell University.

Neohaematopinus patiki, new species

Female (Fig. 2). A small species; length 1.3-1.7 mm., average 1.6 mm. Head bluntly rounded in front with a blunt spine on anterior margin of head. Postantennal angles almost absent, and sides of head nearly parellel. Antenna without a modified setae on first segment.

Thorax as long or longer than head; thoracic spiracles small. Sternal plate (Fig. 7) longer than wide, lacking the anterior median prolongation and with a slight posterior median prolongation. First pair of legs small but more than half the length of last pair of legs.

Abdomen with the ninth tergite, genital plate (Fig. 11) and vestiges of second and third sternal and tergal plates present. Pleural plates 7 and 8 vestigial; posterior angles of other pleural plates prolonged slightly or not at all, and none of the posterior margins with more than two setae. Two rows of setae for the typical abdominal segment extending completely across abdomen, and about 25 setae to a row. Posterior border of genital plate directed laterally and anteriorly.

Holotype: Female; paratype, 11 females. Host, *Citellus* sp. subgenus *Ammospermophilus;* collected at Delta, Utah. April 27, 1938, by Nual Walter. Type and 3 paratypes in the United States National Museum (Cat. No. 57686), and paratypes in the collection of the Department of Entomology, Cornell University.

The following key will aid in differentiating the species described here and two other closely related species of *Neohaematopinus.*

1. Abdominal rows of setae extending entirely across abdomen of female 2
   Abdominal rows of setae not extending entirely across abdomen of female; setae in dorsal and ventral median groups and dorsal and ventral lateral groups .... *mathesoni,* n. sp.
2. Thoracic spiracles small, about one-fourth length of second coxa ... 3
   Thoracic spiracles large and prominent, about half length of second coxa .... *marmotae* (Ferris)
3. Typical abdominal segment with only two rows of spines; sternal plate with only posterior median prolongation 4
   Typical abdominal segment with three rows of spines; sternal plate with an anterior median prolongation and posterior median prolongation .... *traubi,* n. sp.
4. Head acutely rounded in front; sternal plate of thorax with a distinct posterior median prolongation, the plate as long as wide; only vestiges of second abdominal tergal and sternal plates present .... *laeviusculus* (Grube)
   Head bluntly rounded in front; sternal plate of the thorax with but a slight posterior median prolongation, the plate longer than wide; vestiges of second and third tergal and sternal plates present .... *patiki,* n. sp.

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Ewing, H. E. 1929. A Manual of External Parasites. Thomas, Springfield, Mass.

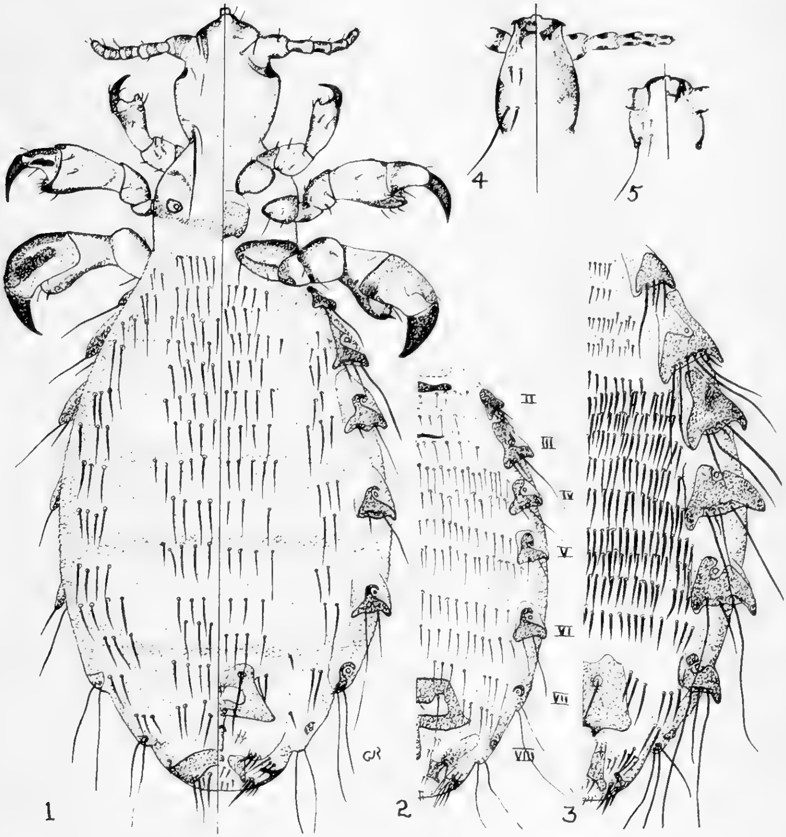


Fig.1.—*N. mathesoni*, ♀, right half ventral view, left half dorsal view; 2.—*N. patiki*, ventral view of abdomen; 3.—*N. traubi*, ventral view of abdomen; 4.—*N. traubi*, head of ♂; 5.—*N. patiki*, head of ♀.
Abbr. *Bp*, basal plate; *E*, endomeral piece; *P*. penis; *Pa*, paramere; *Ps*. pseudopenis; *I-VIII*, pleural plates.

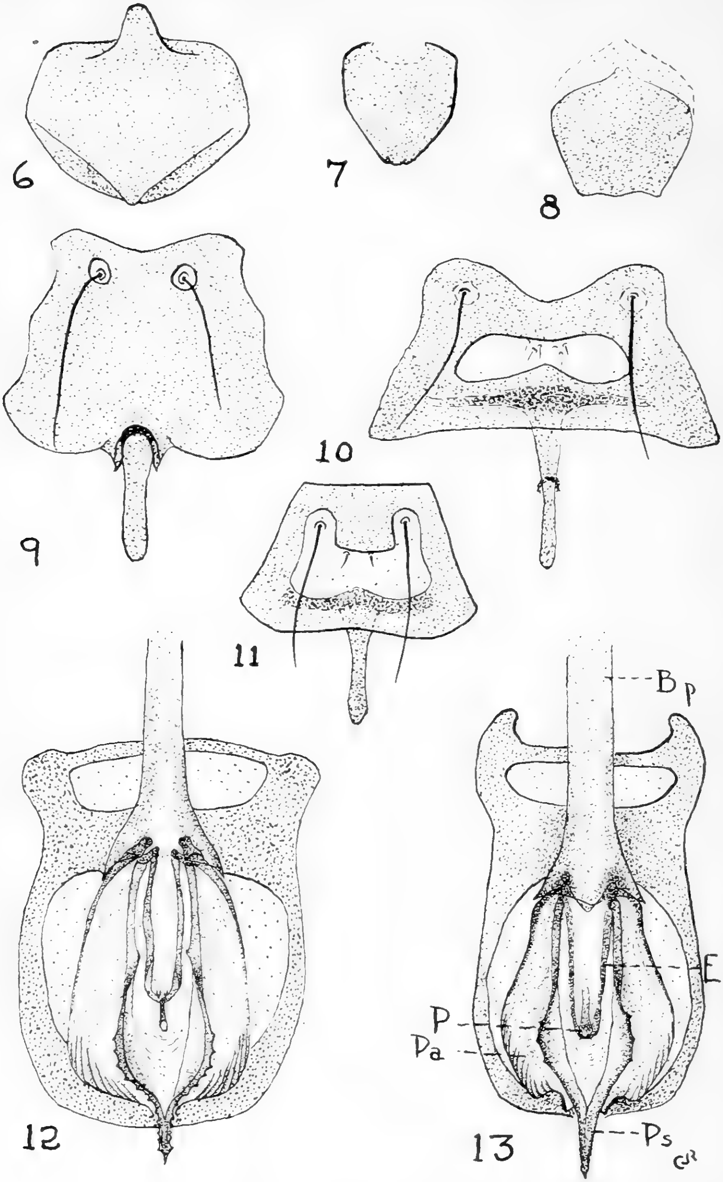


Fig. 6.—*N. traubi*, thoracic sternal plate; 7.—*N. patiki*, thoracic sternal plate; 8.—*N. mathesoni*, thoracic sternal plate; 9.—*N. traubi*, ♀ genital plate; 10.—*N. mathesoni*, ♀ genital plate; 11.—*N. patiki*, ♀ genital plate; 12.—*N. mathesoni*, ♂ genital apparatus; 13.—*N. traubi*, ♂ genital apparatus.

THE LARVA AND MALE OF AEDES (SKUSEA) AMESII (LUDLOW) (Diptera, Culicidae)*

By HARRY HOOGSTRAAL, *Captain*, and ROY W. CHAMBERLAIN, *Lieutenant*, *Sanitary Corps, AUS*

Aedes (Skusea) amesii (Ludlow)

Stegomyia amesii Ludlow, 1903. Jl. N. Y. Ent. Soc. 11:139. Type female: "Habitat: Oras, Samar. Tacloban, Leyte. Twin Peaks, Banquet, Luzon." (Philippine Islands.)

?Stegomyia fusca Leic., 1908. Cul. of Malaya, p. 92 (not *Aedes fuscus* Osten-Sacken, 1877). Type female, Port Swettenham, Malaya.

?Skusea amesii (Ludl.) Edwards, 1917, Bull. Ent. Res. *7*:223. (Description of male from Malay Peninsula.)

Aedes (*Skusea*) *amesii* (Ludl.) Dyar and Shannon, 1925 (in part) Ins. Insc. Mens. *13*:77, 78.

?Aedes (*Skusea*) *furvus* Edwards, 1928. Bull. Ent. Res. *18*:274. (New name for *Stegomyia fusca* Leic. and redescription of the male described in 1917.)

Ludlow described the female and listed the species from three islands of the Philippines. No holotype was designated, and there is now a single female in the U. S. National Museum (Type No. 27796, labeled "*Stegomyia amesii* Ludl., Oras, Samar P. I. June-Dec. C.S.L."), which Dyar and Shannon (1925) referred to as the single type. Edwards (1917) briefly described a male from the Malay Peninsula which he identified as *amesii*, giving *Stegomyia fusca* Leic. as a synonym. In 1928 he corrected this description (giving a new illustration of the hypopygium), and separated the species from *amesii* under the name *furvus*, proposed in place of Leicester's preoccupied name *fusca*. The separation was based on characters given by Dyar and Shannon for the Philippine species. The latter authors, in their comments on *amesii*, state that the type agrees with six specimens that had been identified by C. S. Banks as *Skusea diurna* Theobald. At least two of these specimens, however, are not the same species but have the character given in their key and noted by Edwards, viz., a "patch of white scales, with a diffuse patch of fine hairs intermixed" on the mesepimeron (personal communication from Dr. Alan Stone). The two specimens actually have a distinct patch of fine hairs on the middle third of the mesepimeron, posteriorly, which is lacking in *amesii*, and which apparently indicates an undescribed species. The question of the identity of *furvus*, therefore, is reopened. The illus-

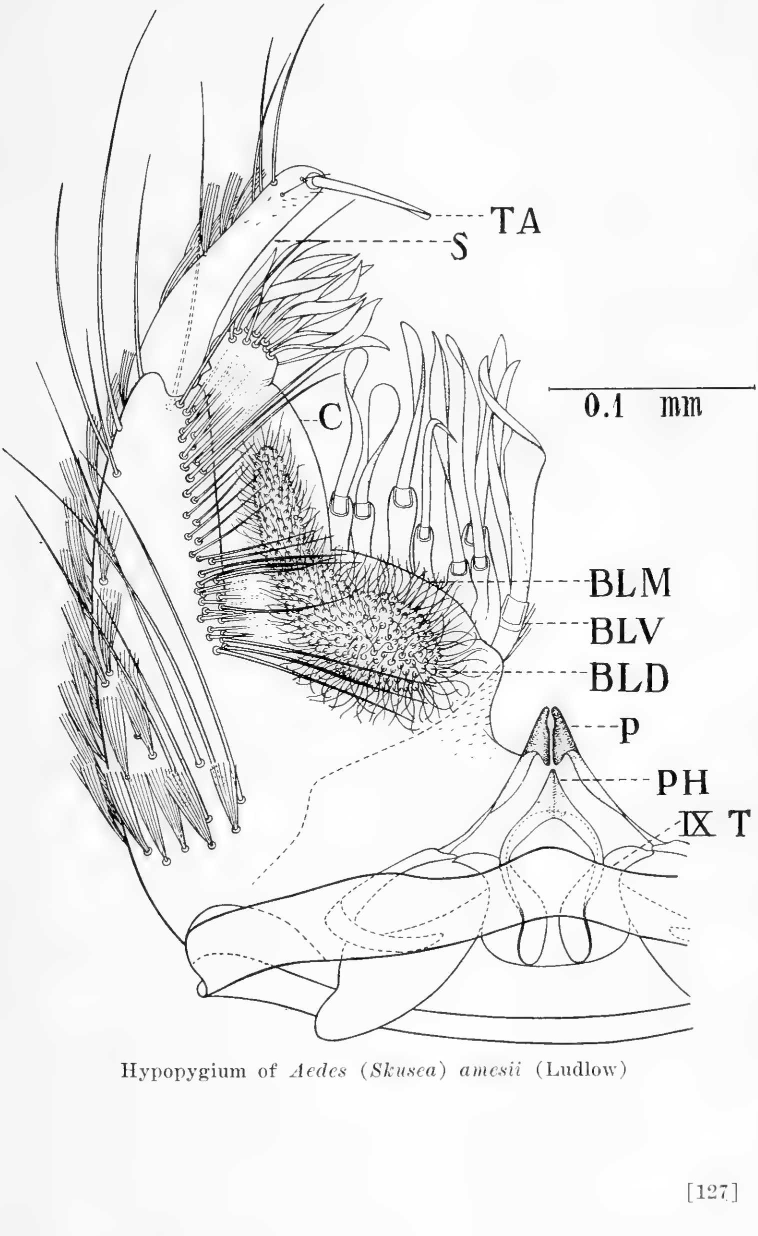
*From the 19th Medical General Laboratory, United States Army, of which Colonel Dwight M. Kuhns, Medical Corps, is Commanding Officer. Contribution Number 7 from the Entomology-Mammalogy Department.

tration of the coxite published by Edwards (1928) is similar to that of *amesii* as far as it goes, differing mainly in lacking the group of flattened filaments at the apex, which might have been overlooked or rubbed in mounting.

A larva obtained in Singapore was also described by Edwards (Bull. Ent. Res. *17*:119, 1926) as the larva of *amesii* but this was later (1928) associated with a new species that he named *Aedes* (*Skusea*) *fumidus*.

Fourteen males and ten females of *amesii* were reared from larvae collected at Puerto Princesa, Palawan, Philippine Islands, in nipa palm leaf axils, possibly with brackish water, in October, 1945, by Lt. J. P. Toffaleti of the 19th Medical General Laboratory with the assistance of members of the 41st Malaria Survey Detachment, and comprise the material described below.

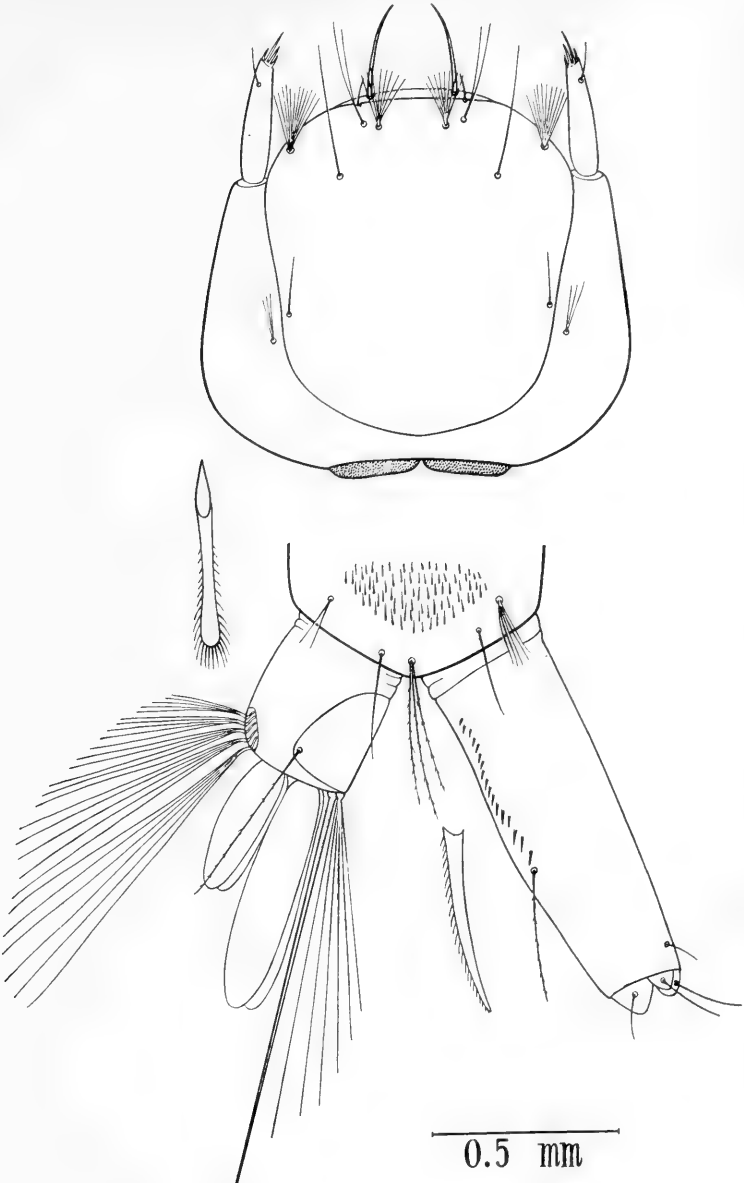
MALE.—*Head:* Proboscis about equal to fore femur, straight, dark brown scaled, with scattered, forward-pointing bristles. Palpus slender, equal to proboscis exclusive of labellae, dark brown scaled, straight, with few bristles except for two or three long ones apically. Clypeus dark, nude. Antenna about as long as proboscis or slightly longer; the flagellum pale, with a whorl of long, dark hairs arising from middle of each segment; torus dark. Vertex and lateral surface of head covered with broad, imbricated scales, dark with bronzy to metallic blue-green reflection, except for a dorso-lateral line of broad white scales curving from the eye margin to the nape, not quite reaching the midline, the width of this line varying from two to seven scales, interrupted in some specimens to form a small patch near the eye margin and a larger patch posteriorly; long, heavy, dark bristles present along eye margin; nape with a small patch of dark, upright forked scales. *Thorax:* Scutum with integument brown, clothed with fine dark brown scales; long, dark, heavy bristles arising from disc and anterior and lateral margins. Scutellum clothed with broad, dark scales with bronzy to metallic blue-green reflection (none observed on posterior margin of scutum); long, dark bristles arising from the posterior border of scutellum. Postnotum bare, varying in pigmentation from light brown to dark brown. Anterior pronotal lobe small, with long dark bristles and broad dingy white scales; posterior pronotal lobe dark, covered on upper half with dark semi-broad appressed scales with metallic blue-green reflection and a row of three or four long bristles along posterior border. Propleuron with a patch of broad silvery white scales and about four long, dark bristles. Pleural integument dark, with three large conspicuous patches of broad silvery white scales, these on the upper and lower sternopleuron and the upper mesepimeron; a row of dark bristles of various lengths along the posterior border of sternopleuron; mesepimeron with a patch of hair-like bristles in upper posterior corner (not arising from the patch of broad scales), lower bristles absent;postspiracular area with a group of four or five dark bristles. Wing length about two and one-half



Hypopygium of *Aedes* (*Skusea*) *amesii* (Ludlow) millimeters; all scales dark, outstanding (plume) scales of veins 2 to 4 elongate, narrow, those at tips of fork cells slightly shorter and denser; anterior fork cell nearly twice as long as its base and arising about level with posterior fork cell; posterior cross vein more basal than mid by a distance of between two and three times its own length. Haltere stem pale, knob dusky. Mid and hind coxae with conspicuous patches of broad silvery white scales, fore coxa with white patch interrupted by central patch of dark scales. Legs dark scaled with bronzy to metallic blue-green reflection, the femora paler on inner surfaces for about half their length; tarsal claws simple, subequal. *Abdomen:* Tergites dark scaled with bronzy to metallic blue-green reflection, except for basal lateral white spots extending nearly the whole length of segment on I and II, not more than half length of the segment on III to VII; sternites pale scaled basally, becoming dark apically. *Hypopygium* (Plate 17; Ninth tergite (IX-T) a narrow, weakly chitinized band, lacking lobes or setae; ninth sternite with a patch of about eleven short setae medio-posteriorly (not illustrated). Paraprocts (P) well developed, heavily sclerotized apically. Phallosome (PH) with basal third constricted, swollen medially, gradually tapered to a point apically; closed dorsally at apical fifth, the closed portion with a weak medio-dorsal carina; open ventrally. Coxite (C) about three and one-half times as long as midwidth, densely clothed with large scales and with numerous scattered long, strong setae; a conspicuous dense row of setae along the full length of the inner margin. Basal lobe very large, divided into three sublobes as follows: a dorsal sublobe (BLD) bulbous basally and constricted apically, densely covered with fine hairs; a medial sublobe (BLM) with seven heavy, flattened, subequal filaments arising from separated elongate bases, the longest filaments extending to or slightly beyond apex of coxite; and a stout ventral, pedicel-like lobe (BLV) bearing two heavy, flattened filaments. Coxite apically with a knob-like tip extending beyond base of style and bearing a cluster of striated, pointed, flattened filaments. Style (S) slightly less than half as long as coxite, swollen basally, bluntly rounded apically, finely and sparsely pilose, scaled on outer surfaces, with a group of three or four rather long setae on outer margin near apex, as well as one or two small subapical hairs on dorsal and ventral surfaces. Terminal appendage (TA) slightly less than half as long as style, nearly straight, slender, the tip with a small lamella.

FEMALE.—Differs from male as follows: Palpus about one-sixth as long as proboscis; antenna dark with pale pubescence, with a whorl of long dark hairs arising near base of each flagellar segment; first fork cell from one and a half to two times as long as its stem; tarsal claws equal; eighth abdominal tergite small, compressed laterally, partially retracted; cerci small.

LARVA: (Plate 18).—*Head:* Slightly broader than long. Antenna about a third as long as head, nearly straight, glabrous; shaft hair single, arising on apical third and extending beyond tip. Preclypeal spines



Head and caudal segments of larva of *A. (S.) amesii* slender, curved apically, almost as long as antenna; a slender clypeal hair about one fourth length of preclypeal spines arising on front of head near base of each spine. Head hair A arising anterior to base of antenna, with from 8 to 14 very lightly plumose branches; B arising about level with or slightly posterior of antennal base and extending beyond front of head, single; C near preclypeus, a little shorter than B, double (sometimes triple); *d* slightly posterior of C and about half as long, 6 to 10-branched; inner sutural hair (*e*) single; outer sutural hair (*f*) double or triple. Mentum broadly triangular, with about 13 lateral teeth and a larger, blunt apical tooth. *Thorax:* Metapleural hair tuft with about 8 branches, the base with a short spine. *Abdomen:* Lateral abdominal hairs of segments I and II each with 5 to 10 branches, III to V each with 2 to 4 branches. Lateral comb of segment VIII a dense triangular patch of about 75 small, narrow, apically rounded and finely fringed scales, the fringe lateral as well as apical; pentad hair 1 with 4 or 5 branches, hairs 2 and 4 single, hair 3 with 2 to 4 lightly plumose branches, hair 5 double, very lightly plumose. Siphon ratio about 3:1, only slightly tapered apically; acus absent; 9 to 20 pecten teeth extending about to middle, each tooth bladelike, very finely fringed to tip along one side; sub-ventral hair single, usually inserted just beyond apical pecten tooth (if a large number of pecten teeth, hair may be inserted level with or slightly anterior to apical tooth), slightly longer than width of siphon, very finely plumose; dorsal preapical spine longer than apical pecten tooth. Saddle small, the lateral hair single, finely plumose; dorsal subcaudal hair tuft 6 to 10 branched, ventral one single; ventral brush with 4 or 5 pairs of tufts confined to grid; anal gills elongate, nearly straight-sided, bluntly rounded apically, the dorsal pair from two to three and one half times as long as saddle, the ventral pair from one-half to three-fourths as long as dorsal pair.

The females agree well with Ludlow's original description. Doctor Alan Stone has kindly informed us that the remaining type in the United States National Museum, while it is old and somewhat faded, agrees with the original description.

This species differs from *A.* (*S.*) *dasyorrhus* King and Hoogstraal of New Guinea as follows: phallosome gradually rather than abruptly tapered; coxite more setose; dorsobasal sublobe bulbous rather than thumb-like and of different vestiture; mediobasal sublobe without spines and with seven subequal filaments from separated elongate bases rather than with three slender spines and only four graduated filaments from contiguous bases; absence of a drooping, taillike appendage from inner face of coxite; absence of apical lobe; presence of apical filaments on coxite; style bulbous basally rather than nearly parallel-sided; and the terminal appendage relatively shorter and not split apically. Externally the male differs from that of *dasyorrhus* by the length of the palps which equal the proboscis rather than being four-fifths as long, and by the scutal scales which are finer and darker. The females of the two also differ in the latter respect. The larvae of the two differ as follows: in *amesii* head hair *d* is slightly posterior rather than anterior to C and has fewer branches; the lateral comb scales are fringed laterally and apically rather than apically only; the siphon is longer, and the anal gills are considerably longer and proportionally narrower.

A. (*S.*) *amesii* differs from *A.* (*S.*) *fumidus* Edwards, by a comparison of Edwards' (1928) drawing of the hypopygium, as follows: absence of a broad elongate base of the median sublobe and presence of filaments instead of spines at the apex of this sublobe; presence of dorsobasal sublobe; absence of a hairy papilla on inner face of coxite; presence of an apical cluster of filaments on the coxite; and style considerably longer. The male palpi of *amesii* do not extend beyond the apex of the proboscis, but in *fumidus* they do by almost the length of the terminal segment.

By a comparison with Edwards' (1928) poor drawing of the hypopygium of *A.* (*S.*) *furvus*, *amesii* appears to differ in having a cluster of filaments apically on coxite, and a terminal appendage about half as long as style rather than only about one third as long.

A. (*S.*) *kabaenensis* Brug (1939, Tijdsch. Ent., *82*:108) of Celebes, differs greatly from *amesii* in many respects of the hypopygium, length of male palpus, position of larval head hairs, branching of antennal tuft, presence of acus, shape of pecten teeth, branching of siphonal tuft, and shape and size of anal gills.

Grateful acknowledgment is made of help given by Doctor Alan Stone and by Lt. Colonel W. V. King in supplying us with information of this and related species in the collections of the United States National Museum, and with excerpts from certain literature not available here in Manila.

BOOK REVIEW

Insect Dietary: Charles T. Brues, 1946. XXVI + 466 pages, numerous illustrations, cloth bound. The Harvard University Press, Cambridge 38, Masachusetts. ($5.00.)

Professor Brues' long interest in the food of insects and his wide knowledge of entomology have enabled him to bring together in this book much of the information on food habits to be found in entomological literature, to generalize on the known facts, and to present the material in its relation to other knowledge about insects. The book includes a storehouse of information on all types of insects, with numerous drawings and original photographs to enliven the text. To read it is to realize the great extent of the insect group and its almost endless variety of food habits and correlated adaptations. Species from all over the world are discussed, but the entomologist will find the habits of the familiar species just as interesting and often just as new to him.

After a foreword and introduction, the book is divided into chapters on: The abundance and diversity of insects, Types of food habits and their relation to structure and environment, Herbivorous insects, Gall insects, Fungi and microbes as food and symbiosis with microörganisms, Predatory insects, Parasitism, Blood-sucking insects and other external parasites, and Insects as food for many and other organisms. Lengthy bibliographies follow each chapter, and these seem a very useful addition.

The subject of food habits is difficult to limit, as it touches on morphology, physiology, life history, distribution, and in fact on all other biological fields. To deal with food habits invites and often requires digression into these other fields. Professor Brues' primary division of his subject according to food habit types, which so frequently cut across phyletic lines, increases the need for explanatory digression. In spite of his grasp of the subject and skillful efforts to organize, the result is a rambling text. His style is factual, clear, and light within the limits of the subject, with occasional Greek terms which may puzzle some readers.

MINUTES OF THE 562d REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

March 7, 1946

The 562d regular meeting of the Society was held at 8 P. M., March 7, 1946, in Room 43 of the National Museum. There were 92 persons present. President Weigel called the meeting to order and the minutes of the previous meeting were approved as read.

Miss Louise Goode, Laboratory Technician, National Institute of Health, was elected to membership in the Society.

At the request of President Weigel, Dr. Bőving introduced to the Society Dr. August Krogh of Denmark. Dr. Krogh addressed the Society concerning his proposed studies on the flight of insects. He gave a detailed description, illustrated by blackboard drawings, of an especially constructed wind tunnel designed to establish the speed of flight attained by the insect and the energy expended. The efficiency of the insect flight mechanism will then be compared with that of an airplane combustion engine.

Miss Helen Trembley presented the first paper on the regular program: Entomological Aspects of a Malaria Drug-Testing Program:

Since 1941, the National Institute of Health has participated in a coordinated search for better anti-malarial drugs. This program includes screening tests conducted on avian malaria, followed by tests on experimentally induced infection in man. The organization at the N.I.H. is under the direction of Dr. G. Robert Coatney, and consists of a laboratory at Bethesda, Md., for work on chick malaria, and one at Atlanta, Ga., for tests on human malarias in volunteers at the Federal Penitentiary.

In the laboratory at Bethesda, the organism used is *Plasmodium gallinaceum*, a chick malaria with a high rate of incidence and mortality. Out of 440 untreated chicks exposed to sporozoite infection, 439 or 99.8 per cent became infected and 432 or 98.4 per cent of those infected, died. *Aedes aegypti* mosquitoes are used as vectors. In the large-scale screening program, it was necessary to provide at least 100 chicks with sporozoite-induced malaria weekly, and the most efficient system of infection was by subcutaneous injection of a suspension of comminuted mosquitoes, 0.1 ml, of which contained the equivalent of one positive mosquito.

Mosquitoes are infected by feeding on a chick showing sexual forms of the malaria parasite in its blood, after which they are incubated for approximately 10 days. The degree of infection and per cent of mosquitoes infected is determined by salivary gland dissections of random samples. On the basis of these figures, mosquitoes are selected for inclusion in an inoculum, consisting of comminuted mosquitoes in serum-saline. This suspension is contrifuged in order to thrown down larger particles, and the supernatant fluid injected subcutaneously, 0.1 ml. into the pectoral region of each chick.

Chicks used in the drug-testing program are drugged by weight, and their infection is followed by examination of smears of the peripheral blood. Brain smears from chicks dying are made for detection of exoerythrocytic forms. In the 440 untreated chicks referred to, the mean prepatent period was about 8 days, and mean survival after patency, 3½ days. Each series of drugged chicks is compared with untreated controls and with those given standard doses of sulfadiazine 3 days prior to and on the day of injection.

Through June 1945, approximately 181,000 female *Aedes aegypti* mosquitoes were used in the drug-testing program at Bethesda; 100,000 of these were infected and the remainder used for other experimental purposes. The number of drugs tested on chicks in the entire project through December 1945, was about 15,000, and on men about 100. In the N.I.H. program, about 2,000 drugs were tested on chicks, about 15 on man. Of the 2,000 drugs tested, 1,500 were used against sporozoite-induced infections, and of these, about 40 showed prophylactic activity. (Author's Abstract)

Miss Trembley illustrated her paper with an interesting series of lantern slides. Discussion followed by Dr. N. E. Good, Lt. R. M. Bohart, and Miss Trembley.

The second paper was read by Dr. J. Linsley Gressitt: The Present Status of Entomology in Japan:

Before the war, Japan was ahead of most oriental countries in entomology. There was a general trend towards publishing articles in Japanese, but many of the works were rather well illustrated. Research was greatly hampered by the war, particularly during the latter part. Considering the extent to which most of the cities of Japan were destroyed, a fairly high percentage of the entomological institutions received little or no damage. The Imperial University, with its many branches, came through largely intact. The collections of the Tokyo Agriculture College were destroyed. None of the more prominent Japanese entomologists were killed during the war. Many have been displaced in the 'southern regions' where they were sent to care for collections or do research. Among those in that category are R. Takahashi, S. Iwata, S. Kawada, K. Iwata and H. Sawada. Among works published during the war are a large two-volume work on medical entomology by M. Tokunaga, Monograph of Japanese Aphididae and Galls and Gall Insects by S. Shinji, Chinese *Anopheles* by K. Morishita, *Anopheles* of the southern regions by N. Omori, and numerous articles on mosquito biology and control by S. Iwata. All are in Japanese. (Author's Abstract)

Discussion by Rohwer, Poos, Reed, Annand, and Weigel brought out that: little work on the development of insecticides was done in Japan during the war; Japan's silk industry suffered severely, the factories having been converted into war plants and the personnel diverted to war purposes; no concentrated work was done on scrub typhus; the mulberry raising districts were converted into emergency vegetable gardens; the pyrethrum industry is still in good shape since pyrethrum was designated as a primary insecticide and production was, therefore, maintained.

The following visitors were introduced to the Society: Lt. (j.g.) Warren H. Wagner, Jr., Dr. Joseph Greenberg, Dr. E. S. Josephson, Dr. Harriet Geer, Dr. F. W. Norris, Mrs. F. W. Norris, Miss Frances Hanusik, Ralph W. Bunn.

Adjournment at 9:40 P. M.

INA L. HAWES,
Recording Secretary.

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PROCEEDINGS OF THE

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VOL. 48 JUNE, 1946 No. 6

SPECIES OF AEDES (FINLAYA) OF THE PAPUENSIS GROUP IN THE AUSTRALASIAN REGION (Diptera, Culicidae)*

By WILLARD V. KING, *Lt. Colonel*, and HARRY HOOGSTRAAL, *Captain, Sanitary Corps, AUS*

A description is given herewith of one new species of this group from New Guinea, and a new name is proposed for *Aedes* (*F.*) *albitarsis* (Taylor), as this name is preoccupied in the genus. Detailed descriptions are given also of two species briefly described in a previous paper by the present writers (1946), together with descriptions of the male and larva of several species of which these stages were not previously known. Diagnostic keys to the adults and larvae are included.

The group is characterized by having either a large area or a median longitudinal stripe of pale scales (either silvery white or golden) on the anterior two-thirds of the scutum. Most of the species have broad white rings on at least the first four segments of the hind tarsi, and patches of both dark and pale narrow scales on the head. Most of the species also show a marked sexual dimorphism in the thoracic ornamentation. For this reason separate keys are given for the two sexes. The females of a few species have a rather narrow median stripe and resemble some of the *scutellaris* group of subgenus *Stegomyia* in this respect, but are readily distinguished by the narrow scales (instead of broad) on the vertex and scutellum. The male hypopygium is quite uniform in the group but shows minor variations in the terminal appendages of the style and harpago.

Included in the keys are four species (*australiensis, auridorsum, anggiensis* and *derooki*) of which material has not been available to the writers for comparison. The first two of these are known only from Australia and perhaps do not belong strictly to the group as they do not have the typical markings of the hind tarsi and head.

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*From the 19th Medical General Laboratory, Colonel Dwight M. Kuhns, M.C., Commanding Officer, Contribution No. 8 from the Entomology-Mammalogy Department.

Key to Females

1. Scutum with a large patch of silvery scales on anterior half extending at least half way over the fossae (Plate 20, B). Scutellum with pale scales on all lobes; abdominal tergites with pale bands.) 2
   Scutum with a median longitudinal stripe, from a sixth to a third the width of the thorax anteriorly, extending only slightly, if at all, on to fossae. (Females, Plate 19, A, B, C, 20, A, C) 5
2. Segment 4 of hind tarsi with a broad white ring and segment 5 with at least a basal white spot; vertex of head with a patch of dark scales on each side of the median pale-scaled area 3
   Segments 4 and 5 of hind tarsi not ringed with white; vertex of head entirely pale scaled 4
3. Pale sealing of scutum unicolorous or with slight lateral yellowish tinge; fifth hind tarsal with the basal half white; wing scales all dark .... *papuensis*
   Scutal patch white centrally, distinctly yellowish laterally and a pair of black submedian spots anteriorly; fifth hind tarsal with only a basal spot; wings with golden scales, particularly on apical third .... *anggiensis*
4. Segments 1 and 2 only of hind tarsi with white basal rings; scutal patch composed of silvery scales; abdominal bands produced in middle .... *australiensis*
   Segments 1 to 3 of hind tarsi ringed with white; scutal scales deep golden; tergites 6 and 7 almost entirely pale scaled *auridorsum*
5. Fifth hind tarsal all dark 6
   Fifth hind tarsal with at least a basal white spot 8
6. Median stripe of scutum about a sixth the width of thorax; scales of scutellum all dark; upper third of posterior pronotum bare of scales; abdominal tergites not banded .... *dobodurus*
   Median stripe of scutum about a third the width of thorax; widened and bulb-shaped posteriorly; scales of scutellum all white except for a few dark ones at base of mid lobe; upper third of posterior pronotum with dark scales; abdominal tergites usually with basal pale bands or median basal spots 7
7. Posterior cross vein usually nearly in line with the mid or separated by not more than half its length .... *novalbitarsis*, new name
   Posterior cross vein at least its own length nearer the base of wing than the mid .... *palmarum*
8. Scutellar scales all dark; abdominal tergites with a pair of submedian yellowish spots halfway between base and apex; scutal stripe about a fourth the width of thorax, slightly narrowed anteriorly .... *derooki*
   Scutellar scales white, at least on mid lobe; abdominal tergites dark above or with narrow basal bands 9
9. Side lobes of scutellum with dark scales (white in male); scutal

stripe, anteriorly, about a fifth the width of thorax, the posterior half distinctly tapered; fifth hind tarsal more than half white .... *argenteitarsis*

Side lobes of scutellum white scaled 10

10. Scutal stripe narrow, about a sixth the width of the thorax; fifth hind tarsal more than half white .... *hollandius*

Scutal stripe about a third the width of thorax, touching edge of fossae 11

11. Scutal stripe rounded but not enlarged posteriorly; abdominal tergites with short lateral spots, on some specimens extending as complete basal bands on two or more segments *subalbitarsis*, n. sp.

Scutal stripe bulbous posteriorly; tergites with a median basal spot on some specimens .... *novalbitarsis* variation

KEY TO MALES

1. Fourth and fifth hind tarsal segments dark. (Scutum largely pale, the scales bright golden.) .... *auridorsum*

Fourth hind tarsal with a broad white ring 2

2. Fifth hind tarsal all dark 3

Fifth hind tarsal marked with white 5

3. Scutellar scales all dark; scutum with a large oval white patch; abdominal tergites usually with incomplete bands on some segments .... *dobodurus*

Scutellar scales white; scutum largely pale scaled; abdominal tergites with complete basal white bands on several segments 4

4. Posterior cross vein usually not more than half its length closer to base of wing than mid .... *novalbitarsis*, new name

Posterior cross vein usually separated from mid by at least its own length .... *palmarum*

5. Scutum largely pale scaled with only a narrow lateral border of black (Males Plate 19, C and 20, B); fifth tarsal not more than half white 6

Dark border of scutum at least half as wide as the white patch (Males, Plate 19, B and 20, C); fifth hind tarsal with the basal three-fourths white 8

6. Scutal patch with a distinct border of golden scales and two black submedian spots anteriorly; wing scales pale golden, especially on apical third of wing .... *anggiensis*

Scutal patch all silvery white or with only a narrow lateral golden area; wing scales all dark 7

7. Head scales all pale .... *papuensis*

Head with an area of dark scales on each side of the median white area .... *subalbitarsis*, n. sp.

8. Posterior third of scutal patch tapered to a point .... *argenteitarsis* *novalbitarsis* variation

Scutal patch broadly rounded behind, with only a short median point .... *hollandius*

(Male of *australiensis* and *derooki* not known.)

Key to Larvae

1. Comb a single irregular row of 9 to 14 scales, each thorn-shaped apically 2
   Comb scales arranged in several rows in a triangular patch, each rounded and fringed apically 3
2. Preclypeal spines strongly curved and thickened; one pair of anal gills as long as saddle, the other pair only half as long .. *palmarum**
   Preclypeal spines slender, at least half as long as antenna, not strongly curved; anal gills all equal, distinctly longer than saddle. (Pecten teeth with a fine fringe on one side on basal third.) .... *argenteitarsis* and *dobodurus*
3. Comb scales numbering 18 to 25, each with an apical spine stouter than the rest of the fringe; a row of heavy spines along posterior border of anal saddle; pecten teeth with a fine fringe on basal third .... *hollandius*
   Comb scales numbering 40 or more, evenly fringed apically;

*From description of *A.* (*F.*) *australiensis* in Lee (1944).

   saddle without unusually heavy spines on posterior border; pecten teeth with a few stout denticles toward base 4
4. Head hairs B and C arising nearly in a transverse line toward front of clypeus; head very darkly pigmented; 11 to 14 pecten teeth each with 3 to 6 prominent denticles .... *papuensis*
   Head hairs arising at different levels; pecten teeth with one (rarely two) large denticle and one or two smaller ones 5
5. Siphon ratio about 3.5:1; 11 to 17 pecten teeth; anal gills slender, apically, gradually tapered to a narrow tip (Plate 22 C). .... *subalbitarsis*, n. sp.
   Siphon ratio about 2:5.1; 7 to 11 pecten teeth; anal gills stouter, tapered to a bluntly rounded point apically (Plate 23, B) *novalbitarsis*, new name

(Larva of *australiensis, auridorsum, anggiensis,* and *derooki* not known.)

Aedes (Finlaya) dobodurus King and Hoogstraal

Aedes (*Finlaya*) *dobodurus* King and Hoogstraal, 1946, Proc. Ent. Soc. Wash. *48:* p. 37. Holotype female, allotype male; near Dobodura, Australian New Guinea.

FEMALE.—*Head:* Proboscis somewhat longer than fore femur, entirely black scaled. Tori dark. Palpi about one-sixth length of proboscis, black scaled. Clypeus dark, devoid of scales. Median area of vertex with narrow silvery scales, extending between eyes, the area as wide anteriorly as scutal stripe, tapering posteriorly; sides of vertex clothed with flat black scales; posterior area with black upright forked scales, fewer anteriorly; lateral surface with an upper and lower area of broad silvery scales interrupted by a small area of broad black scales. *Thorax* (Plate —, A): Scutal integument dark, covered with fine, narrow scales, all black except for a prominent median stripe of silvery scales about one-sixth width of thorax, nearly parallel sided, apically tapered to a point reaching the antescutellar space. Scutellum with narrow black scales on each lobe. Postnotum dark. Anterior pronotal lobe with a wide stripe of broad silvery scales. Posterior pronotum bare above, a patch of broad silvery scales on lower third. Postspiracular area with several bristles, devoid of scales. A stripe of broad silvery scales on paratergite (just below mid border of scutum). Sternopleuron with a patch of broad silvery scales on the upper border and another on the posterior border just above the coxa; a patch on the subspiracular area in line with the upper sternopleural patch. Upper mesepimeron with a large patch of broad silvery scales. Propleuron densely clothed with broad silvery scales; about five propleural bristles. Coxae each with a large patch of silvery scales, that on fore coxa with a spot of black scales anteriorly. Femur with small silvery knee spot on fore leg, larger ones on mid and hind leg; fore and mid femora otherwise dark except for a narrow line of silvery scales below; hind femur largely pale on basal half except for a black stripe above. Tibiae completely black scaled. Fore and mid tarsi black scaled except for narrow dorsal basal white spots on 1 and 2, and a few white scales at base of 3; hind tarsi with broad basal white rings on 1 to 4, 5 entirely dark; ring on 3 about half length of segment, on 4 about three-fifths length of segment; fore and mid tarsal claws toothed, hind claws simple, smaller than others. Wing scales all black; outstanding (plume) scales of veins 2 to 4 fairly narrow, slightly broadened and somewhat more dense on apical half of forks of vein 2; upper fork cell 1.5 to 2 times as long as its stem; posterior cross vein arising about its own length closer to the base of the wing than the mid. Length of wing 3 mm. Halteres with black scales and a rim of silvery ones on knob. *Abdomen:* Tergites completely black scaled dorsally except for very small extensions of the lateral spots of V and VI; large silvery lateral spots on segments II to VII arising basally below but curving slightly sub-basally, posterior borders rounded, the spots on apical three segments at least half as long as segment. Sternites silvery scaled basally and black scaled apically. Segment VIII black scaled with a few basal silvery scales dorsally, the sternite compressed laterally, triangular. Cerci small, retracted, black.

Little variation in markings has been noted in the entire series of adults.

MALE.—Palpi about as long as proboscis; long segment with a white ring, slightly swollen apically; the two apical segments with white spots on basal third of each, the subapical segment and apex of long segment with a dense tuft of long hairs underneath. Antennae about two-thirds length of probiscis, flagellar segments densely plumose, the hairs pointing in two directions. Scutum (Plate 19, A) with a broadly oval patch of silvery scales (instead of a narrow stripe as in female), a little more than half as wide as thorax and covering about a third of the fossae. Lateral spots of abdominal tergites IV to VII extending well onto dorsum sub-basally, but not forming complete bands (some specimens show incomplete bands on only one or two tergites). Fore and mid tarsal claws of unequal size, the larger toothed. Markings otherwise similar to female. *Hypopygium* (Plate 21, D and J): Coxite nearly twice as long as broad, scaled on external half; a sub-basal lobe in the form of an elongate ridge with a row of about ten bristles along rim, decreasing in length inwardly, and scattered shorter hairs. Style (clasper) slender, slightly more than half length of coxite, the appendage slightly sub-apical, blunt, about a fifth length of stem. Basal arm of harpago (claspette) pilose, slightly curved; apical arm much longer, the main stem slender, pointed, with a wide, membranous striated keel extending from base nearly to tip. Paraproct with a heavily chitinized, bluntly pointed tip. Phallosome simple, broadly scoop-shaped. Ninth tergite connected in the middle by a narrow band, the rounded shoulders without bristles. The membranous keel of the harpago is much larger than in other members of the group (except possibly *auridorsum*) and the appendage of the style is shorter.

LARVA (Plate 22. A).—*Head:* Moderately pigmented, slightly broader than long. Antennal shaft with very sparse, minute spicules; shaft-hair single or with 2 or 3 branches. Preclypeal spines long and slender. Head hair A (preantennal) well internal and slightly anterior to base of antennae, with 4 to 6 branches; B (lower head hair) near front of clypeus, with 3 to 5 branches; C (upper head hair) slightly posterior and internal to B, with 4 to 8 branches; these hairs all simple (i.e. nonplumose); *d* minute, about 4 branched; inner and outer sutural hairs small, usually 2 and 4 branched. *Abdomen:* Lateral abdominal hairs on segment I with upper pair 3 to 5 branched, the lower usually single, occasionally double; lateral hairs on II with 3 or 4 branches; III with 4 to 6; V and VI with 2 or 3 each. Comb of segment VIII an irregular row of 10 to 13 scales; scales elongate, thorn-shaped, fringed at base of thorn; pentad hair 1 and 5 (upper and lower) with 4 to 7 branches; 2 and 4 single; 3 with 6 to 9 branches; pentads lightly plumose except 2 and 4. Siphon short and stout, index of 2.0 to 2.25, sides tapered, apex a little more than half width of base; pecten of 11 to 15 teeth; teeth with a light fringe or minute denticles on one side at base; tuft usually at end of pecten, rarely inserted before the apical tooth, with 3 to 6 branchs. Anal segment not completely ringed, several small spines and setae along posterior border of saddle; lateral hair with 1 to 3 branches, plumose; dorsal sub-caudal tuft usually with 5 or 6 branches, the ventral one single; anal gills equal, 1.5 to 3 times length of saddle, bluntly rounded.

The larva is very similar in all respects to that of *A.* (*F.*) *argenteitarsis*, material of which was collected at Hollandia in 1945. The writers are unable to distinguish the two species on larval characters alone.

The sources of the type series were as follows: holotype female, allotype male, and 2 males, 5 females, paratypes (Lot K142B), reared from larvae taken from a cup fungus in rain forest at elevation of about 100 feet, near Dobodura, Austalian New Guinea, 7 December 1943 (W. S. Monlux, collector); 1 male (K-136-1) from larva from can in forest near sea-level, Dobodura, 27 November 1943 (W. S. Monlux); 5 females (K-148) from larvae from tin cans, same location as 136-1, 14 December 1943 (W. S. Monlux); 1 male, 1 female (924) from larvae in fallen palm leaves in open ravine forest, elevation about 500 feet, Hollandia, Netherlands New Guinea, 31 March 1945 (H. Hoogstraal); 1 female (899) from larva in fallen palm leaves in open forest on rocky hillside, about 350 feet, Hollandia, 26 March 1945 (H. Cook); 2 males, 2 females (890) from larvae in fallen sago leaves in sago swamp, elevation about 500 feet, Hollandia, 20 March 1945 (H. Hoogstraal); 1 female (908C) from larva in same location as 899, 28 March 1945 (H. Cook); 1 female (498A) from larva in crevice in fallen log, Hollandia, 3 January 1945 (L. W. Saylor); 1 male (761D) from pupa in fallen palm leaves in open mountain-side forest, about 1,300 feet, Cyclops Mountains, just above Doromena, Hollandia area, 25 February 1945 (W. R. Fullem and S. G. Jewett, Jr.); 2 females (771) taken under same circumstances as 761D but at least 2,000 feet elevation, 1 March 1945 (W. R. Fullem and H. Cook); 1 male from larva in hole in log, Sansapor, Netherlands New Guinea, 1945 C. O. Mohr).

This species is immediately separated from the others in the group by the combination of all black scutellar scales and all black fifth hind tarsal. The narrow scutal stripe of the female is found in only three others, *A. hollandius,* which in this characteristic is very similar, *A. derooki,* which has a somewhat wider stripe, and *A. argenteitarsis,* in which the posterior half of the stripe is tapered. The membranous keel of the male harpago is distinctive among the known males of the New Guinea group.

Breeding with this species in the cup fungus at Dobodura were larvae of *Uranotaenia ?papua* Brug. Other species taken in association with it at various times were: *Aedes* (*Finlaya*) *hollandius*, *Aedes* (*F.*) *argenteitarsis*, *Uranotaenia nigerrima* Taylor, *Megarhinus splendens* (Wied.), *Aedes* (*Stegomyia*) *scutellaris scutellaris* (Walker), *Culex* (*Culiciomyia*) sp., *A.* (*F.*) *novalbitarsis,* and *Tripteroides bimaculipes* (Theob.).

Aedes (Finlaya) hollandius King and Hoogstraal

Aedes (*Finlaya*) *hollandius* King and Hoogstraal, 1946, Proc. Ent. Soc. Wash. *48:* p. 38. Holotype female, allotype male; Mount Defonsero, Cyclops Range, Hollandia area, Netherlands New Guinea.

FEMALE: Thoracic ornamentation (Plate 19, B) and other characters similar to *A. dobodurus* except as follows: scutellum with narrow silvery scales on each lobe; posterior pronotum with the upper half lightly clothed with narrow black scales, a large patch of broad silvery scales below posteriorly; conspicuous knee spots on mid and hind femora, none on fore femur; broad basal white bands on all hind tarsal segments, that on 3 almost half as long as segment, on 4 fully half as long as segment, 5 almost all white except for a narrow apical black band; abdominal tergites with the lateral spots on II to VII entirely basal, at least half as long as segment, about as broad as long, without extensions on to dorsum; dorsum entirely black scaled; sternites with narrow silvery basal bands; VIII completely black scaled.

In the Finschhafen paratype and in a few of those from higher elevations in the Cyclops Mountains, the white and black areas on the fifth hind tarsal are about equal.

MALE.—Similar to female of this species except as follows: the narrow median stripe of the scutum is replaced by a patch of silvery scales (Plate 19, B), anteriorly with straight sides about one-third width of thorax, barely touching fossae, posteriorly bulged and slightly overlapping fossae, the posterior border with a short, tapered point reaching the antescutellar space. In some of the paratypes, the white scutal patch is rather similar in shape to that of *dobodurus* (i.e. egg-shaped). Abdominal tergites IV to VI with complete silvery bands covering about basal fifth of segment; palpi and antennae similar to male of *A. dobodurus*. *Hypopygium* (Plate 21, F and L): similar to *A. dobodurus* except as follows: terminal appendage of style longer, being more than a third as long as the style; apical portion of harpago about equal its stem in length, without a wide membranous keel but apparently with a thin striated membrane around a portion of the blade, the striations having the appearance of coils of wire.

LARVA (Plate 22, B).—Differs principally from *A. dobodurus* in the form of the lateral comb, the shape of the comb scales, and the spines on the posterior border of the anal saddle. Minor differences occur in some of the other characters. *Head:* Lightly pigmented, almost as long as wide. Antenna slender, without spicules; tuft usually single but sometimes double, usually arising at the middle of the shaft but sometimes well anterior. Preclypeal spines more than half as long as antenna, slightly thickened, straight. Head hair A well internal to base of antenna, 4 or 5 branched; B near front of clypeus, 3 branched; C slightly posterior of B, 6 to 8 branched; none of these hairs plumose; *d* minute, about 5 branched; inner sutural hair usually double, outer 4 to 6 branched. *abdomen:* Lateral abdominal hairs on segment I usually with upper pair 2 or 3 branched, lower single; lateral hairs on other segments 2 or 3 branched. Segment VIII with lateral comb of from 18 to 28 scales arranged in a triangle, each scale rounded and fringed apically, with an apical spine distinctly larger than the others. Pentad hairs 1 and 5 typically with 5 branches, sometimes 4 to 7 branched, plumose; 2 and 4 single; 3 with 6 to 8 branches, plumose. Siphon ratio a little over 2, the sides tapered; apex a little more than half as wide as base;

surface covered with short, curved rows of minute spicules; acus present; pecten teeth usually 11 to 14, extending to about middle of siphon; rarely with as many as 20 teeth extending well beyond middle of siphon; each tooth spine-shaped, with a minute basal fringe (sometimes very difficult to see); hair tuft 3 to 5 branched, arising near base of apical pecten tooth, rarely before the last tooth. Anal segment not completely ringed by saddle; saddle with a conspicuous row of long spines on posterior border and a subapical area of short rows of spicules and setae; saddle hair single, lightly plumose; dorsal subcaudal hair tuft 4 to 6 branched, the ventral one single; ventral brush consisting of 5 pairs of tufts arising from a grid, these tufts 3 to 6 branched. Anal gills typically about twice length of saddle, sometimes up to 3 times length of saddle.

The sources of the type series were as follows (all reared from larvae taken from shaded fallen palm leaves during 1945 unless otherwise indicated): holotype female, allotype male, and 12 males, 4 females paratypes (Lots 797 A, B and C) from Mount Dafonsero, Cyclops Range, Hollandia area, Netherlands New Guinea, 4 March 1945, elevations from 4600 to 5325 feet (W. R. Fullem and H. Cook, collectors); 2 males, 3 females (777) same locality, 2 March, about 4800 feet; 9 males, 16 females (1131, 1134, 1136 to 1142, 1147), 17, 19, 20, 24, and 25 March, elevations from about 4500 to 5100 feet (H. Cook). From Hollandia: rain forest about 250 feet elevation: 6 males (235), 28 September 1944 (H. Hoogstraal); 1 male (400), 10 December 1944 (D. P. Furman); 2 males, 8 females (877), 18 March (H. Hoogstraal and J. Toffaleti); 13 males, 12 females (887), 19 March (H. Hoogstraal); 2 males, 3 females (949 and 950), 10 April (H. Cook); from ravine forest about 500 feet elevation: 1 male (924-2), 31 March (H. Hoogstraal); from sago swamp about 200 feet elevation: 1 female (890), 20 March (H. Cook); from light trap at edge of rain forest, elevation about 250 feet: 1 male, 28 March (King and Hoogstraal). From localities in Australian New Guinea: 1 female (40th M. S. U. No. 212) Finschhafen, April, 1944 (D. P. Furman); 1 male (K-136) Dobodura, from larva in tin can in forest, 27 November 1943 (W. S. Monlux).

A considerably larger series of specimens was obtained in the Hollandia area but many of these were badly damaged in transit.

Larvae of this species were taken in the Hollandia area each month between September 1944 and June 1945. Twenty-five collections were from shaded fallen palm leaves in rain forest, sago swamp forest, open hillside forest, ravine forest, and mossy mountainside forest, ranging in elevation from sea level to 5,325 feet. Commonly associated with it in these breeding places were *Uranotaenia nigerrima, U.* sp., and *Aedes argen-*

teitarsis; less commonly found were *Aedes dobodurus, A. notoscriptus* (Skuse), *A. wallacei* Edw., *A. novalbitarsis, A. albolineatus* (Theob.), *A. s. scutellaris, Culex pullus* Theob., *C.* (*Culiciomyia*) sp., *U.* sp., *Armigeres milnensis* Lee, and *Megarhinus splendens.* A single collection was made from a shaded rock pool containing organic matter and leaves at 3,000 feet elevation; *Aedes subalbitarsis* was breeding in asociation with it there. Two collections were taken from tree holes, one in rain forest with *U. nigerrima,* the other in open coastal woods with *Aedes aureostriatus* Dole., *A. albolineatus,* and *Culex brevipalpis* Giles. Shaded cans in rain forest yielded, besides this species, *Aedes novalbitarsis, A. notoscriptus, Culex* (*Culiciomyia*) sp., *Megarhinus splendens* and *Tripteroides* sp. A single collection was taken in a coconut husk in a grove, with larvae of *Aedes s. scutellaris.* A light trap operated at the edge of a rain forest from January to June produced only one specimen of this species, a male, in March. None were taken biting during the same period.

Aedes (Finlaya) subalbitarsis, new species

FEMALE.—Similar to *A.* (*F.*) *dobodurus* except as follows: palpi almost a fourth as long as proboscis; median silvery stripe of scutum (Plate 19, C) about a third as wide as thorax (barely touching edge of fossae), the sides nearly parallel, rounded behind and extending to antescutellar space; scutellum with narrow silvery scales on each lobe, a very few black ones at the base of mid-lobe; posterior pronotum lightly clothed on upper half with narrow black scales, a few broad silvery ones along the posterior border; a small patch of broad silvery scales among the postspiracular bristles, another patch just below the prealar knob; no silvery scales bordering the scutum between the wing root and the spiracle and none on the area anterior to the upper sternopleural patch; hind tarsal segments with broad basal rings on segments 1 to 4 inclusive, those on 3 and 4 about two-fifths length of segment, 5 with a narrow basal ring; upper fork cell about equal its stem; posterior cross vein arising slightly closer to the base of the wing than the mid; knob of halteres largely silvery scaled except for small apical patch of black scales; abdominal tergites III and IV with very small median, basal, silvery patches, III to VI with small dorsal extensions of the lateral spots.

Among the paratypes of this species, the abdominal markings are variable. Complete narrow basal silvery bands are usually found on two, three or four of the tergites from III to VI, but a few of the specimens have either completely black dorsal tergites or more or less conspicuous basal median silvery spots. The white ring of the fifth hind tarsal usually covers the basal fifth of the segment, but sometimes slightly more, or may be reduced to an anterior spot. The posterior cross vein is usually as mentioned for the holotype, but sometimes may be in line with the mid, or about half its length closer to the base of the wing than in the holotype. Two specimens show a few broad silvery scales just below the border of the scutum between the wing root and the spiracle.

MALE.—The silvery patch on the anterior half of the scutum (Plate 19, C) is much larger than in the female and is similar to that of the male of *A. novalbitarsis*, new name. Anteriorly it extends about half way over the fossae, while posteriorly it covers nearly the entire width of the scutum; posterior border nearly straight except for a median prolongation that reaches the antescutellar space. Scutellum and posterior pronotum as in female. Upper fork cell slightly shorter than its base. Abdominal tergites III to VI with basal silvery bands covering about one-fourth of the dorsal surface; VII with a dorsal extension of the lateral silvery spot. Characters otherwise similar to female. Palpi and antennae similar to male of *A. dobodurus*.

Among the series of males at hand, the posterior cross vein is usually slightly closer to the wing base than the mid; in a few specimens it is fully its own length closer. The basal white band of the fifth hind tarsal is consistently narrower in the male than in the female. *Hypopygium* (Plate 21, E and K): Similar in general to *A. dobodurus* except as follows: terminal appendage of style somewhat longer, about one-third length of stem; bristles along edge of sub-basal lobe of coxite much stouter; apical portion of harpago about equal in length to basal arm, with a thin membrane, having a finely crinkled appearance, along the basal half and produced on one side into a narrow keel.

LARVA (Plate 22, C).—*Head:* Broader than long, rather darkly pigmented. Antenna narrow, shaft with small spicules; hair tuft situated at about middle of antenna, 3 to 5 branched. Preclypeal spines slender, tapered, straight, about half as long as antenna. Head hair A with 5 to 8 branches, plumose, arising near base of antenna; B with 3 to 5 branches, arising toward front of clypeus; C with 5 or 6 branches, arising slightly anterior of B and about in line with A; *d* minute, about six branched, arising just posterior and inside of C; outer sutural hair with 2 to 5 branches, inner single. *Abdomen:* Lateral hairs on segment I either single and double or both double; on segments II to VII with 2 or 3 branches. Segment VIII with lateral comb a large triangular patch of almost 100 elongate, bluntly rounded, apically fringed scales. Pentad hair 1 usually with 3 branches, lightly plumose; 3 very long, with 7 to 10 branches, heavily plumose; 5 with 4 branches, sometimes with 3, lightly plumose; 2 and 4 single, non-plumose. Siphon long and rather narrow; ratio of about 3.5:1, the surface covered with short rows of minute spicules; acus present; pecten teeth numbering from 11 to 17, not reaching the middle of the siphon; each tooth long, narrow, and sharply tapered, with one to three sub-basal denticles; hair tuft arising just beyond base of apical pecten tooth, long, about eight branched, plumose. Saddle not covering entire anal segment, with numerous spicules near posterior border and smaller ones arising in rows on entire surface; saddle hair single. Dorsal sub-caudal tuft about 8 branched, ventral single. Anal gills a little more than twice as long as saddle, slender and gradually tapered to a narrow tip.

Holotype.—Female (1017-3), reared from larva taken in a rock pool at side of stream, shaded by cliff, with organic matter and leaves at bottom; about 3,000 feet elevation, Mount Dafonsero, Cyclops Mountains, Hollandia area, Netherlands New Guinea, 21 April 1945, W. E. Brewer, collector. *Allotype.*—Male (1017-18), same data as above. *Paratypes.*—13 males and 18 females, mostly with larval exuviae, as follows: 11 males, 7 females (1017), same data as above; 2 males, 1 female (1016) taken at same time as above in a K-ration box in the stream nearby; 8 females (488D) from semi-shaded pool on rock in stream, about 750 feet elevation, Hollandia, 31 December 1944 (H. A. Levy and A. R. Gaufin); 2 females (608) from pupae in a shaded hole in log in rain forest, about 250 feet elevation, Hollandia, 25 January 1945 (H. Hoogstraal). Holotype, allotype, and paratype material deposited in the United States National Museum; other paratypes in the Museum of the Division of Economic Entomology, Council for Scientific and Industrial Research, Canberra, A. C. T., Australia.

The female is readily distinguishable from other species in this group by the straight-sided median scutal stripe, which is one-third as wide as the thorax, and by the narrow white band or spot on the fifth hind tarsal. The male, however, very closely resembles that of the typical *A. novalbitarsis*, except for the small white basal ring on the fifth hind tarsal, but the writers cannot distinguish it from the variation mentioned under *A. novalbitarsis.*

This species is apparently rare at Hollandia and we do not know that other entomologists have collected it there or elsewhere in New Guinea. *Aedes* (*Finlaya*) *novalbitarsis* was found breeding with it in each of the collections except the one from the K-ration box in the mountain stream (1016). *A.* (*F.*) *hollandius* was found breeding with the type collection (1017) and *A.* (*Stegomyia*) *albolineatus* was taken from the collection in the log hole (608).

Aedes (Finlaya) novalbitarsis, new name

Leucomyia albitarsis Taylor, 1914. Trans. Ent. Soc. London, part I, p. 194. (Nec. *Anisocheleomyia albitarsis* Ludlow, 1905, Can. Ent. *37*: 131 = *Aedes* (*Stegomyia*) *desmotes* (Giles), 1904; syn. by Edwards, 1922, Ind. J. Med. Res. *10*:464). Type female from Lakekamu Gold Field, Papua.

Aedes (*Finlaya*) *albitarsis* (Taylor). Edwards, 1924, Bull. Ent. Res., *14*:381 (new combination).

Aedes (Finlaya) albitarsis (Taylor), 1944, Proc. Linn. Soc. N. S. W., *69*:121.

As indicated above, the name *albitarsis* Taylor is preoccupied in *Aedes* by *albitarsis* Ludlow. Taylor (1944) corrected the description of the scutal ornamentation by stating that the median stripe was moderately broad, instead of a line as originally described. He also placed *A. palmarum* Edwards, 1924, as a synonym. As indicated in the discussion of this species, however, we find that the two are distinct.

The type female, in the school of Hygiene and Tropical Medicine, University of Sydney, has been examined by the senior author, as also a large series reared from larvae collected by the writers and others in eastern and northern New Guinea. The median silvery stripe of the scutum (Plate 20, A), anteriorly, is about a third the width of the thorax, touching the edges of the fossae; posteriorly, it is wider and distinctly bulbous; scales sometimes golden along sides of stripe and on upper part of posterior pronotum, as well as along the margins of the median white scales of the vertex of the head. Scales of the scutellum all white except for a few dark ones at base of midlobe, 5th hind tarsal all dark. Abdominal tergites either with complete narrow basal bands on segments II to IV or II to V, or with long, narrow, basal, median spots on these segments. Wing with the posterior crossvein nearly in line with the mid, sometimes slightly distal to it or rarely as much as half its length proximal. In the male, the scutum (Plate 20, A) is largely pale scaled on the anterior half. The posterior cross vein tends to be separated slightly more from the mid than in the female, rarely nearly its own length away. The hypopygium (Plate 21, B and H) shows only slight differences from *subalbitarsis,* the appendage of the style being more than a third the length of the stem, and the bristles of the basal lobe of the coxite more slender.

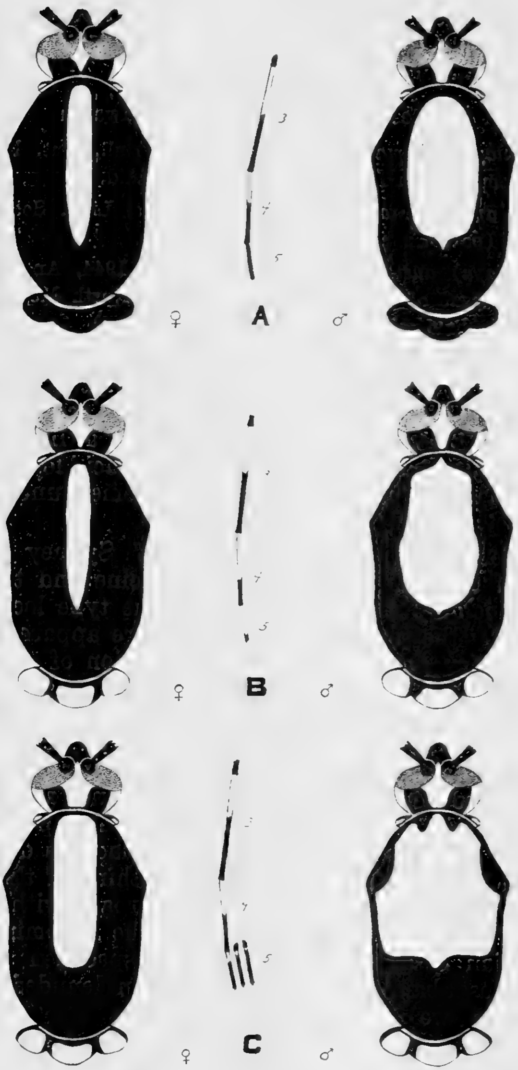
An occasional specimen of this species has a few white scales or a small spot at the base of the fifth hind tarsal. In one lot from the Hollandia area (488D), five females showed a small spot or a narrow basal ring, while a male and two females had the segment all black as usual. Sixteen specimens examined from Goodenough Island (off the eastern end of New Guinea), all showed a distinct basal white spot or ring on this segment, which suggests the occurrence of a variation of the species in that locality. The Goodenough specimens consisted of four males and one female received from Ensign L. J. Carleo, and eleven females examined by the senior author in the collection of D. J. Lee at the University of Sydney.

LARVA (Plate 23, B).—The larva of this species has not previously been described. The following description is based on specimens from Dobodura, Hollandia and Finschhafen. It is quite similar to *subalbitarsis*, but is chiefly distinguished by the characters given in the key.

Head: Antenna about half as long as head, with scattered spicules; shaft hair long, arising near middle, with 2 to 4 branches. Head hair A lightly plumose, with 3, rarely with 4 to 6, branches; B and C near front of clypeus, non-plumose, B with 3 branches, C with 4 to 6; *d* minute, about 4 branched; inner sutural hair single, outer double or triple. *Abdomen:* upper lateral hair of segment I with 2 or 3 branches, lower single, lateral hairs on II double or triple; III to VI with 2 to 5 branches. Segment VIII with a dense, triangular lateral comb of about 50 elongate scales, apically rounded and fringed; pentad hair 1 single or double; 2 and 4 single; 3 with 7 or 8 plumose branches; 5 with 2 or 3 broad branches. Siphon ratio about 2.5:1, the sides tapered, a prominent acus present; from 7 to 11 long; spine-like pecten teeth extending about to middle of siphon, each with one large, and sometimes with one or two smaller, denticles; hair tuft arising about level with apical pecten tooth, with 6 to 8 plumose branches. Anal segment more than half covered by saddle, saddle covered with short rows of spicules that become much larger posteriorly; scattered setae also near posteroventral border; lateral hair single, rarely double; dorsal subcaudal hair tuft 5 or 6 branched, the ventral one single; anal gills equal, tapered to a blunt point apically, about 2 times length of saddle.

A. novalbitarsis was a rather common species in the Oro Bay and Hollandia areas. At the latter place from 49 collections of larvae made between November 1944 and June 1945, 160 males and 177 females were reared. They breed primarily in small water containers, and were taken oftenest in shaded tree holes, log holes and tin cans, and frequently also in depressions in rocks along streams. These places accounted for 31 of the 49 collections. They were taken occasionally in a variety of other places, including fallen palm bracts, cocoanut leaves and husk, sags in canvas, drum heads, helmets, and a sea shell. One collection was from a pool in a sawdust pile. Other species taken in association with it in these breeding places include *Aedes s. scutellaris*, *A. notoscriptus*, *A. aurimargo*, *A. ornatus*, *A. albolineatus*, *A. papuensis*, *A. novalbitarsis*, *A. dobodurus*, *A. hollandius*, *A. subalbitarsis*, *Armigeres milnensis*, *Megarhinus splendens*, *Tripteroides bimaculipes*, *Uranotaenia nigerrima*, *Culex brevipalpis*; *C.* (*Lophoceraomyia*) *?uniformis* and *C.* (*Culiciomyia*) sp.

Most of the collections were from low elevations but the species was also taken a number of times from different elevations in the Cyclops Mountains. One was from water in fallen palm leaves in a mossy forest at the peak of Mount Dafonsero (5,325 feet), where it was associated with larvae of *A. hollandius*.



Ornamentation of head, scutum, and hind tarsi: A. *Aedes* (*Finlaya*) *dobodurus;* B. *Aedes* (*Finlaya*) *hollandius;* C. *Aedes* (*Finlaya*) *subalbitarsis.* (The dotted line indicates the extent of the fossa on one side of the scutum.)

No definite biting records were obtained. One female was collected at night during a "biting collection" but it was not noted that puncturing actually occurred. Three females were taken in a light-trap operated between January and June at the edge of a rain forest.

Aedes (Finlaya) palmarum Edwards

Aedes (*Finlaya*) *palmarum* Edwards, 1924. Bull. Ent. Res., *14*:382. Type female from Palm Island, N. Queensland.

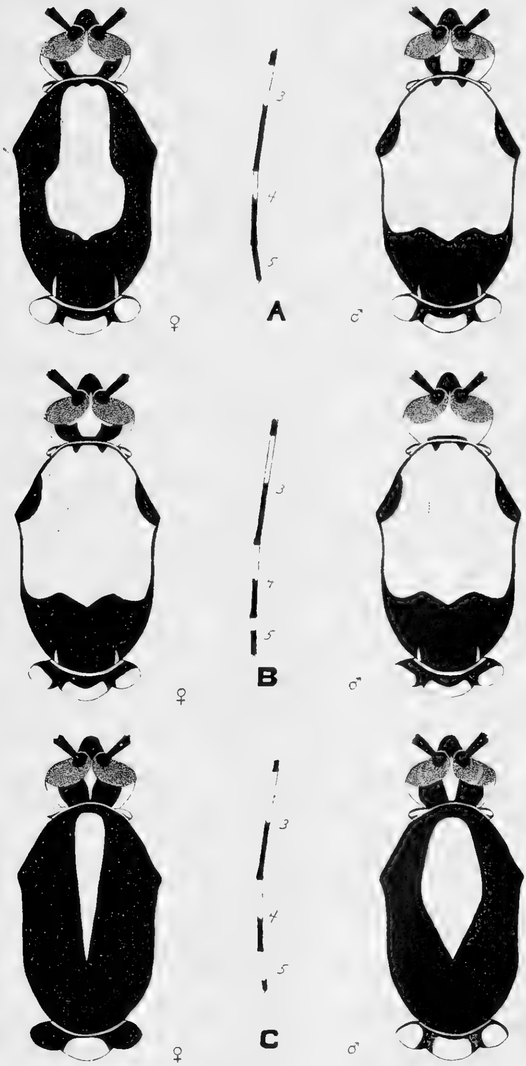
Aedes (*Finlaya*) *albitarsis* Taylor, 1944, Proc. Linn. Soc. N. S. W., *69*:121 (partim; nec. Taylor, 1914).

Aedes (*Finlaya*) *australiensis* Theobald. Lee, 1944, An Atlas of the Mosq. Larvae of the Australasian Region, North Melbourne, p. 58 (nec. Theobald, 1910). (Description of larva.)

The brief original description was as follows: "Allied to *A.* (*F.*) *albitarsis* (Taylor), but differing from it in the following particulars:—The median pale stripe of the scutum is moderately broad (it could hardly be described as a 'line') and composed of golden, not white, scales; prothoracic lobes (and also proepimera) with flat black scales; abdomen unbanded dorsally."

Four females in the University of Sydney collections (School of Hygiene and Tropical Medicine and the Department of Zoology) from Palm Island, the type locality, were examined by the senior author. These are apparently distinguishable from *novalbitarsis* by the position of the posterior cross vein, which is about 1.5 times its own length nearer the base of the wing than the mid, whereas in *novalbitarsis* the cross veins are nearly in line or only slightly separated. The scutal stripes are almost identical in shape in the two species, and the scales were silvery white or with only a faint yellowish cast in the Palm Island specimens. The pronotal lobes have some pale semi-broad scales (not black as described by Edwards) and the scales on the upper third of the posterior pronotum vary from narrow to semi-broad, with the usual patch of dusky white flat ones below. The abdominal tergites have median basal white spots in one specimen and nearly complete basal bands in another (abdomen denuded or missing in the other two).

A female specimen from Brisbane and three males from Mt. Glorious (near Brisbane) were also examined in the Department of Zoology, through the kindness of D. J. Lee, who stated that these were associated with larval material "from Brisbane (Perkins)," described by him in 1944 (*op. cit.*), under the name *A.* (*F.*) *australiensis* (Theobald). The female appeared to be identifiable as *A. palmarum* since no distinctive



Ornamentation of head, scutum, and hind tarsi: A. *Aedes* (*Finlaya*) *novalbitarsis;* B. *Aedes* (*Finlaya*) *papuensis;* C. *Aedes* (*Finlaya*) *argenteitarsis;* (the dotted line indicates the extent of the fossa on one side of the scutum).

differences were noticeable. The abdominal tergites had complete basal bands, wider in the male.

The larva of the above-mentioned lot, as illustrated by Lee, has a single, slightly irregular row of comb scales, the individual scales being thorn-shaped and lightly fringed near base, thus being easily separable from *novalbitarsis*.

Aedes (Finlaya) papuensis (Taylor)

Leucomyia australiensis var. *papuensis*. Taylor, 1914. Trans. Ent. Soc. of London, 1913 p. 193. Type female, Milne Bay, Papua.

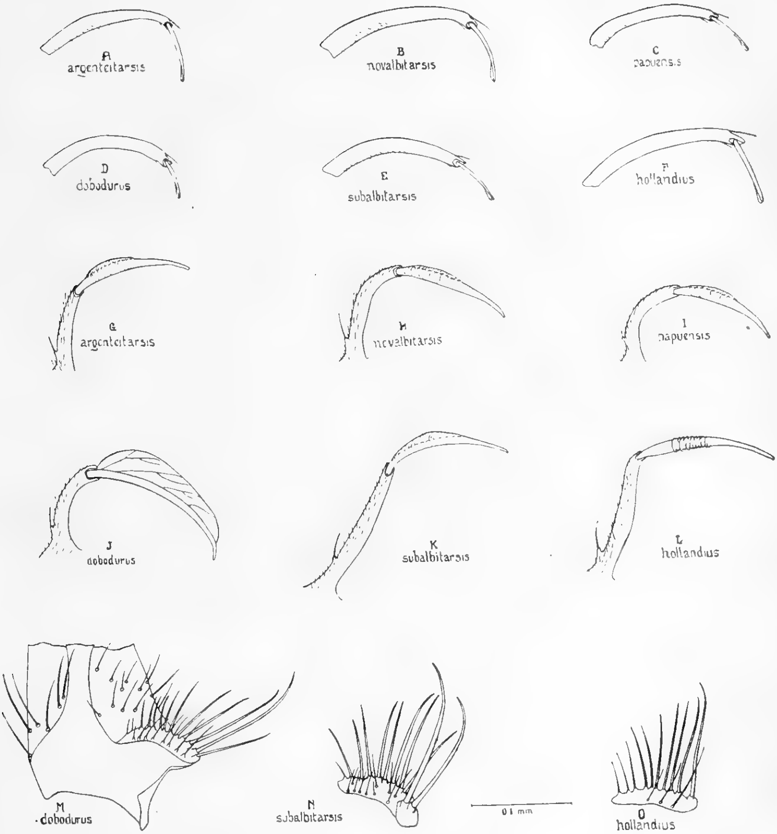
?*Aedes* (*Finlaya*) *papuensis* (Taylor). Brug, 1927, Nova Guinea, *15*: 358. (Description of male.)

Aedes (*Finlaya*) *papuensis* Taylor. Lee, 1944, An Atlas of the Mosq. Larvae of the Australasian Region, North Melbourne, p. 61. (Illustrations of larva.)

From an examination by the senior author of the type female in the University of Sydney collection the following characters were noted: vertex of head with a wide median area of narrow pale scales and an equal area of dark scales on each side; anterior half of scutum nearly all white-scaled except for a narrow lateral border of dark; prototal lobes with flat white scales above, narrower ones below; mid-lobe of scutellum with narrow pale scales apically, dark basally; a few pale scales visible on side lobes; abdomen with narrow basal white bands on segments II to V; hind tarsi with broad white basal rings on all segments, those on 4 and 5 about half the length of the segments.

Female specimens reared from larvae obtained in the Hollandia area agree well with the type. In general coloration, including the extent of white on the scutum (Plate 20, B), the associated males are similar to the female, except that the head is entirely pale scaled. The scales toward the sides of the scutal patch and those on the upper part of the posterior pronotum often have a golden cast. The hypopygium (Plate 21, C and I) is similar to that of *subalbitarsis*. Brug (1927) described specimens identified as *A.* (*F.*) *papuensis* from Albatrosbivak and his illustration of the male genitalia shows a double apical appendange on the style, instead of the usual single appedange. This is possibly an aberrent condition or else the species differs from our material. The description is inadequate for determining whether his species is otherwise identical.

LARVA (Plate 23, A).—Head darkly pigmented and considerably broader than long; antenna heavily spiculate and unusually long, almost as long as head; head hairs B and C arising about in a line toward front of clypeus; hair A typically with 5 branches, B and C usually 6 branched; *d* close to C, very small. Comb of segment VIII a dense tri-



Parts of male genitalia: A. Style of *argenteitarsis;* B. Style of *novalbitarsis;* C. Style of *papuensis;* D. Style of *dobodurus;* E. Style of *subalbitarsis;* F. Style of *hollandius;* G. Harpago of *argenteitarsis;* H. Harpago of *novalbitarsis;* I. Harpago of *papuensis;* J. Harpago of *dobodurus;* K. Harpago of *subalbitarsis;* L. Harpago of *hollandius;* M. Inner lateral aspect of basal portion of soxite of *dobodurus* to show sub-basal lobe; N. Sub-basal lobe of coxite of *subalbitarsis;* O. Sub-basal lobe of coxite of *hollandius.*

angular patch of about 50 elongate comb scales, apically bluntly rounded and fringed. Siphon index about 2:1, sides tapered; from 11 to 14 heavy, spine-shaped pecten teeth, each with 3 to 6 prominent denticles toward base; hair tuft long, about 6 branched, arising just below base of apical pecten tooth; apical appendages of siphon with very long hairs. Saddle large, not completely encircling anal segment, with long spicules and setae posteriorly, lateral hair usually single; anal gills about one and a half times as long as saddle.

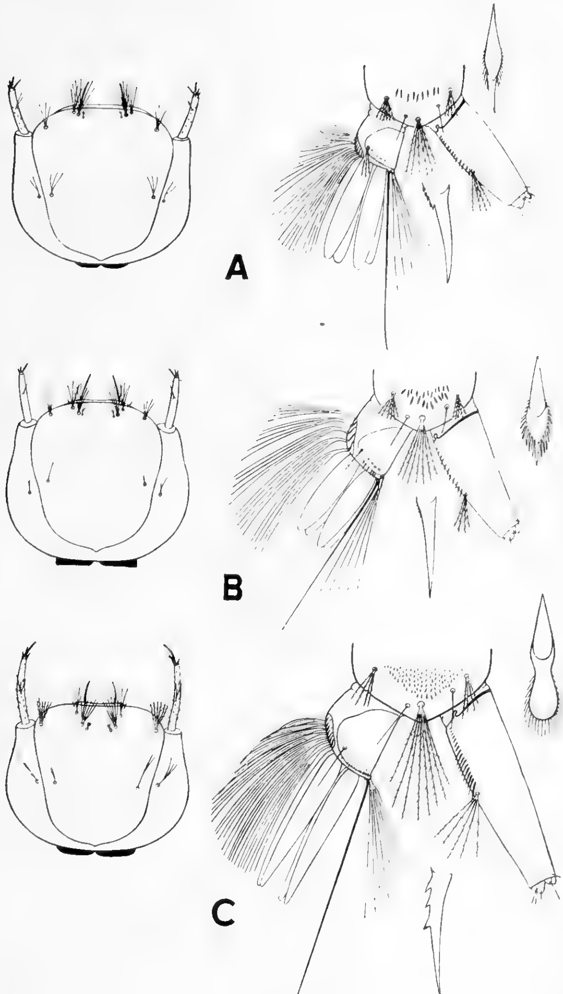
In March, 1945, collections of this species were made near Doromena village, on the sea coast near Hollandia. Three of these were from tree holes and were associated with *Aedes scutellaris, A. novalbitarsis, A. notoscriptus,* and *A. albolineatus.* One collection was from a shaded pool on a rock, with *A. s. scutellaris* and *A. novalbitarsis.* Members of the 220th Malaria Survey Unit found it breeding in a tree hole in collections of water on papers and on drum heads in the Hollandia area in April and June. In Eastern New Guinea, one collection was made from a rock pool in a stream bed at Higatura in the Oro Bay area in October, 1944 (King). It was also taken at Finschhafen, in September, 1944, once from a sunlit rut with decaying vegetation in a coconut grove along with *Culex* (*Culiciomyia*) *pullus* Theob., and another time from fresh water in a sunlit coral pool in the Gusika area (Hoogstraal).

Aedes (Finlaya) argenteitarsis Brug

Aedes (*Finlaya*) *argenteitarsis* Brug, 1932, Bull. Ent. Res. *23*:76. Type female, Upper Digoel River (South New Guinea).

The following characteristics were included in the original description: Scutum with a median longitudinal stripe of pale scales about one-fifth width of thorax, extending about opposite wing roots and tapered posteriorly; scutellum with white curved scales on mid-lobe and large black curved ones on side lobes; a line of flat scales from base of wing half way to proepimeron; all segments of mid tarsi with broad white rings, those on 3 to 5 occupying more than half of the segments; abdominal tergites II to VII dark brown with silvery white lateral basal spots.

A fairly large series of specimens collected by us as larvae in the Hollandia area agree well with Brug's description except for minor variations. There are narrow black scales on the upper third of the posterior pronotum in addition to the pale flat ones mentioned by Brug. The male (not previously described) differs from the female in having a median scutal patch of white about half the width of the thorax and rather oval in shape anteriorly, tapering to a point posteriorly (Plate 20, C). It differs also in having white scales on the side lobes



Larvae: A. Head and terminal portion of *dobodurus;* B. Head and terminal portion of *hollandius;* C. Head and terminal portion of *subalbitarsis.*

as well as the mid lobe of the scutellum. In the genitalia (Plate —, A and G), the style is finely pilose on basal half of inner surface and the appendage is fully half as long as clasper.

LARVA.—The larva (not previously described) appears to be indistinguishable from that of *A.* (*F.*) *dobodurus.*

About 50 adults of this species were reared from larvae in the Hollandia area between December, 1944 and May 1945. These came from 14 collections, all from fallen palm leaves in shaded sago swamp and rain forest at altitudes from 200 to 300 feet. Breeding with them were *Aedes hollandius, A. dobodurus, Uranotaenia nigerrima,* and *U.* spp. Two females were attracted to a light trap operated at the edge of the rain forest during this period.

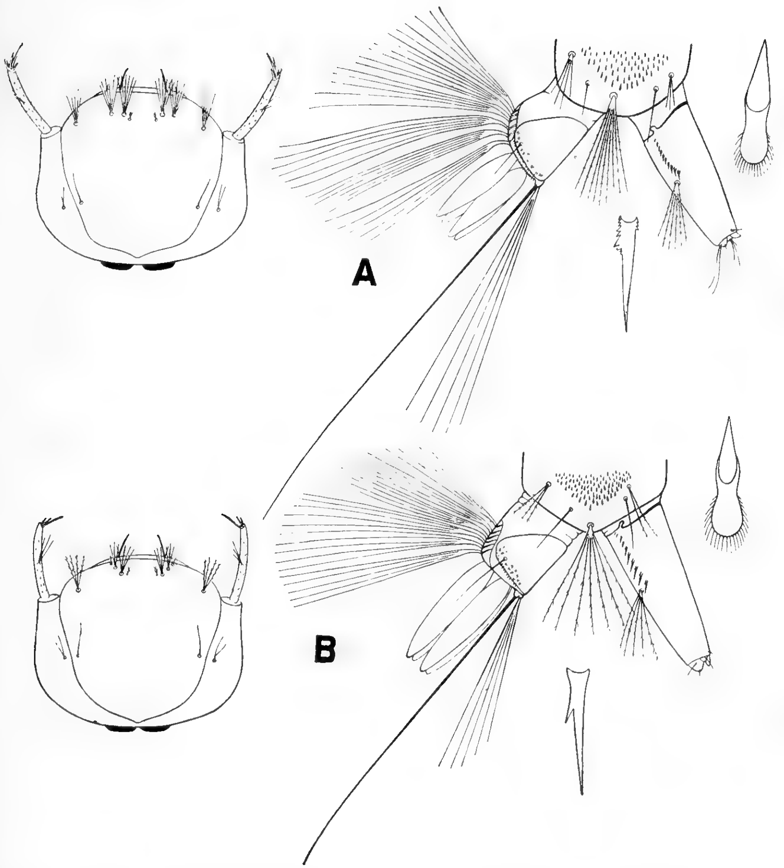
The following four species are included in the group but no information is at hand beyond that given in the original description. The principal diagnostic characters are shown in the keys.

A. (*F.*) *australiensis* (Theobald), 1910. Mon. Cul. *5*:313 (*Leucomyia*). Type female, Stannery Hills, Queensland. The species is known only from the unique type, which Edwards (Bull. Ent. Res. *14*:381, 1924) said was considerably damaged. He thought it distinct from its closest allies, *A. auridorsum* and *A. papuensis.*

A. (*F.*) *auridorsum* Edwards, 1922. Bull. Ent. Res., *12*:93. Type female from Eidsvold; paratypes, one female from Biglow scrub, one male, two females from Eidsvold, Queensland. The type locality was originally given as Sydney, but later corrected to Eidsvold by Edwards (1924), *op. cit.*).

A. (*F.*) *derooki* Brug, 1932. Bull. Ent. Res., *23*:75. Types, two females from Ternate, Moluccas.

A. (*F.*) *anggiensis* Bonne-Wepster, 1937. Meded. Dienst. Volksgez. Ned. Ind., *26*:97. Types, 3 males, 3 females from Anggi Lakes, Western New Guinea (2,000 m.).



Larvae: A. Head and terminal portion of *papuensis;* B. Head and terminal portion of *novalbitarsis,*

A SMALL, DARK-COLORED NEW KALOTERMES FROM GUATEMALA

By Thomas E. Snyder, *Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture*

All except one species of the subterranean termites of the genus *Reticulitermes* Holmgren which damage the woodwork of buildings in the United States are dark-colored. The non-subterranean termites of comparable size are all light-colored, except *Kalotermes milleri* Emerson, of the Florida Keys and Jamaica. A recent interception of winged and soldier termites in a log from Guatemala by inspectors of the Bureau of Entomology and Plant Quarantine at San Francisco, Calif., proves to be another small, dark-colored *Kalotermes* and is new. Both *milleri* and this new species *nigritus* superficially resemble, and might be mistaken by the layman for, species of *Reticulitermes*. They are the only small, dark-colored species of *Kalotermes* (s. str.) occurring in the Americas; *milleri* is the smallest known species of *Kalotermes* (s. str.) and *nigritus* is not much larger. The description of this new species follows.

Kalotermes nigritus, new species

Winged adult.—Head dark shining castaneous brown to blackish, lighter colored at posterior margin, longer than broad, with scattered long hairs. Eye black, not round, angular, separated from lateral margin of the head by a distance a little less than the long diameter of the eye and from the posterior margin by a distance equal to over two diameters of the eye. Ocellus suboval, close to eye. Labrum yellow brown.

Antenna yellow brown, with 14-15 segments, third segment large, dark-colored, somewhat modified, and longer and darker than second or fourth segment.

Pronotum of same color as head, broader than long, broadly, roundedly emarginate anteriorly, and more sharply emarginate posteriorly, with scattered long hairs.

Legs with femora dark castaneous brown, tibiae yellow brown, claws with pulvillus.

Wings dark-colored, costal veins with golden tinge, hairs on upper margin and surface. Median vein slightly closer to subcosta than to cubitus, unbranched to apex, subcostal veins with 6 (mostly long) branches to subcosta. Cubitus in about center of wing, branched to apex, with 11 main branches to lower margin.

Abdomen castaneous brown, with long hairs at base of each tergite.

Measurements:

Length of entire winged adult	7.50-8.00 mm.
Length of entire dealated adult	5.00-5.25 mm.
Length of head (to tip of labrum)	1.18-1.25 mm.
Length of pronotum (to anterior corner)	0.70-0.75 mm.

Length of forewing	5.00-5.50 mm.
Length of hind tibia	0.70-0.75 mm.
Diameter of eye (long diameter)	0.19-0.25 mm.
Width of head (at eyes)	0.95-1.00 mm.
Width of pronotum	0.95-1.10 mm.
Width of forewing	1.45-1.50 mm.

The winged adult of *Kalotermes nigritus* is close to *K. milleri,* but in *milleri* the third segment of the antenna is small and there are only 13, not 14 or 15, segments. The tibiae are darker colored in *nigritus,* and the wing membrane is hyaline in *milleri,* not dark as in *nigritus.* The imago of *nigritus* is somewhat larger than *milleri.* A. E. Emerson believes *nigritus* to be distinct.

Soldier.—Head light castaneous brown, darker anteriorly, sides nearly parallel, nearly flat, with a slight slope and depression at the epicranial suture, with scattered long and short hairs. Eye spot white, suboval, elongate. Gula narrow in middle, half as wide as at front.

Antenna yellow brown, with 10-11 segments, third segment dark castaneous brown, modified, as long as the fourth and fifth segments together.

Mandibles black, stout at base, slender, pointed and incurved at apex. Left mandible with two somewhat blunt, marginal teeth or a molar at the apical third, and a sharper pointed tooth near base. Right mandible with a molar near base.

Pronotum yellow-brown, lighter posteriorly; anterior margin denticulate or roughened, broadly and roundedly emarginate, corners high and rounded; posterior margin slightly emarginate, with long and short hairs.

Legs yellowish white, femora swollen.

Abdomen yellowish gray, with long hairs at the base of each tergite.

Measurements:

Length of entire soldier	5.75-6.25 mm.
Length of head with mandibles	2.75-2.90 mm.
Length of head to anterior	1.75-1.90 mm.
Length of left mandible	1.00-1.15 mm.
Length of pronotum	0.75-0.77 mm.
Length of hind tibia	0.76-0.88 mm.
Width of head	1.18-1.25 mm.
Width of pronotum	1.13-1.25 mm.

The soldier of *nigritus* has a broader head and wider gula than in *milleri,* and the marginal teeth of the mandibles differ.

Type locality.—Guatemala.

Described from a series of 12 winged adults, 4 nymphs, and 2 soldiers intercepted at San Francisco, Calif., in a log of *Guajacum officinale* in cargo of the S. S. Makawao, by C. H. Oatridge, May 21, 1945, No. 19228.

[1]Later interception of soldiers (12 segments to antennae) from San Jose, Pacific Coast of Guatemala.

Cotypes, winged adults, U. S. National Museum, Catalogue No. 57718; *comorphotypes, soldiers,* U. S. National Museum. Also types in collection of A. E. Emerson, Department of Zoology, University of Chicago.

MINUTES OF THE 563d REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

April 4, 1946

The 563d regular meeting of the Society was held at 8 o'clock in the Auditorium of the U. S. National Museum. President Weigel presided and there were 38 members and 39 visitors present. The minutes of the previous meeting were read and approved.

The Society was privileged to see "The Story of Rocky Mountain Fever," a film prepared at the Rocky Mountain Spotted Fever Laboratory, Hamilton, Montana, under the direction of R. R. Parker. In his introductory talk Lt.-Col. C. B. Philip spoke of the excellent work done by N. J. Kramis who organized the film for presentation. Lt.-Col. Philip also made explanatory comments as the picture was shown.

In answer to questions by Sollers, Anderson, Trembley, and others, Lt.-Col. Philip made the following statements. The vaccine used in prophylaxis confers active immunity for only about one year, although if taken for several consecutive years some tissue immunity will develop. There is seldom a severe reaction unless the egg vaccine is given to a person allergic to eggs. At present, the time requird by the laboratory tests necessary to prove infection in a given tick makes them of little aid in prompt diagnosis. The rash characteristic of the disease is never present without other symptoms. It is difficult to compare the virulence of different strains accurately, since there is greater mortality among older people. More younger people are infected in the East. In the West the fever is largely an occupational disease and only about ten per cent of adults have been immunized. DDT is not satisfactory against ticks, and no really good repellent has as yet been developed. A tick does not infect its host until about 12 hours after attaching. The percentage of infected ticks is small under natural conditions. The serum used for the treatment of Rocky Mountain Spotted Fever is an active anti-serum. Its efficiency depends on the speed with which diagnosis is made and treatment started. In the average case, there are no sequelae following recovery.

President Weigel next asked for reports from members who had attended the St. Louis meetings of the American Association for the Advancement of Science. M. P. Jones reported that, at the meetings of the Extension Entomologists, the bulk of the discussion concerned the purposes for which each speaker would approve the use of DDT. It was interesting to note the wide variation in recommendations. Some time was also devoted to discussion of the extent to which Extension Entomologists participate in broader programs, such as Rural Health and Rural Housing.

Mr. Haeussler had attented sessions on the adaptation of the airplane for the distribution of insecticides and fungicides. He made special reference to a paper by Dr. Decker of Illinois, who gave the State Entomologist's viewpoint on the problem. Another interesting session was devoted to the types of machines and equipment, other than the airplane, for applying insecticides. Mr. Haeussler referred to a paper by H. G. Ingerson on trends in the development of new equipment for dispersion of insecticides, and also to the account by Floyd Smith of work by the U. S. Bureau of Entomology and Plant Quarantine, in cooperation with several State agencies, on the development of equipment for the application of concentrated sprays.

Dr. Porter spoke on the meetings held by the North Central States Entomologists. The program is always of the conference type at which different topics are discussed under the guidance of selected leaders. Conflicts between various section meetings made it difficult to hear all papers of interest. Dr. Porter also reported that the Entomological Society of America had elected Mr. Muesebeck as its new President.

The Society elected new members as follows:

Eugene P. Reagan, U. S. Bureau of Entomology and Plant Quarantine

Capt. Harry Hoogstraal, Army of the United States

2d Lt. Roy W. Chamberlain, Army of the United States

The meeting adjourned at 9:45 P.M.

INA L. HAWES,
Recording Secretary.

BOOKS—WAR VICTIMS

During the war, the libraries of half the world were destroyed in the fires of battle and in the fires of hate and fanaticism. Where they were spared physical damage, they were impoverished by isolation. There is an urgent need—now—for the printed materials which are basic to the reconstruction of devastated areas and which can help to remove the intellectual blackout of Europe and the Orient.

There is need for a pooling of resources, for coordinated action in order that the devastated libraries of the world may be restocked as far as possible with needed American publications. The American Book Center for War Devastated Libraries, Inc., has come into being to meet this need. It is a program that is born of the combined interests of library and educational organizations, of government agencies, and of many other official and non-official bodies in the United States.

The American Book Center is collecting and is shipping abroad scholarly books and periodicals which will be useful in research and necessary in the physical, economic, social and industrial rehabilitation and reconstruction of Europe and the Far East.

The Center cannot purchase books and periodicals; it must depend upon gifts from individuals, institutions, and organizations. Each state will be organized to participate in the program through the leadership of a state chairman. Other chairmen will organize interest in the principal subject fields. Cooperation with these leaders or direct individual contributions are welcomed.

WHAT IS NEEDED: Shipping facilities are precious and demand that all materials be carefully selected. Emphasis is placed upon publications issued during the past decade, upon scholarly books which are important contributions to their fields, upon periodicals (even incomplete volumes) of significance, upon fiction and non-fiction of distinction. All subjects —history, the social sciences, music, fine arts, literature, and especially the sciences and technologies—are wanted.

WHAT IS NOT NEEDED: Textbooks, out-dated monographs, recreational reading, books for children and young people, light fiction, materials of purely local interest, popular magazines such as *Time*, *Life*, *National Geographic*, etc., popular non-fiction of little enduring significance such as Gunther's *Inside Europe*, Haliburton's *Royal Road to Romance*, etc. Only carefully selected federal and local documents are needed, and donors are requested to write directly to the Center with regard to specific documents.

HOW TO SHIP: All shipments should be sent PREPAID via the cheapest means of transportation to THE AMERICAN BOOK CENTER, C/O THE LIBRARY OF CONGRESS, WASHINGTON 25, D. C. Although the Center hopes that donors will assume the costs of transportation of their materials to Washington, when this is not possible reimbursement will be made upon notification by card or letter of the amount due. The CENTER CANNOT ACCEPT MATERIAL WHICH IS SENT COLLECT. Reimbursement cannot be made for packing or other charges beyond actual transportation. When possible, periodicals should be tied together by volume. It will be helpful if missing issues are noted on incomplete volumes.—K. R. SHAFFER, *Executive Director, American Book Center.*

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 48 OCTOBER, 1946 No. 7

FAMILY NAMES IN THE ORDER DIPTERA

By CURTIS W. SABROSKY

U. S. Public Health Service

Changes and uncertainty in the names for families always attract attention because of the wide use of these names in both taxonomic and non-taxonomic fields. The reasons for changes in familiar names are not always apparent, nor the principles involved well understood.

In the order Diptera, there has existed for some time conflicting usage on the names of a number of well known and widely recognized families.[1] Examples in point are the names Chironomidae vs. Tendipedidae, Tachinidae vs. Larvaevoridae, Cecidomyiidae vs. Itonididae, Simuliidae vs. Melusinidae, Sarcophagidae vs. Metopiidae, and so on.

Opinions 133 and 141 of the International Commission on Zoological Nomenclature resolved the problem of whether a family name should be the oldest proposed family name or one based on the oldest genus, with a decision in favor of the former. There still remain several points of contention, however, and a more comprehensive statement of general principles is needed to clear up many disputes that still exist in the nomenclature of family names.

In addition to the problem which was settled in Opinions 133 and 141, there are other situations which could be settled by an Opinion on principles, and still other problems in which the strict application of the Rules would engender confusion or would involve drastic changes of well known and long recognized family names in favor of obscure and unfamiliar names. Certain of these situations in the order Diptera are discussed below. It is believed that suitable action should be taken by the International Commission, where found necessary and desirable, in order to conserve the following family names of two-winged flies.[2]

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[1]Cf. review by Sabrosky, 1939, Verh. VII. Internat. Kongr. Ent., Berlin, 2: 599-612. Because of the large number of details involved, references in the present paper have been limited to certain key publications. The others have been cited by author and date only, because the complete reference is not necessary here for the author's purpose in bringing the problems up for discussion.

[2]Recommended names have been capitalized.

1. *PSYCHODIDAE* (moth flies), based on *Psychoda* Latreille (1796): The name appears to date from Newman (1834, Ent. Mag., 2: 379-431) as Psychodites, the "moth gnats," a "natural order" in Stirps Culicina; or it dates from Bigot (1854) as Psychodidae. If the International Commission admits the priority of super-generic names originally proposed with the suffix "-ites," then Psychodidae will be the oldest proposed family name, as of 1834. If priority must be based on the ending "-idae," however, then the oldest proposed proper name for the group appears to be Flebotomidae Rondani (1840) (Cf. also Phlebotomidae Walker, 1851; Phloebotomidae Rondani, 1856). Aside from these few early papers, the name Psychodidae has been in general and well known use for nearly 100 years, is widely used at the present time in general publications, and is not involved in the discussions of the Meigen 1800 vs. 1803 generic names. No conceivable good would seem to be served by a change, if one be strictly necessary.

2. *SIMULIIDAE* (black flies, buffalo gnats), based on *Simulium* Latreille (1802).
3. *TRICHOCERATIDAE* (*TRICHOCERIDAE*) (the winter crane flies), based on *Trichocera* Meigen (1803).

The name Simuliidae appears to date from Newman (1834) as Simuliites (cf. also Simulides Zetterstedt 1842, Simulina Rondani 1856), or Simulidae Schiner, (1862, Fauna Austriaca), depending on which suffix has priority. Most of the species in the family, which contains numerous important blood-sucking pests of both man and beasts, have been described under the name *Simulium*.

It was stated by Hendel (1908, Verh. zool.-bot. Gesell. Wien, 58: 50) that *Simulium* Meigen, 1803 = *Melusina* Meigen, 1800. The family name Melusinidae was consequently adopted by Grünberg (1910), Lundstrom (1912), Engel (1915), and recently for Lindner's extensive "Die Fliegen der palaearktischen Region."

However, Stone (1941, Annals Ent. Soc. Amer., 34: 412) has pointed out that under strict adherence to the Rules (category 3 of Opinion 46), *Melusina* actually applies to the winter crane-flies, with synonyms *Petaurista* Meigen, 1800, and *Trichocera* Meigen, 1803. *Petaurista* has page precedence, but since it is preoccupied, *Melusina* has been selected as the next available valid name. The family has generally been known as the Trichoceridae (Trichoceratidae), although Lindner's series used the term Petauristidae, which in the light of the homonymy referred to is of course incorrect. Thus, even though Stone pointed out that the description of *Melusina* is more that of a "simuliid" than a "trichocerid," strict nomenclature would require that *Melusina* and the corresponding family name Melusinidae be applied to the winter crane flies, replacing Trichoceridae. Since the family is relatively small and unimportant, the change is not serious, as Stone has noted, and the important family Simuliidae remains unchanged.

Several courses are possible for the Commission:

(a) To adhere strictly to the Rules of Nomenclature, and recognize Simuliidae for black flies and Melusinidae for winter crane flies (in which case no Opinion would appear necessary, but one would strengthen the establishment of this alternative if it were the method chosen).

(b) To suspend the Rules and place *Melusina* (= *Simulium*) on the Official List, and thus to establish Melusinidae (= Simuliidae) for the black flies and Trichoceratidae (= Petauristidae) for the winter crane flies.

(c) To suspend the Rules and suppress *Melusina* entirely, on the grounds of possible confusion resulting from the application of the family name Melusinidae to two different families at various times, and thus to establish Simuliidae for the black flies and Trichoceratidae for the winter crane flies.

It is believed that either (a) or (c) would be preferable to alternative (b); that because of the unimportant family involved on the one hand (the winter crane flies), the choice of (a) would work no great hardship; but that because of the conflict in usage of the name Melusinidae, the choice of (c) would be most appropriate. Accordingly, the third alternative has been recommended to the Commission.

4. *PSILIDAE* (carrot rust fly, etc.), based on *Psila* Meigen (1803). The name apparently dates from Walker (1853, 1857) as Psilides, or from Loew (1862) as Psilidae. Except for a few early instances, the family has been known under that name for nearly 100 years.

Actually, the oldest proposed name for this family, twenty years before Walker, was Loxoceridae of Macquart (1835, Hist. nat. des Insectes, Diptères, 2: 372), based on *Loxocera* Meigen, 1803. It was referred to under that name only once more, as far as I can find, by Westwood (1840, Introd. Mod. Classif. Ins.), as Loxocerides. The group included *Loxocera* Meigen, *Psila* Meigen, and *Chyliza* Fallén.

A third name for the group, though apparently used only once, is Chilizina, based on "*Chiliza* Meigen" (error for *Chyliza* Fallén) and employed by Rondani (1856, Dipterologiae italicae prodromus, 1: 25-27) as a stirps under the family Agromyzidae, to include "*Chiliza*," *Loxocera*, *Psila*, et al.

Inasmuch as the name Psilidae has been in use for nearly one hundred years for a relatively small but compact and well-recognized group of flies, it is believed that no useful purpose would be served in overthrowing it at this late date. Accordingly, it has been recommended that the Rules be suspended to suppress the prior use of the family combination Loxoceridae, and thereby to conserve the name Psilidae. It is of course patent that this suppression would not affect the validity of the generic name *Loxocera,* but only the use of the family combination founded upon it. It may also be pointed out that suppression of the use of this super-generic combination should only be for the purpose of conserving the name Psilidae; if at some future time the genus *Loxocera* (or any other genus under similar circumstances) should be separated from the group as a distinct family unit, there is no reason why the name Loxoceridae could not be resurrected for the restricted group, since it would not then interfere with the use of the conserved Psilidae. In fact, if the newly restricted family happened to be monotypical, consisting only of *Loxocera,* no other name would be possible!

It is interesting, though unimportant now, to note in Opinion 153, p. 199, under "The case of *Psilus, Bethylus* and *Dryinus*" (Hymenoptera), that strict application of the Rules appeared to require the name Psilidae for a group of wasps, based on *Psilus* Jurine 1801. Because the latter name ceased to be available with the suppression of the "Erlangen List," the problem of identical family names based on similar but non-identical generic games fortunately does not complicate the present use of Psilidae in the Diptera.

5. *CLUSIODIDAE,* based on *Clusiodes* Coquillett, 1904 (= *Heteroneura* Fallén 1823, preoccupied). The old name of this family was Heteroneuridae, until Coquillett (1904) pointed out that the type genus, *Heteroneura* Fallén, was a homonym. Coquillett continued to use the family name Heteroneuridae, and did not rename the family as prescribed by Article 5 of the International Code (which was not published until 1905, however, although adopted in 1901). Later authors (Johnson, 1913, and Malloch, 1918, 1922) did use the proper Clusiodidae, based on the generic name which Coquillett proposed to replace *Heteroneura* Fallén.

Hendel (1916, Ent. Mitt., 5: 297) used the form Clusidae, based on *Clusia* Haliday (1838), on the theory that the name to replace Heteroneuridae should be based on the next oldest generic name. Somewhat earlier, Bezzi (1893) had used the combination Clusiinae. Recent authors have tended to follow Bezzi and Hendel, and thus we find that Aldrich, Frey (1921), Melander and Argo (1924), Brues and Melander (1932), Curran (1934), and Czerny (1928, in Lindner's "Die Fliegen der palaearktischen Region") used Clusiidae. Johnson himself changed to Clusiidae in a later work (1925, Diptera of New England, p. 245).

Two courses seem open to the Commission:

(a) To suspend the Rules, since this would appear to be necessary, and adopt the name Clusiidae in favor of Clusiodidae, on the grounds of general usage at the present time. It would involve thereby a change in the original type genus upon which the family was founded.

(b) To affirm Clusiodidae as the proper family name, thus avoiding any change in the original type genus.

In view of the fact that the family is small and relatively uncommon, that neither name in question has been in the literature very long, and that it is undesirable in principle to change the original type genus, the second alternative has been recommended. Fortunately, in view of the fact that Clusiodidae and Clusiidae are similar in form, little if any confusion would result from either choice.

6. *TRYPETIDAE,* the fruit flies, based on *Trypeta* Meigen (1803).

The earliest use of the name known to the writer is by Loew (1862), already in its present form of Trypetidae. Most workers have adopted this name, including such recent comprehensive publications as Brues and Melander (1932) and Hendel (1927, in Lindner's ''Die Fliegen der palaearktischen Region'').

Strict adherence to the International Code, however, would invalidate the name Trypetidae on two different grounds:

(a) The genus *Trypeta* Meigen (1803), under strict interpretation of the Rules, is an isogenotypic synonym of *Euribia* Meigen (1800) (cf. Stone, 1941, l.c., p. 410). Strictly, therefore, the family name would change to Euribiidae, a form which has been used only by Czerny (1909, Verh. zool. bot. Ges. Wien, 59: 252).[3] Some Dipterists, of course, still refuse to recognize the Meigen 1800 names, despite Opinions 28 and 152.

(b) There exists an older proposed family name, which under Opinions 133 and 141 would have precedence over Trypetidae. Newman (1834) proposed a group called Tephritites (Tephritidae by Macquart, 1835, and Swainson, 1840) based on *Tephritis* Latreille (1804). This form has been used only rarely, by Speiser (1910, Sjöstedt's Zool. Kilimandjaro-Meru Exped. 1905-1906, Vol. II), and by Hendel (1916, Ent. Mitt., 5: 297).

In addition to the foregoing, the name Trupaneidae, based on *Trupanea* Schrank (1795), was proposed by Bezzi (1913) on the theory that the family name should be based on the

[3]Czerny obviously recognized that *Trypeta* would change to *Euribia* upon acceptance of the Meigen 1800 names, but it remained for Coquillett (1910) to definitely designate the genotypes for both names.

oldest included valid and available generic name (Bezzi actually wrote Trypaneidae, based on the emended form *Trypanea* Agassiz, 1846). Obviously, in view of Opinions 133 and 141, this change was not necessary under the Code.

As with the other cases, several alternative solutions are possible:

(a) To adhere strictly to the Rules, which would require the use of the little known name Tephritidae as the oldest proposed family name (the oldest regardless of whether "-ites" or "-idae" is required for priority).

(b) To suspend the Rules as interpreted by Opinions 133 and 141, in order to suppress the use of Tephritidae for the family, but to accept *Euribia* Meigen (1800) as valid, and with it the virtually unknown name Euribiidae.

(c) To suspend the Rules and suppress Tephritidae, and to accept *Euribia* Meigen (1800) as valid under the Rules, but to legalize and conserve the familiar family name Trypetidae (which would then be based on a generic name in synonymy).

(d) To suspend the Rules as interpreted by Opinions 133 and 141, in order to suppress Tephritidae, and also to suspend the Rules and suppress the name *Euribia* Meigen (1800), thus validating the name *Trypeta* Meigen (1803) and the use of the well-known family name, Trypetidae.

Inasmuch as the family name Trypetidae is widely known in general biology and in both economic and general entomology, for a large family of flies which includes many serious pests such as the Mediterranean, Mexican and West Indian fruit flies, the apple maggot, cherry fruit flies, celery fly, the olive fly, etc., it is believed that it would not be in the best interest of uniformity to rule in favor of either of the little known names. Accordingly, either the third or the fourth alternative has been recommended to the Commission.

7. *CEROXYDIDAE* Steyskal (= Ortalidae of authors, = Otitidae), based on *Ceroxys* Macquart (1835).

For years, a large and common family of acalyptrate, pictured-winged flies, similar to the trypetid fruit flies in appearance and size, has been well known under the name Ortalidae, based on *Ortalis* Fallén (1810). Not until 1932 was it pointed out, by J. M. Aldrich (Proc. U. S. Nat. Mus., 81 (Art. 9): 7) that *Ortalis* Fallén is preoccupied by *Ortalis* Merren (1786) in ornithology. Instead of basing the new family name on the generic name which replaced *Ortalis*, Aldrich elected to call it Otitidae, based on *Otites* Latreille (1804, 1805?), thus changing the type genus, although still in the same subfamily (Ortalinae of authors).

Interestingly enough, later in the same year in which Aldrich published the name Otitidae, Curran (1932, Nyt Mag. f.

Naturvidensk., Oslo, 71: 354) also recognized that *Ortalis* was preoccupied, and like Aldrich he chose to change the type genus as well as the family name. Unfortunately, by selecting Platystomidae, based on *Platystoma* Meigen (1803), he transferred the family name to another subfamily, and one which is recognized by some authors as a family in its own right. In 1934, however, in his manual of "The Families and Genera of North American Diptera," Curran adopted the name Otitidae, on the grounds that *Platystoma* was preoccupied in the Mollusca, a point, incidentally, which was denied by Hendel (1935, Konowia, 14: 51-57), who pointed out that *Platystoma* Klein was a pre-Linnaean name dating from 1753.

The relation of type genus to subfamily should be noted especially. The classification of the "Ortalidae" *sens. lat.* is not yet well established. Some authors prefer to recognize only one all-encompassing family with a half dozen or more subfamilies; others recognize each of the latter as a family in its own right; and to make matters more difficult, as illustrated in a later paragraph on *Seioptera* Kirby, on some genera there is no agreement as to which family (or subfamily) they should be assigned. When these annectant or aberrant genera are involved in the names of super-generic groups, confusion may easily result.

Neither Aldrich nor Curran cited any earlier authors, but both of their proposed family names had been suggested many years before. Otitidae was first proposed by Westwood (1840) as Otitides, and Schiner (1864, Fauna Austriaca) had erected a subfamily Platystominae. In neither case were the names all-inclusive, for Westwood also had a subfamily Ortalides, which included *Ortalis* and *Platystoma*, and Schiner a subfamily Ortalinae, including *Ortalis* and *Otites*.

On its face, the case appears clearcut. Ortalidae is unquestionably untenable, and it is believed that the new family name should be founded on whatever generic name replaced the preoccupied *Ortalis* Fallén. The use of Otitidae suffers from the drawback of changing the type genus, and since its revival is relatively recent, it can hardly be said to have become firmly "established" in either taxonomic or biological literature.

The determination of the proper generic name to replace the preoccupied *Ortalis* led to complications regarding the type species of *Ortalis* itself.

Ortalis Fallén (1810, Spec. Ent. Meth. Exh.: 17) was proposed with five species, of which three were named, viz. '*Musca urticae, vibrans* et *putris* Linn.'. The first species designated as type of *Ortalis* was *vibrans,* by Westwood in 1840. Earlier, *Musca vibrans* had been the sole originally included species, and hence the genotype by monotypy, in the genus *Seioptera*

Kirby (1817), while *putris* Linnaeus had been referred to *Sepsis* by Fallén in 1820. Hendel (1911, Wien. Ent. Ztg. 30: 90) maintained that *M. urticae* was thus the genotype of *Ortalis* by elimination, but it is perhaps doubtful if this viewpoint would be sustained.[4]

Inasmuch as *Ortalis* Fallén (if we accept *vibrans* as type) and *Seioptera* Kirby are isogenotypic, it follows then that *Seioptera* as the next oldest available valid name will replace *Ortalis* preoccupied. The family name Seiopteridae would then replace "Ortalidae" or "Ortalinae."

The following complication has been pointed out by my friend, Mr. George Steyskal, to whom I am also indebted for information on the fate of *Ortalis* and its original species.

"Adoption of the name *Seiopteridae* may also necessitate renaming two of the subfamilies, the *Ortalinae* (*Otitinae*) and *Ulidiinae*, recognized by some authors as families, since the matter is complicated by the classification of *Seioptera*, which Hennig (1940) placed as an anomalous member of the 'Otitidae', and not as a member of the 'Ulidiidae' where it has generally been placed. If *Seioptera* is to be placed with what has been known as the *Ortalinae*, that group as the typical subfamily would then bear the name *Seiopterinae*, and the *Ulidiinae* would continue to be known as such. However, if as usually, *Seioptera* is to be grouped with *Ulidia*, the subfamily *Ulidiinae*, then containing the type genus of the family, must fall to *Seiopterinae*, and the *Ortalinae* of authors must have a new name, based upon the valid name for the genus containing *urticae* Fallén.

"The genus *Ortalis* of authors (with *M. urticae* L. considered as type) is apparently equal to *Ceroxys* Macquart (1835, Hist. Nat., Dipt. 2: 437), which was erected with eight species, the second of which, *M. urticae*, was designated as type by Westwood (1840). The subfamily *Ortalinae* of authors must in the latter case (*Seioptera* in *Ulidiinae*) be known as *Ceroxydinae*.

"Were *Musca urticae* declared officially to be the type of *Ortalis* Fallén, *Ceroxydidae* would become the valid name of

[4]Cf. Opinion 62; also the recent publication of the complete Opinion 6, on October 17, 1944, especially Editorial Note 3, p. 134, by Secretary Hemming. It should be pointed out, however, that while Mr. Hemming is quite correct in saying that Opinion 6 is *definitely* applicable only to cases of genera with *two* originally included species, yet neither Opinion 6 nor the later Opinion 62 excludes the possibility that in the case of a genus with three originally included species, the referral of two of these species to other genera also can be construed as having fixed the sole remaining species as the type of that genus, just as the removal of one fixed the other as type in the genus with two species. *Ortalis* is not exactly typical of the problem, because Fallén originally said *five* species, but actually named only *three*.

the family, the somewhat uncertain position of *Seioptera* would not affect the names of either *Ulidiinae* (*Ulidiidae*) or *Ceroxydidae*, and a continuity of concept would be maintained for the well known 'Ortalidae' of authors."

Considering all the complications, it is believed that Mr. Steyskal's proposed name is the simplest and most direct solution to the problem. It has therefore been recommended that *Musca urticae* Linnaeus be declared the type of *Ortalis* Fallén, either by accepting type by elimination (Hendel's argument), or by suspending the Rules to suppress Westwood's designation of *vibrans*, and thereafter to designate *urticae* as type of *Ortalis*. Since *Ortalis* Fallén is preoccupied, and since it would be isogenotypic with *Ceroxys* Macquart under these actions, the latter name would then replace *Ortalis* and the family name would become Ceroxydidae (= Ortalidae of authors and also Ortalidae *sensu strictu*).

Undoubtedly, many other complex situations exist in the class Insecta and elsewhere. Eventually, the difficult cases would probably come to light and be decided, each on its own merits. It is believed, however, that the prompt initiation of a comprehensive effort to discover and settle the problems and to organize an "Official List of Family Names in Zoology" would be a real contribution to stability and an orderly nomenclature.

THE VECTORS OF TSUTSUGAMUSHI DISEASE

By Lt. G. W. Wharton H(S) USNR,[1] *U. S. Naval Medical Research Unit No. 2*

Tsutsugamushi disease is caused by a rickettsia that is carried to man by certain larval mites, chiggers, of the family Trombiculidae. The disease has been found on the mainland of southern Asia and northern Australia and the islands that lie between them. As a result of the military campaigns recently completed in these areas, tsutsugamushi disease became important to Americans. Womersley and Heaslip (1), Farner and Katsampes (2), Ewing (3), and Blake *et al.* (4) present a splendid review of the available literature on the disease and the trombiculid mites that occur in the areas from which the disease has been reported.

A study of specimens of most of the species of trombiculids known from areas where tsutsugamushi disease is endemic was

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[1]On military leave from Duke University.

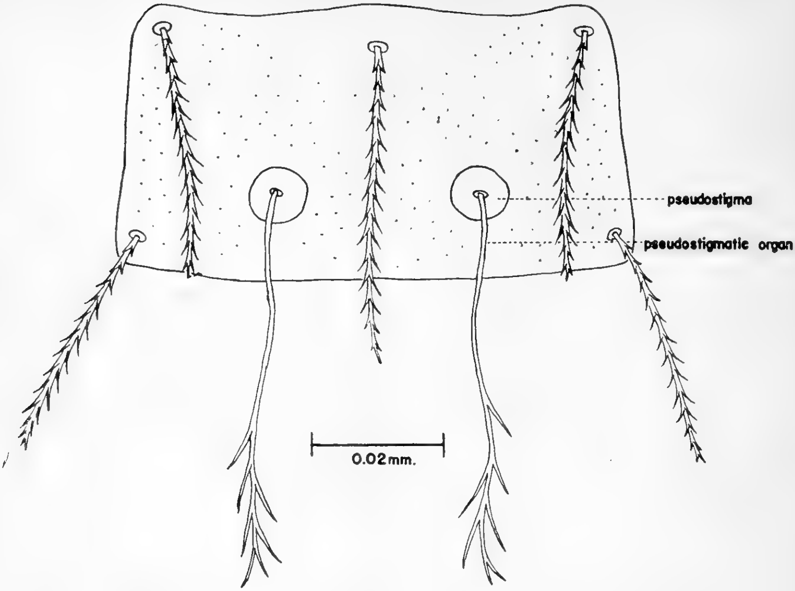

Figure 1. Scutum of *Trombicula akamushi* (Brumpt 1910).

greatly facilitated by the directors and staffs of the South Australian Museum, Australian Museum, School of Public Health and Tropical Medicine University of Sydney, and the U. S. National Museum. The two eminent authorities on the Trombiculidae Dr. H. E. Ewing and Mr. H. Womersley were particularly helpful. During the course of the study, it soon became apparent that only a few of the many species were known to be involved in the transmission of the disease and that these few species were all closely related.

Nagoya *et al.* (5) pointed out that there were five species of chiggers on the ears of voles in areas in northwestern Japan that were known commonly as "tsutsugamushi." They described these carefully and included them in a tsutsugamushi group without defining the limits of the group. Walch (6) in an English version of his 1922 Dutch paper in which he described *Trombicula deliensis* pointed out that it definitely belonged to the tsutsugamushi group. In 1924 Walch (7) described a second species, *Trombicula keukenschrijveri,* that he also placed in the tsutsugamushi group. Subsequent authors ignored the existence of this group. The tsutsugamushi group as here defined are mites of the genus *Trombicula* that have larvae with a lightly pitted, rectangular or nearly rectangular scutum (Figure 1); palpi with a feathered seta on segment

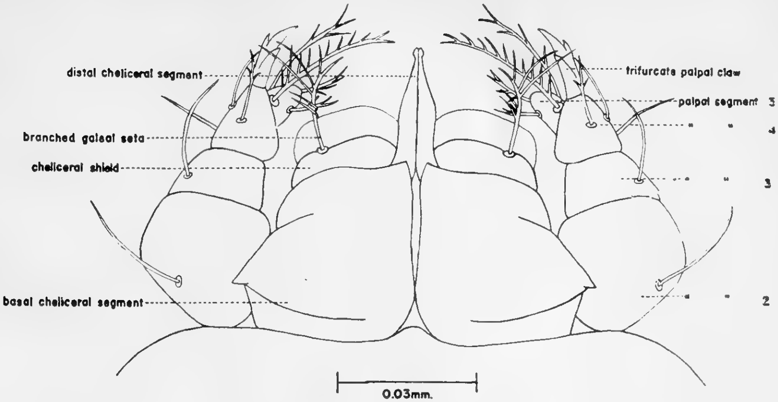

Figure 2. Gnathosoma of *Trombicula akamushi* (Brumpt 1910).

one, a nude seta on the dorsal aspect of segment two, a nude seta on the dorsal aspect of segment three, a feathered seta on the dorsal aspect of segment four, a nude seta on the lateral aspect of segment four, a nude seta on the ventral aspect of segment four, and several setae on segment five; chelicerae with a lateral angular expansion on the basal segment; and feathered galeal setae on the cheliceral shields (Figure 2).

Of the many species of trombiculid mites described, the only species that can definitely be placed in the tsutsugamushi group as here defined are: *Trombicula akamushi* (Brumpt 1910), *Trombicula pallida* Nagayo *et al.* 1919, *Trombicula scutellaris* Nagayo *et al.* 1919, *Trombicula intermedia* Nagayo 1920, *Trombicula deliensis* Walch 1922, *Trombicula fletcheri* Womersley and Heaslip 1943, *Trombicula obscura* Womersley 1944, and *Trombicula fulleri* Ewing 1945.

Trombicula akamushi (Brumpt 1910) is reported by Nagayo *et al.* (5) to be the only species that carries the disease to man in northwestern Japan. Rickettsia that are the same as those which cause tsutsugamushi disease in man have been recovered from this species and the ability of the larva to infect experimental animals by its bite has been demonstrated (5). *T. akamushi* is recognized as the vector in Formosa and the Pescadores Islands (2). In the Federated Malay States Gater (8) reports *T. akamushi* as common on man and probably the principal vector of tsutsugamushi disease in that area. Specimens from Malaya labeled *T. akamushi* were described as a new species *T. fletcheri* by Womersley and Heaslip (1). A specimen from Gater in the U. S. National Museum is the same as *T. fletcheri*.

Trombicula pallida Nagayo *et al.* 1919 has infrequently been found to attack man. However, larvae of this species were successful in carrying the disease to animals (5). This species has not been reported outside of Japan.

Trombicula scutellaris Nagayo *et al.* 1919 is not known to attack man. An emulsion of 1,400 larvae of this species when injected into a monkey by Kawamura (9) produced a fever in the host typical of tsutsugamushi disease after an incubation period of fifteen days. Inoculation of material from the original monkey into another caused a similar reaction in the second monkey.

Trombicula intermedia Nagayo 1920 is reported as being capable of producing the disease in experimental animals by its bite (5). It has not been found on man.

Trombicula deliensis Walch 1922 has been associated with tsutsugamushi disease in Sumatra (7), India (Mehta 10), Australia (Heaslip 11), Malaya (8), New Guinea (Kohls *et al.* 12), and Bat Island (Philip and Kohls 13). Under the synonym (13) *Trombicula walchi* Womersley and Heaslip 1943, *T. deliensis* was shown to harbor the rickettsia of tsutsugamushi disease in New Guinea (12). Philip and Kohls (13) also found the rickettsia in *T. deliensis* from Bat Island which is south of the Admiralty Islands.

Trombicula fletcheri Womersley and Heaslip 1943 has been reported from Malaya where it was originally confused with *T. akamushi* (see above), and from New Guinea. Blake *et al.* (4) recovered strains of rickettsia from *T. fletcheri* that were found to be identical with strains from human cases of tsutsugamushi disease. *T. fletcheri* is considered by them to be an important vector in New Guinea.

Trombicula obscura Womersley 1944 occurs in New Guinea where tsutsugamushi disease is also present.

Trombicula fulleri Ewing 1945 is reported from Burma. Tsutsugamushi disease has been found in Burma (2) but Ewing's (14) record is the first of a trombiculid mite from Burma that belongs to the tsutsugamushi group.

It has been suggested (5) that the species in Japan that carry the disease to animals but not to man, may be important in maintaining a high level of infection in the vertebrate "reservoir" host. It should be mentioned here that no reservoir host has yet been demonstrated for tsutsugamushi disease. Animals have been found that harbor rickettsia by Kohls *et al.* (12) that are identical with those that produce the disease in man, but it has never been demonstrated that a larval mite can become infected by biting a host that harbors the rickettsia. On the other hand it was shown by Miyajima and Okumura (15) that larvae transmit the disease the first time that they attempt to feed. Presumably the rickettsia are passed from adult to larva through the egg. Nagayo *et al.* (5) report having obtained rickettsia from the adult. It is possible that the free-living nymphs and adults of the trombiculid mites that belong to the tsutsugamushi group pick up the rickettsia and that the infected vertebrates are incapable of transmitting the virus to the larvae or are unnecessary for the maintenance of the rickettsia. However, available evidence points to cricetid and murid rodents as the main reservoirs of the disease, but it is not conclusive.

A survey of certain Pacific islands was conducted by members[2] of U. S. Naval Medical Research Unit No. 2 in order to determine the distribution of trombiculid mites. During the course of the survey certain areas were investigated thoroughly. At Cape Torokina, Bougainville Island three endemic foci of tsutsugamushi disease were found. All of them were outside the area held by American forces in 1944, but were within the area covered by patrol activity. Within the occupied area trombiculid mites were common. *Schöngastia blestowei* Gunther 1939 was a pest and frequently produced scrub-itch. Opportunity was afforded to examine one of the foci of infection when a road block was established at the mouth of the Jaba River. At this location where many cases of tsutsugamushi disease had been contracted (Anderson and Wing 16), the rats were heavily infested with a subspecies of *Trombicula deliensis* that typically has a bifurcate rather than trifurcate palpal claw. At Guiuan, Samar, Philippine Islands tsutsugamushi disease was widespread as were murid rodents which carried large numbers of a local representative of *Trombicula deliensis* in their ears. Ponam, a small island in the Admiralty group where numerous cases of tsutsugamushi disease had been contracted was visited after vigorous control measures had halted the appearance of new cases. The only species of trombiculid found was *Eutrombicula buloloensis.* No reports of tsutsugamushi disease on Guam, Rota, Okinawa, Iwo Jima, Ulithi, Peleliu, Truk, or Guadalcanal were found. While trombiculid mites were collected on all these islands, none belonged to the tsutsugamushi group.

Gunther (17) suggested that *Eutrombicula buloloensis* (Gunther 1939) might be the vector of tsutsugamushi disease in New Guinea. Blake *et al.* (4) and Kohls *et al.* (12) could find no evidence in support of this theory, and the fact that the prevalence of scrub-itch caused by the attachment of the larvae of *E. buloloensis* and *Schöngastia blestowei* was not associated with the prevalence of tsutsugamushi fever seems to

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[2]Lt. Comdr. D. H. Johnson, Lt. R. H. Baker, Lt. (jg) A. B. Hardcastle, J. M. Fritts, PhM1/c, R. H. Carver, PhM2/c, L. A. Posekany, J. N. Strong, O. A. Muennink, and W. L. Necker.

deny the validity of Gunther's suggestion. Walch and Keukenschrijver (18) reported *Schöngastia schüffneri* (Walch 1922) as a vector since they found the typical primary eschar of tsutsugamushi disease at the site on a laborer where they had previously collected a specimen of *S. schüffneri*. *S. schüffneri* is closely related to *S. blestowei* and epidemiological evidence presented by Walch and Keukenschrijver (18) indicates that its activities are similar to those of *S. blestowei*. In other words there was no correlation between the prevalence of *S. schüffneri* and prevalence of tsutsugamushi disease.

There are several other species of trombiculids that are closely related to the tsutsugamushi group and one which may in reality belong to it. However, no evidence is available indicating that they are involved in the transmission of the disease. *Trombicula keukenschrijveri* Walch 1924 is incompletely known. Walch (7) had only a single specimen from Sumatra, while Gater (8) found only three in Malaya. Gater (8) reports that the pseudostigmatic organs of all specimens were broken off, therefore the generic position of this species is in doubt since the type of pseudostigmatic organs is one of the most important generic characters of the trombiculids. The setae on the palps and cheliceral shields are like those of the tsutsugamushi group, but two of the setae on palpal segment four have not been described so their character remains in doubt. *Trombicula palpalis* Nagayo *et al.* 1919 was included in the tsutsugamushi group originally. It does not fit into the group as here defined because it has a feathered ventral seta on palpal segment four instead of a nude ventral seta. *T. palpalis* is the only species of the original tsutsugamushi group from which rickettsia have not been reported. *Trombicula japonica* Tanaka 1916, *Trombicula californica* Ewing 1942. and *Trombicula microti* Ewing 1928 comprise a "japonica" group that is close to the tsutsugamushi group. *Trombicula burmensis* Ewing 1945 is also close to the tsutsugamushi group but different from it in type of palpal setae.

In certain areas tsutsugamushi disease is known to be endemic but surveys for the vectors have not yet been made. The disease is known from Java, but no certain records of mites of the tsutsugamushi group are known. It is interesting though that Womersley obtained a slide of *Trombicula deliensis* from Java. No collection data were on the slide, however, so the locality from which the specimen came is unknown. As far as can be determined no trombiculid mites of any kind are known from Ceylon, the Maldive Islands,[3] China, or Indo-China where tsutsugamushi disease is endemic (2). Trombi-

[3]Radford, 1946, Parasitology 37:46-54, reports *T. deliensis* from Ceylon and the Maldive Islands.

culid mites have been collected from from Borneo and Celebes. Although tsutsugamushi disease occurs in these islands no mites of the tsutsugamushi group have yet been found. Walch (19) collected trombiculid mites from rats near Macassar in Celebes. Farner and Katsampes (2) report that the area where tsutsugamushi disease is found is around Minahassa at the opposite end of the island from Macassar. Species from Borneo were all collected on a mouse deer and are discussed by Gunther (20).

The material in this paper can be summarized in a few general statements. The rickettsia that cause tsutsugamushi disease have been recovered from mites that belong to the tsutsugamushi group and from no other mites. In areas where trombiculid faunas are well known tsutsugamuchi disease has been found associated with mites of the tsutsugamushi group. In many areas where the disease does not occur, no mites of the tsutsugamushi group have been found. For these reasons it is suggested that mites of the tsutsugamushi group may be the sole vectors of tsutsugamushi disease. It is realized that this hypothesis still remains to be proved, but the evidence indicates that mites of the tsutsugamushi group play the same role in the transmission of the disease that is taken by anopheline mosquitoes in the transmission of malaria.

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A NEW SPECIES OF AEDES OF THE FINLAYA GROUP FROM ANGAUR ISLAND

By GORDEN S. STARKEY and J. E. WEBB, JR.*

Among other species of mosquitoes collected on Angaur Island in December 1944 by Pfc. William B. Lewellen of the Entomology Section, 18th Medical General Laboratory, was a species found breeding only in water held in axils of leaves of the pandanus tree. Several specimens of the larvae were reared to adults. One female was captured on the inside surface of a hospital ward tent, apparently having obtained a blood meal. They were found to be an undescribed *Aedes* species of the Finlaya group, which the authors have named *Aedes* (Finlaya) *lewelleni* after the original collector.

Aedes (Finlaya) lewelleni, new species

Male.—Length 3-4 mm., wing 2.4-2.6 mm. Median area of vertex with several broad, appressed, whitish scales, mixed with some narrow, curved, whitish and upright, dark scales; sides of vertex with broad, appressed, whitish scales and a spot of dark ones; a patch of white, appressed, broad scales low on cheeks which extends to the eye margin. Torus light with a patch of small, broad, whitish scales on the inner side. Proboscis long, black, and slender, with a yellowish ring in the center approximately one-fourth as long as the proboscis; white scaled at the tip; ventrally the white scales extend basally for an approximate distance of one-fifth the length of the proboscis; scales are more yellowish dorsally. Palpus slightly longer than the proboscis, black with white rings. Mesonotum with bicolorous scaling more or less in a definite pattern of chocolate brown and golden, narrow curved scales, the golden scales in definite patches; shoulder spots of golden scales present, also a few whitish scales are found around the antescutellar space. Pronotum with broad, appressed whitish scales; posterior pronotal scales are not as white as those on the anterior lobe. Scutellum with whitish, broad, appressed scales and a few narrow, curved, paler ones. Pleuron with 3 or 4 post-spiracular bristles and no lower mesepimeral bristles; light brown with many white, broad scales in an irregular band and a small patch of white scales beneath it. Wings elaborately spotted with yellow, white, and black, broad scales; 4 irregular pale spots and 4 larger irregular dark spots along the costa; vein 3 with a white spot in the center and a smaller light spot at the base; vein 6 with a few white scales apically, preceded by a long, black spot of scales; basally all scales are light; pale fringe spots present opposite tips of all longitudinal veins. Halter whitish except at the knob, which is light yellow, and with a few white scales. Legs.—Coxae light brown with some pale and dark scales; femora mainly black scaled with several yellowish to whitish bands, apical, ven-

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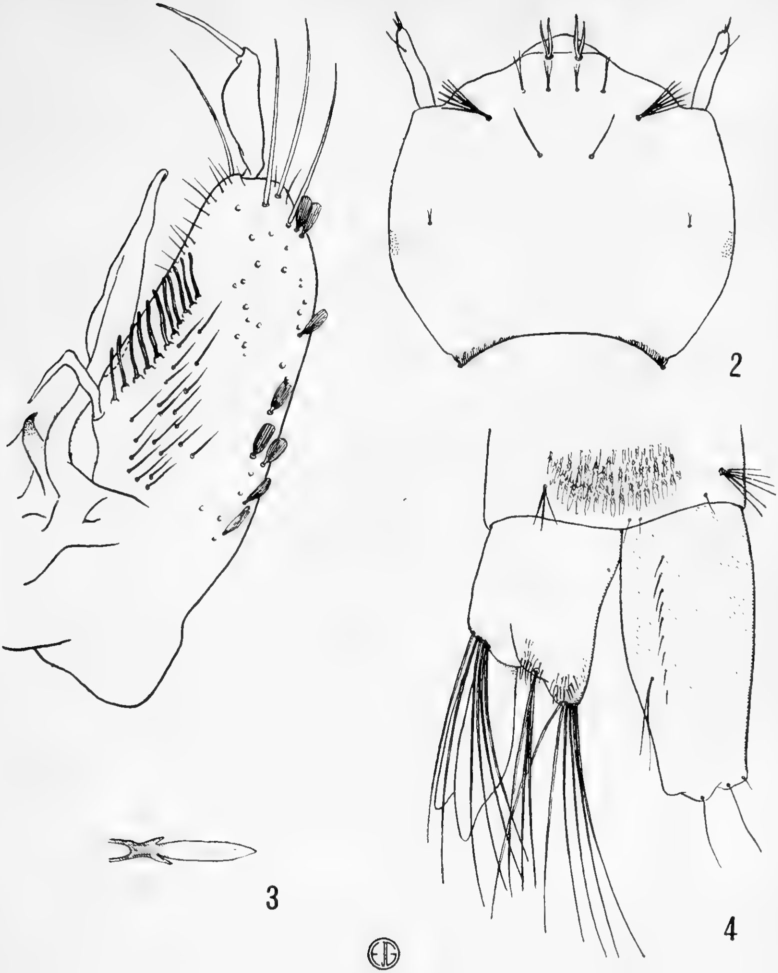
*Joseph E. Webb, Jr., Major, Sanitary Corps, AUS. Gorden S. Starkey, Technical Sergeant, Medical Department, AUS.

tral tufts of long, outstanding scales present; tibiae with apically whitish bands, plus 4 or 5 other whitish bands; first tarsal segment of all legs with apical and basal light bands and a narrow light band in the center; second and third tarsal segment of hind tarsi and the second segment of the mid-tarsi basally all dark, apically with a light band approximately one-third the length of the segment; second tarsal segment of the foreleg has from a few white scales to a distinct band apically; third tarsal segment of the fore and mid-legs is all black scaled; fourth tarsal segment of all legs all dark scaled; fifth tarsal segment of all legs whitish scaled. Abdomen mostly dark dorsally, with two distinct spots of yellowish white scales on tergites II to V, also with some whitish scales basally; tergites VI and VII largely yellowish with a few white scales; white lateral apical spots present on tergites IV, V and VI, plainest on VI; sternites with apical black bands on V, VI, and II, also tufts of long, outstanding black scales; Genitalia (Figure 1).—Basistyle about three times as long as wide, with a large specialized seta at the base and a row of stout setae running from this specialized seta apically for about three-fourths the distance of the basistyle. Dististyle slender, slightly inflated medially, less than half as long as the basistyle; apical spine more than one-half as long as dististyle. Claspette long, slender, spear shaped with a sharp point when viewed laterally. Lobes of ninth tergite with a single bristle; mesosome simple.

Female.—Differs from male chiefly as follows: Palpus about one-fifth as long as the proboscis, slightly swollen apically, all black scaled except at the extreme apex, where there are a few broad white and yellowish scales. Abdomen mostly dark above; tergites II to V usually with two yelowish median spots.

Larva (Figures 2, 3, and 4).—Length 5 mm. Head slightly broader than long; antennae not slender, apical half tapering very slightly, its length less than one-third width of head; no spicules present; hair tuft single, placed about apical third; clypeal spines moderately stout, two branched, yellow, curved downward and slightly inward; anteantennal hair (A) with 3 to 6 branches; lower head hair (B) single or double, about as long as the antenna, placed about on a horizontal line with hair (d); upper head hair (C) single, placed almost directly behind hair (B) but slightly basal of hair (A); postclypeal hair (d) double or triple; sutural hair (e) double. Thorax.—Prothoracic hairs plumose; upper one single and stout, lower many branched; mesothoracic upper hair stout, single, lower many branched, both plumose; metathoracic hairs both several branched and plumose. Several stellate hairs on both the thorax and abdomen. Abdomen.—First segment with 5 pairs of stellate hairs; upper lateral hair tuft multiple and plumose; lower single and plumose. Comb scales on eighth segment consist of several rows in a large triangular patch; individual scales with a narrow base; at about the basal third there is a tooth projecting on each side and from the center extends a blade shaped structure approximately twice as long as the basal part. Siphonal index 2; 7 to 9 pecten teeth, not fringed and



Aedes lewelleni, n. sp. 1. Male genitalia, ventral; 2. Head of larva; 3. Enlarged view of comb scale; 4. Anal segment of larva. (Drawn by Eugene J. Gerbergh, 1st Lieutenant, Sanitary Corps, A.U.S.)

with no lateral spines, hair tuft double and plumose, placed approximately in the center of air tube; whole of air tube finely spiculed; ventral and latero-dorsal valves bear a long single hair approximately as long as siphon. Dorsal saddle of anal segment small, finely spiculed, indistinctly defined, but with long, fringed spines (not so long as the saddle is wide) on the outer dorsal margins; lateral hair tuft triple and plumose. Ventral hair group consists of several hairs grouped so as to form the ventral brush, each furcated some distance from the base, not plumose; dorsal hair group consists of two long single hairs and two multiple tufts, the multiple tufts furcated some distance from the base, not plumose; gills four, approximately as long as the air tube.

Holotype.—Male, reared from larva. Collected at Angaur Island, Palau Group, Western Carolines, 14 December 1944, by W. B. Lewellen. Deposited in the U. S. National Museum, Washington, D. C.

Allotype.—Female, reared and collected as above. Deposited in the U. S. National Museum, Washington, D. C.

Paratypes.—1 male collected as above; 1 male reared from larva, 1 female reared from larva, 21 December 1944 (C. H. Waite and W. B. Lewellen); 15 males and 5 females reared from larvae, 11 February to 18 February 1945 (F. Gabriel, J. L. Sills, and R. W. Baker). 1 male deposited with C. H. Waite; 1 male and 1 female deposited with J. E. Webb; 2 males and 1 female deposited with G. S. Starkey; 2 males and 2 females deposited with 18th Medical General Laboratory; 6 males deposited in U. S. Army Medical Museum; 5 males and 2 females deposited in U. S. National Museum.

Type larvae.—17 collected by W. B. Lewellen on Angaur Island, Palau Group, Western Carolines, 13 December to 19 December 1944, from leaf axils of pandanus trees. 2 deposited in U. S. National Museum, Washington, D. C.; 12 deposited with G. S. Starkey; 1 deposited with E. J. Gerbergh; 2 deposited with Hawaiian Sugar Planters' Association, Honolulu, T. H.

Type locality.—Angaur Island, Palau Group, Western Carolines. The larvae were found exclusively in pandanus trees.

HYDROPSYCHE ANTILLES, AN UNUSUAL NEW SPECIES FROM SANTO DOMINGO (Trichoptera, Hydropsychidae)

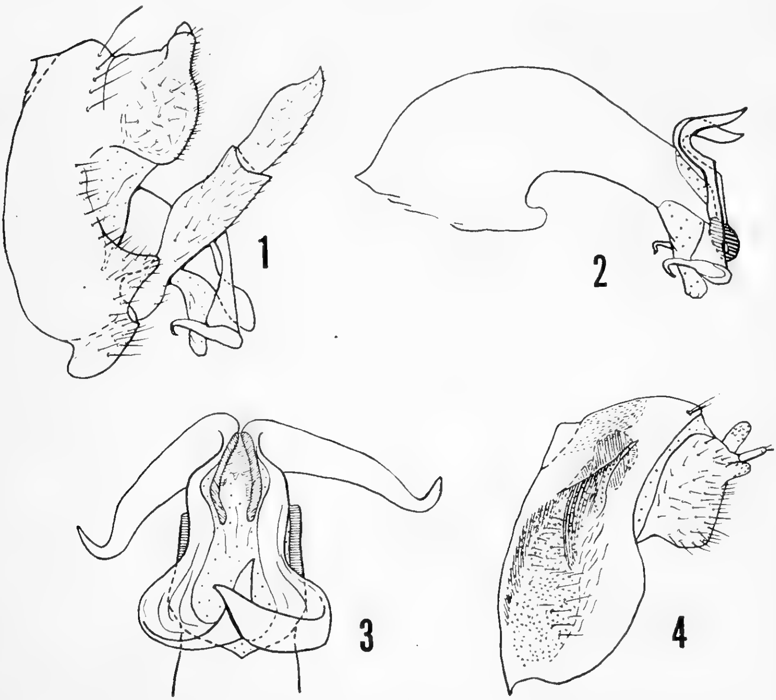
By HERBERT H. ROSS, *Illinois Natural History Survey*, and BOYD B. PALMER, *Polytechnic Institute, San German, Puerto Rico*

The following species is the second of the caddis fly genus *Hydropsyche* to be recorded from Santo Domingo. In 1941 Banks described *Hydropsyche domingensis* from this region, which until the present has been the only one known from the island.

The species described below is one of the most unusual in structure yet encountered in the genus. It differs from all of the North American forms in the biramous sclerotized processes at the apex of the aedeagus. On the basis of this and other characters, it fits into no previous group of the genus and a new group is therefore proposed for it.

Antilles Group

This group differs from others in the genus in the simple pretarsi of the males, which bear no clusters of black hairs as in other members of the genus. The structure of the aedeagus is also distinctive, especially the large basal portion and the curious apical processes. The female has many characteristics in common with the *Depravata Group*, notably the round lobes of the eighth sternite and the almost circular, deep clasper receptacle. It differs from this group in having no vestige of a brush at the apico-lateral corners of the eighth tergite. The middle tibia and tarsus of the female are only slightly flattened and expanded. In this respect also it is more similar to members of the *Depravata Group*.



Diagnostic Structures of *Hydropsyche antilles.* Fig. 1.—Male genitalia, lateral aspect; Fig. 2.—Aedeagus, lateral aspect; Fig. 3.—Apex of aedeagus, postero-dorsal aspect; Fig. 4.—Female ninth and tenth tergites, lateral aspect.

Hydropsyche antilles, new species

Male.—Length from head to tip of wings, 11 mm. Color brown, the venter of the body straw color, antennae and wings with markings only indistinct due to teneral condition. Eyes separated on dorsum by nearly twice dorsal width of eye. Malar space very short, only one-fifth lateral height of an eye. Venation typical for *Hydropsyche;* hind wings with *m-cu* distinct and at right angles to the veins it connects, M_{3+4} therefore separated markedly from Cu_1.

Male genitalia (Fig. 1) with ninth segment annular and only moderately long, with a sharp posterior lobe extending over the base of the clasper. Tenth tergite fairly short, its apex divided into a smooth rounded mesal projection and a pair of raised lateral lobes which merge with the lateral margin, the posterior margin of this area bearing a brush of minute hairs; lateral portion of tenth tergite with a large membranous raised area of sparse setae. Claspers with apical segment distinct, two-thirds length of basal segment, its dorsal margin sinuate and the apex pointed, as seen from lateral view; basal segment somewhat moniliform, constricted to a narrow stalk near base, and expanded into a bulbous area beyond middle. Both segments of claspers with short hair. Aedeagus (Figs. 2, 3) with large and bulbous base, tapering to a moderately narrow, cylindrical, preapical portion. The apex bears a pair of very long, twin bladed structures, one blade proceeding laterad, the other dorsad; these blades are movable to some extent; between them is situated an arcuate sclerotized structure.

Female.—Similar in size and general structure to male. One of the specimens is more fully colored than others in the type series and indicates that the basal antennal segments have dark V-marks and that the wing pattern is irrorate, similar to *H. scalaris* Hagen. Middle tibiae and tarsi only slightly flattened and very little wider than hind tibiae and tarsi. Plates of eighth sternite evenly rounded, very similar to those of *H. scalaris.* Eighth tergite without apico-lateral brushes. Ninth tergite large (Fig. 4), clasper receptacle deeply excavated and almost round, clasper groove well marked, the portion between the groove and th anterior margin of the tergite slightly concave and spiculate with minute teeth. The entrance channel to the clasper receptacle is also densely spiculated. Lateral lobe not differentiated.

Holotype, male—Trujillo City, Santo Domingo, January 3, 1940, Boyd B. Palmer, INHS.

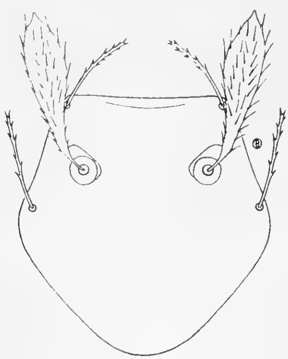
Allotype female and two *paratype* females.—Same data as for holotype.

These specimens were collected along the banks of a small mountain stream tributary to one of the rivers running to Trujillo City. At the point of collection the stream was about twenty feet wide, a foot or so deep, and had a stony bottom and moderately strong current. The banks were somewhat open, partially shaded with shrubs and trees.

A NEW HOST AND LOCALITY RECORD FOR THE TROMBICULID MITE, WALCHIA AMERICANA EWING, WITH A NOTE ON ITS MORPHOLOGY

By DONALD S. FARNER[1]

In the course of investigations on the biology of trombiculid mites conducted jointly by the U. S. A. Typhus Commission and the Rocky Mountain Laboratory, U. S. Public Health Service, a series of vertebrates from Dunn County, Wisconsin, was examined for ectoparasites. Two specimens of *Walchia americana* Ewing were removed from a pine squirrel, *Tamiasciurus hudsonicus loquax* (Bangs), collected at Colfax, Wisconsin, October 22, 1945, by Mr. Levi Sankey. Heretofore, this chigger has been recorded only from the type host, ''on cotton mouse,'' and only from the type locality, Talahassee, Florida (Ewing 1942, Jour. Parasit. 28:491). The finding of this chigger is apparently the second recorded occurrence of the genus *Walchia* in the Western Hemisphere. Although the collecting locality recorded here is interesting because it is widely separated from the type locality it should be noted that such a distribution is not dissimilar to that displayed by some of the trombiculid mites of the Pacific area.



One of the specimens has both sensillae intact and is therefore of particular value since these organs are lacking in all of the specimens of the type series (U. S. National Museum No. 1418) and have, therefore, not been observed prior to the examination of this specimen. The sensillae are illustrated in the accompanying camera lucida outline of the dorsal plate prepared by Dr. E. W. Baker. The measurements in micra are as follows: Maximum length, 70.6; maximum width, 68.0;

[1]Lieutenant H(S) USNR attached to U.S.A. Typhus Commission. Now at Museum of Natural History, University of Kansas.

length of sencilla, 48; anterolateral seta, 24; posterolateral seta, 29. The measurements for the second specimen, except for the sensillae which are lacking, are almost identical to those listed above.

The author is indebted to Dr. H. E. Ewing and Lieutenant George W. Wharton USNR (Navy Medical Research Unit No. 2) who kindly compared the above described specimens with the type series and confirmed the identification. The specimens described in this note are deposited in the collection of the Rocky Mountain Laboratory, U. S. Public Health Service, Hamilton, Montana (A. P. No. 22052).

TWO NEW SPECIES OF MOSQUITOES OF THE GENUS FICALBIA FROM NETHERLANDS NEW GUINEA[1]

By WILLARD V. KING, *Lt. Colonel*, and HARRY HOOGSTRAAL, *Captain, Sanitary Corps*

Ficalbia (Mimomyia) modesta, new species

MALE.—*Head:* Proboscis slightly longer than fore femur, apical half somewhat swollen, basal two thirds with brownish-yellow scales, gradually becoming darker on apical third. Clypeus dark, nude. Palpus longer than proboscis by nearly half the length of apical segments which are swollen, dark scaled, and fused; long segment slightly swollen apically, brownish-yellow scaled. Antenna about as long as palpus, flagellum yellowish except for the two elongate terminal segments which are dark; dense, long pale hairs pointing forward mostly in two planes; torus dark with scattered small hairs. Eyes contiguous medianly. Vertex and lateral surface of head covered with broad, white to dusky scales with a faint metallic reflection; a small patch of dark upright forked scales at nape; long bristles along eye margin. *Thorax:* Scutum and posterior pronotal lobe dark brown, contrasting with the pale yellowish pleura. Scutum covered with slender dark scales which have a bronzy reflection in bright light, a few over wing base slightly paler, distinctly so on antescutellar space; long bristles arising from the anterior and lateral borders. Scutellum with scales similar to those on scutum. Postnotum dark, nude. Anterior pronotal lobe with long dark bristles, apparently unscaled. Posterior pronotal lobe with broad translucent scales, appearing dusky white in some lights, on upper half and posterior border; a row of five bristles along posterior border. Paratergite fairly large, pale in color and bare of scales. No spiracular or postspiracular bristles. Sternopleuron with a patch of broad white scales on upper posterior

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[1]From the 19th Medical General Laboratory, U. S. Army. Contribution Number 9 from the Entomology-Mammalogy Department.

half, extending as a line on lower half, and a row of long, fine yellowish bristles along upper and posterior border. Mesepimeron with a patch of fine bristles in upper posterior corner and a patch of fine hairs on lower half posteriorly. Propleuron unscaled, with about 10 bristles. Wing length about 2.5 mm.; squama fringed; wing scales rather sparse, all dark basally, slightly paler towards apex; outstanding scales of veins 2 to 4 short and broad, the apex of each either rounded or truncate; anterior fork cell almost equal to its stem and arising distinctly closer to apex of wing than the posterior cell; posterior cross vein more basal than mid by almost its own length; tip of anal vein abruptly curved to posterior border of wing well beyond fork of vein 5. Haltere pale basally, dark apically. Legs dark scaled with metallic reflection, the undersurface of the femora largely pale; fore and mid tarsal claws subequal, the larger claw of each toothed. *Abdomen:* Tergites with dark scales with a metallic reflection; tergites II to VII with inconspicuous basal pale lateral spots; long golden hairs arising apically from each segment. Sternites pale scaled. *Hypopygium* (Fig. 1): Ninth tergite with separated lobes (IX T-L), each bearing three to five stout bristles at different levels. Paraprocts (P) curved, heavily sclerotized apically, terminating in two or three large teeth. Phallosome thinly chitinous, hyaline, apparently a simple tube. Coxite (C) conical, nearly four times as long as mid width, clothed with scattered scales and moderately long setae; basal lobe (BL) small, triangular, in apposition to coxite, bearing two stout and two slender bristles. Style (S) about .6 as long as coxite, narrow, slightly curved apically; terminal appendage (TA) one-eighth length of style, the apical half with a narrow lamella.

FEMALE.—Similar to male except as follows: Proboscis dark scaled except ventrally on basal two-thirds which is mostly brownish-yellow; palpus one-fifth as long as proboscis, dark scaled, very slightly swollen at apex; antenna completely dark with a pale pubescence, a whorl of about five bristles arising near base of each flagellar segment (the first flagellar segment not elongate); scales on front part of vertex appear slightly darker than those on posterior half; posterior cross vein closer to wing base than mid by about half its own length; fore and mid tarsal claws equal, not toothed; eighth abdominal segment short, cerci completely retracted. Genitalia with three spermathecae, each of a different size.

LARVA.—Unknown.

Holotype.—Male, collected by the writers in a light trap at the edge of rain forest, about 250 feet elevation, Hollandia, Netherlands New Guinea, 23 January 1945. *Allotype.*—Female, same data as above. *Paratypes.*—2 males, 9 females, same data as above, except that the dates of collection are as follows: 12, 24 and 31 January 1945, 10, 15, 17, and 18 March 1945, and 12, 26 and 27 April 1945. Holotype, allotype and paratype material deposited in the United States National Museum, other paratypes in the Museum of the Division of

Economic Entomology, Council for Scientific and Industrial Research, Canberra, A. C. T., Australia.

This species differs from *Ficalbia* (*Mimomyia*) *metallica* Leic. of the Malayan subregion (also said to occur in the New Guinea region), in at least the following characters: distinctive area of yellow scales near wing roots absent, abdomen without a continuous median longitudinal stripe, and first fork cell almost equal its stem rather than only half the length of its stem. In the latter respect this species likewise differs from *F.* (*M.*) *chamberlaini* (Ludlow), Oriental Region and Philippines), as well as in the absence of tarsal and tibial markings, presence of lateral abdominal spots, and less conspicuous lateral scutal ornamentation. *F.* (*M.*) *metallica* was not taken by us in New Guinea. At Hollandia the only other described species of the genus taken was *F.* (*Etorleptiomyia*) *elegans* (Taylor), a very brightly ornamented species, also from light trap collections.

From the trap operated at the edge of a rain forest on 115 nights between January and June, four males and twenty females were taken. None were taken in May and only one female in February. Another trap nearby but in the large laboratory clearing, attracted only one male and two females during this period. Specimens not mentioned as types were damaged too badly in transit from New Guinea to be used. A single *Ficalbia* larva collected by the writers in a grassy side pool of a river at Hollandia is similar to that of *F.* (*M.*) *chamberlaini* (as described by Barraud, 1934, p. 110) except that head hair C has 3 branches rather than 6 to 8, and that the lateral comb scales are 26 in number rather than 10 to 16. This specimen may well be that of *modesta* but was not definitely associated with an adult.

Ficalbia (Mimomyia) flavens, new species

MALE.—Similar to *F. modesta* except as follows: general color paler; basal three-fourths of proboscis covered with yellowish scales laterally and ventrally; long segment of palpus yellow scaled except for a dark tip and dorsal dark stripe, the apical clubbed segment with a large yellowish spot below on basal half; scutal integument dark centrally but pale brown laterally, forming a wide contrasting border that extends onto posterior pronotum and side lobe of scutellum; scales on the pale border black on fossa, bright golden posterior to this area, especially over wing roots; posterior pronotum and all pleurites bare of scales; lower mesepimeron without a patch of hairs (possibly denuded); first fork cell of wing five-sevenths as long as stem, its base slightly distal to that of second; wing scales distinctly pale for a short distance near base of costa and vein 1. *Hypopygium:* coxite about three times as long as its mid width, the apical half distinctly thicker than in *modesta*;

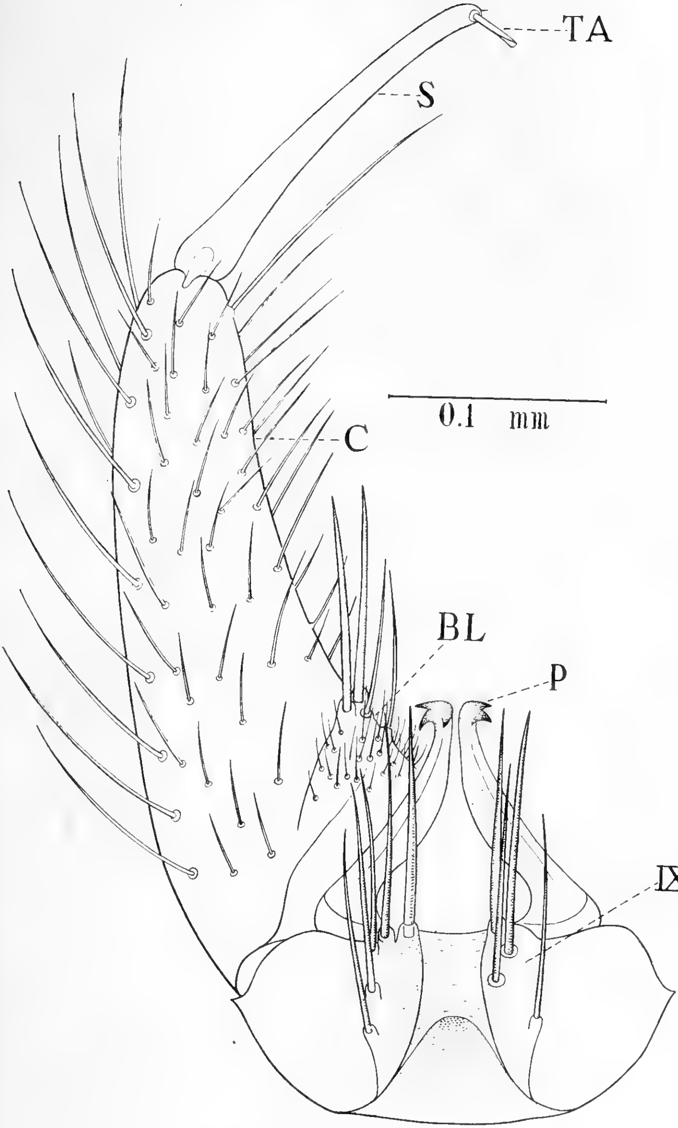

Fig. 1. Male Hypopygium of *Ficalbia (Mimomyia) modesta* new species

style longer, about .75 of coxite; terminal appendage about one-sixth length of style; lobes of ninth tergite each with three apical bristles; basal lobe of coxite with only two stout bristles visible (mount rather poor).

Female and larva unknown.

Holotype.—Male collected by the writers in a light trap at edge of rain forest, about 250 feet elevation, Hollandia, Netherlands New Guinea, 27 April 1945; deposited in the United States National Museum.

Although represented by only one specimen not in the best of condition, this form appears sufficiently distinct from *modesta* and other known species to warrant naming. The contrasting colors of the scutum are very noticeable, whereas in the type series of *modesta* the integument is uniformly dark, as is also the lateral scaling except for a very few pale scales over wing root in some specimens. In the paratypes of *modesta,* at least a few scales are present on the sternopleuron and usually on the posterior pronotum in even the poorest specimens. Since these sclerites in *flavens* are not entirely denuded of bristles, it is unlikely that the absence of scales is due merely to denudation.

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NOTE ON HAEMAGOGUS SPEGAZZINII BRETHES, 1912 (Diptera, Culicidae)[1]

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Until recently the name *Haemagogus spegazzinii* was considered a synonym of *Haemagogus equinus* Theobald, 1903. Dyar (1), in 1921, while discussing the mosquitoes of Argentina, made the following comment concerning *Haemagogus capricornii:* "Brèthes described *H. spegazzinii* without describing the claws, as these were apparently missing in his specimen. A single specimen in the Paris Museum has toothed claws, and thus Brèthes species is obviously the same as *capricornii* from Brazil. The exact status of this species must await discovery of the male."

In a paper on *Haemagogus* published the same year Dyar (2) suggested that the species referred to as *Haemagogus* (*Stegoconops*) *capricornii* Lutz should be included as a synonym of *Haemagogus equinus.* He remarked as follows: "In the monograph we recognize *capricornii* from the Canal Zone and Trinidad and state that the male has short palpi, figuring the hypopygium of the supposed male on plate 24 figure 165. The male figured is from Trinidad (F. W. Urich breeding number 17) but there exists no reason for associating with it females with toothed claws as has been done. Urich's No. 17 contains only males; but his Nos. 21 and 22 are females with simple claws. Our females of *capricornii* are really *equinus*, and our supposed males of *capricornii* are referred to below under the caption *Haemagogus janthinomys* new species." On pages 112 of this same paper he gives a short description of

[1]The studies and observations on which this paper is based were conducted with the support and under the auspices of the "Serviço de Estudos e Pesquisas sôbre a Febre Amarela," Ministry of Education and Health of Brazil, and of the "Sección de Estudios Especiales del Ministerio de Trabajo, Higiene y Previsión Social" of Colombia, both in cooperation with the International Health Division of The Rockefeller Foundation.

an adult *H. janthinomys*, which was presumably a male, adding that "The male hypopygium is figured as '*capricornii,*' plate 24, figure 165 of the monograph."

In 1928 Dyar (3) included the species described by Brèthes and Lutz as a synonym of *H. equinus.* Also, he redescribed all of the phases of *H. janthinomys* which practically invalidated the two other similar species of which the males were still unknown. He did state, however, that *H. spegazzinii* might be a different species, a positive opinion on which point would have to await the discovery of the male.

However, in 1927, Shannon and Del Ponte (4), while studying female mosquitoes collected in Ledesma, Province of Jujuy, Argentina, the same locality from which the females described by Brèthes as *H. spegazzinii* came, had rejected the conclusion that this species was a synonym of *equinus* and *capricornii.* They described their specimens and discussed the principal characteristics by which *H. equinus, H. spegazzinii* and *H. uriartei* could be differentiated. In fact, their description permits a better recognition of the characteristics of *spegazzinii* than does the original description by Brèthes, as the article by Shannon and Del Ponte gave certain details which had been omitted from the original paper.

In 1937, while experimenting with *Haemagogus* as a transmittor of yellow fever virus, Antunes and Whitman (5) proved that *H. janthinomys* could act as a vector, a finding which stimulated considerable interest in the taxonomy of this species.

Later, Antunes (6) revalidated the designation of *capricornii* and considered *janthinomys* to be a synonym, saying: "O único *Haemagogus* encontrado em São Paulo, localidade tipo da espécie de Lutz, corresponde exatamente à descrição de *janthinomys.* Sendo assim, o nome dado por Lutz deve prevalecer visto antedatar de muito o de Dyar." From that time on the question became more involved, partly because of the position of *janthinomys* in relation to *capricornii,* and partly owing to the rôle it plays in the transmission of yellow fever and also to the fact that no males of the revalidated species had been studied.

In 1943, Cerqueira (7), in a paper dealing with several new species from Bolivia, described for the first time the genitalia of *H. capricornii* Lutz, 1904, and of *H. spegazzinii* Brèthes, 1912. He revalidated the latter species and suggested that *H. janthinomys* Dyar, 1921, should be considered as a synonym of *H. spegazzinii,* because the terminalia were similar and because the name *spegazzinii* had priority over *janthinomys.*

Although Cerqueira's paper clarified the relationship between these two species and *equinus,* it was important to determine whether specimens of *H. capricornii* and *H. spegazzinii* from the type areas in Brazil and Argentina, respectively, corresponded exactly to supposedly similar material collected in Bolivia. Accordingly Cerqueira and Lane (8) obtained specimens of *H. capricornii* from the type area in São Paulo, Brazil, and described them in detail. The following report deals with the characteristics of *H. spegazzinii* secured in the type locality for that species as well as in certain places in Brazil.

To this end Boshell captured female *spegazzinii* for oviposition in Ledesma in the Province of Jujuy, Argentina, that is to say, in the type locality for *H. spegazzinii.* Specimens were also taken at Ilhéus, in the southern part of the state of Bahia, an endemic region of jungle yellow fever; in Cururipe, near São Salvador, Bahia, and also at various places in the vicinity of Arado, Cuiabá, in the State of Mato Grosso. Captures made at those localities yielded a satisfactory number of females, from which eggs were obtained and larvae were successfully reared. It should be noted that the captures made in Cururipe were intended not only to obtain material for breeding, but also to verify whether the local species was *H. janthinomys* = *spegazzinii* or *H. janthinomys* = *capricornii*, because the material used by Antunes and Whitman (5) had come from that same locality.

Haemagogus (Haemagogus) spegazzinii Brèthes, 1912

1912 *Haemagogus spegazzinii* Brèthes, Bol. Inst. Ent. y Pat. Veg., B. A. 1:39.

1921 *Haemagogus* (*Haemagogus*) *janthinomys* Dyar, Ins. Ins. Mens. 9: 112 and 150.

1927 *Haemagogus spegazzinii* Shannon & Del Ponte, Rev. Inst. Bact., B. A. 67.

1928 *Haemagogus* (*Haemagogus*) *janthinomys* Dyar, Mosq. of Amer., 140.

1943 *Haemagogus spegazzinii* Cerqueira, Mem. Inst. Osw. Cruz, 39 (1): 10.

The material on which the following description is based was obtained from eggs coming from female mosquitoes caught in Ledesma, in the Province of Jujuy, Argentina, the type locality for *H. spegazzinii.* This material was compared with material derived from eggs coming from the mosquitoes captured in Cururipe and Ilhéus, in the State of Bahia, and also from Arado, State of Mato Grosso, Brazil.

From the 190 female mosquitoes captured in Ledesma and brought to the Bogotá laboratory by air, 3,086 eggs were obtained. These eggs yielded 172 larvae, from which 86 females and 15 males were bred out. The larval skins were preserved.

From the mosquitoes captured in Brazil we obtained 3,795 eggs. Of these 1,371 were used for study purposes. Ninety-five males and 106 females were reared from these eggs, partly at Ilhéus and partly in the Rio de Janeiro laboratory.

FEMALE

Head. Proboscis blue-black, with slight dark-green reflection, long, slender, about one fifth longer than the femur of the front leg. Palpi blue-black, short, slightly longer than the clypeus. Clypeus and torus shining black. Antennae dark. Occiput metallic blue with intense green reflection; margin of the eyes with a broad band of white scales united at vertex and forming a large spot on the mental region; black setae present on the margin of the eyes and vertex.

Thorax. Pronotal lobes with blue-green scales except for white ones along the anterior margin. Sometimes the white scales cover more than two thirds of the pronotal lobes, while at other times they are reduced to only a few on the lower margin; black setae present on the anterior margin and above. Mesonotum covered with flat, broad ovate, bronzy green scales, intermixed with narrow ones chiefly in the center; base of wings and scutellum covered with longer and broader green scales with blue reflections; black setae present over the bases of the wing and on scutellar margin. Posterior pronotum with white scales on the posterior margin and below. Pleurae and coxae, with patches of white scales, the large median patch reaching the mesonotal suture; sternopleura with two setae, one much lighter and slenderer than the other.

Abdomen. Covered dorsally with dark violaceous blue scales, except on the posterior margin of the segments, wher they have a metallic blue-green color; laterally from the first to fifth tergites there are continuous large silvery white markings; on the sixth and seventh tergites are oblique basal spots which form dorsal bands. Venter covered with violet-blue scales, with broad segmental basal silvery white bands.

Legs. Metallic violet-blue; fore-femur with a small basal white internal spot, mid- and hind-femora almost completely covered internally with white scales. Fore- and mid-tarsal claws toothed, hind ones simple.

Wing. With iridescent metallic blue scales.

MALE

Proboscis and palpi slightly longer than in the female, antennae strongly plumose. Coloration as in the female except for the mesonotum which is green and the abdomen which has a deeper tinge in the dark blue-green scales of the posterior margin.

Fore- and mid-tarsal claws large and toothed, hind ones small and simple (fig. 1 and 1a).

Genitalia. (fig. 2) Side piece about three times the length of its greatest width, strongly setose on the ventral side from the lobe up to

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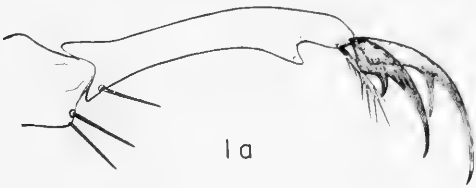

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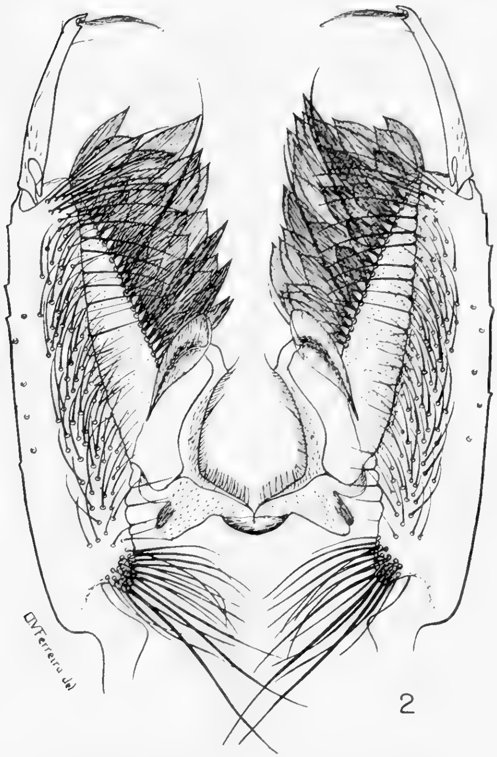

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Haemagogus spegazzinii Brèthes, Male.
Fig. 1 and 1a, Tarsal claws of front and middle legs;
Fig. 2, Male terminalia.

the apex, stronger and longer setae are found on the outer side intermixed with scales; inner scales are of three sizes—oval, pointed and broad; basal lobe mamillated with a few very long, foliaceous setae. Clasper one third the length of the side piece, nearly straight, narrower near apex, with one or two preapical hairs besides smaller ones at basal third; apical appendicle strong, about half as long as clasper. Claspette (fig. 3) high, the stem slender, pilose, curved and twisted outward at distal third, one seta at this point and another prebasally; filament somewhat narrow, long, striated, constricted preapically. Tenth sternite (fig. 4) high, strongly sclerotized, with a single row of small teeth and some spicules on the apical membraneous portion. Ninth tergite (fig. 5) with two to five setae on each side. Mesosome (fig. 6, 6a and 6b) truncated at base, pointed at apex, having a group of spicules on the apical outer margin, ventrally. Eighth tergite as in fig. 7.

LARVA

Skin densely spiculose or villose. Head (fig. 8) rounded, the laterofrontal depression slight. Antennae short, cylindrical, with few spines and a single hair just above the middle. Postclypeal hairs branched, long, fine and light; frontal internals single, slender and slightly longer than the postclypeals; frontal medians single, also slender and about three times the length of the internals; frontal externals triple or quadruple, slightly shorter than the length of antennae; supraorbitals single or double, long. Mental plate (fig. 9) triangular, with eight teeth on each side, the central one larger than its neighbors.

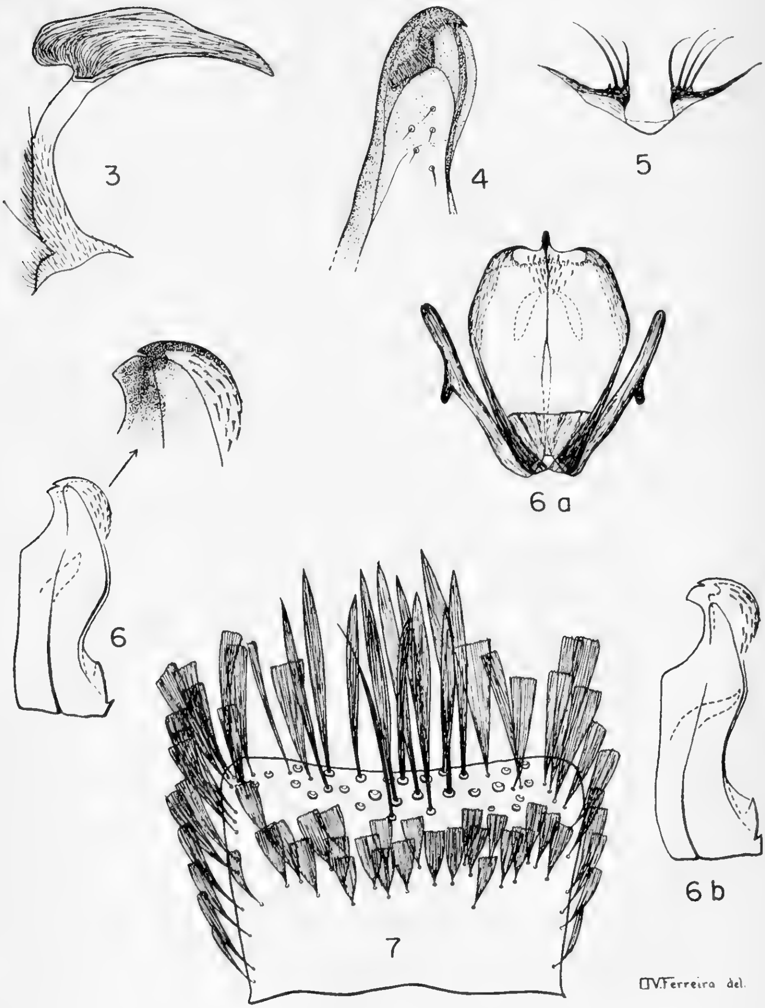
Eighth segment (fig. 10, 10a and 10b) with the lateral comb formed by 8 to 14 scales placed close together and inserted in a sclerotized plate. Air tube with the length varying from one and a half to two and a half times the greatest width; pecten with 9 to 12 spines and 1 to 3 basal teeth occupying a little less than half the length of the air tube and followed by a double hair. Anal segment longer than wide, the plate somewhat narrow and spiny on the posterior margin; dorsal hairs, one single and one quadruple; lateral tuft with from two to six branches; ventral brush with about eight pairs of double tufts, the central ones long and the anterior and posterior ones very short. Anal gills about twice as long as the dorsal plate.

Type locality Ledesma, Province of Jujuy, ARGENTINA.

The foregoing description is based on 86 females and 15 males with their corresponding larval skins, bred from eggs obtained from females captured at the type locality in March 1944. (col. J. Boshell-Manrique.)

Additional localities Cururipe, Salvador, Bahia, 1937 (P. C. A. Antunes col.) : March 1944 (N. L. Cerqueira, col.) ; Ilhéus, Bahia, March and April 1944 (N. L. Cerqueira col.) ; Aradó, Mato Grosso, February, 1944 (J. Boshell-Manrique col.) ; Caldas Novas, Goiaz, March, 1945 (N. L. Cerqueira col.).

Types. As no male allotype has been designated for this spe-



Haemagogus spegazzinii Brèthes, Male terminalia. Fig. 3, Claspette, lateral view; Fig. 4, Tenth sternite, apical portion; Fig. 5, Ninth tergite; Figs. 6 and 6a, Mesosome, dorsal and lateral views of Argentinian specimens; Fig. 6b, Lateral view of specimen from Ilhéus, Brazil; Fig. 7, Eighth tergite.

cies we have selected one of the male specimens with corresponding larval skin which was used for the foregoing description. It will be deposited in the Oswaldo Cruz Institute in Rio de Janeiro. Other specimens will be sent to the United States National Museum in Washington.

DISCUSSION

Among the mosquitoes captured at Ledesma, Province of Jujuy, Argentina, there were two species of *Haemagogus*. One of them, *H. uriartei*, was taken by Shannon and Del Ponte and was represented by two females only. The other species encountered by those workers corresponded to that on which these investigations are based.

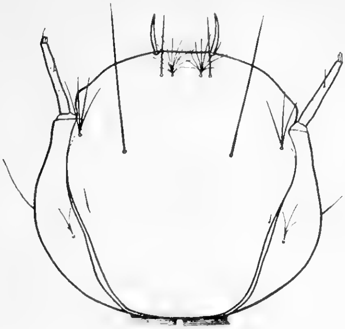
There is close similarity between these specimens of *H. spegazzinii* from the type locality and those described originally by Brèthes as well as the others redescribed subsequently by Shannon and Del Ponte, who based their description on female mosquitoes captured in the same place. Comparisons of male and female specimens secured in the type locality in Argentina with others obtained in Bolivia, Cururipe, Ilhéus and Arado (Brazil), show conclusively that all belong to the same species, and permit us to confirm the revalidation of *H. spegazzinii* Brèthes, 1912. We would like to point out furthermore that recent specimens collected at Cururipe were identical with earlier material studied by Antunes and Whitman (5) and used by them in their yellow fever transmission studies.

Consequently, *H. janthinomys*, Dyar, 1921, should be considered as a synonym of *H. spegazzinii* Brèthes and not as a synonym of *H. capricornii* Lutz, as previously suggested by Antunes (6). The geographical distribution of *H. spegazzinii* and *H. janthinomys* covers an extensive area while that of *H. capricornii* is much more restricted.

The presence of only one species, *H. spegazzinii*, in Ilhéus and Arado, where yellow fever infection is endemic, and more recently in Goiaz, where yellow fever epidemics have occurred, points to the conclusion that this species is probably incriminated in the dissemination of yellow fever virus in those areas.

ACKNOWLEDGMENTS

We are indebted to the following persons: Dr. Henry W. Kumm of The Rockefeller Foundation, at whose suggestion this work with material from the type locality was undertaken; to Dr. P. C. A. Antunes of the Institute of Hygiene of the University of São Paulo, who provided certain specimens collected in Cururipe; to Drs. Frederico Acquer and L. Gil Guimarães of the National Yellow Fever Service, and to Dr.



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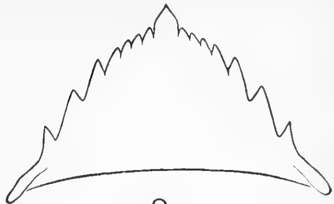

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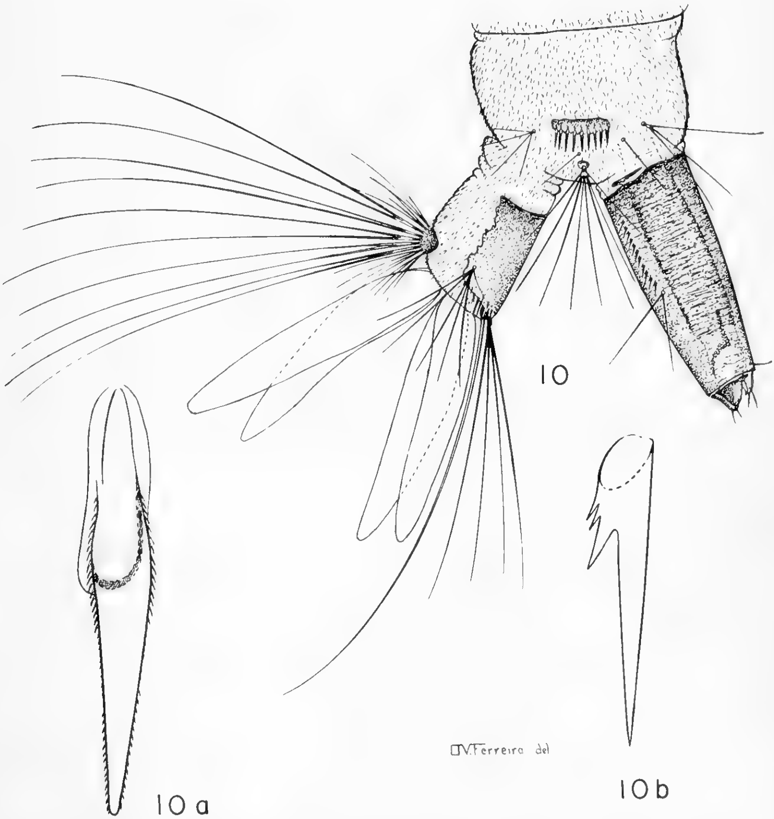

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10a

10b

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Haemagogus spegazzinii Brèthes, Larval characters. Fig. 8, Head; Fig. 9, Mental Plate; Fig. 10, Eighth segment; Fig. 10a, Comb scale; Fig. 10b, Pecten spine from breathing tube.

J. Serafim, Jr., of the National Malaria Service, for assistance rendered during the captures made at Cururipe.

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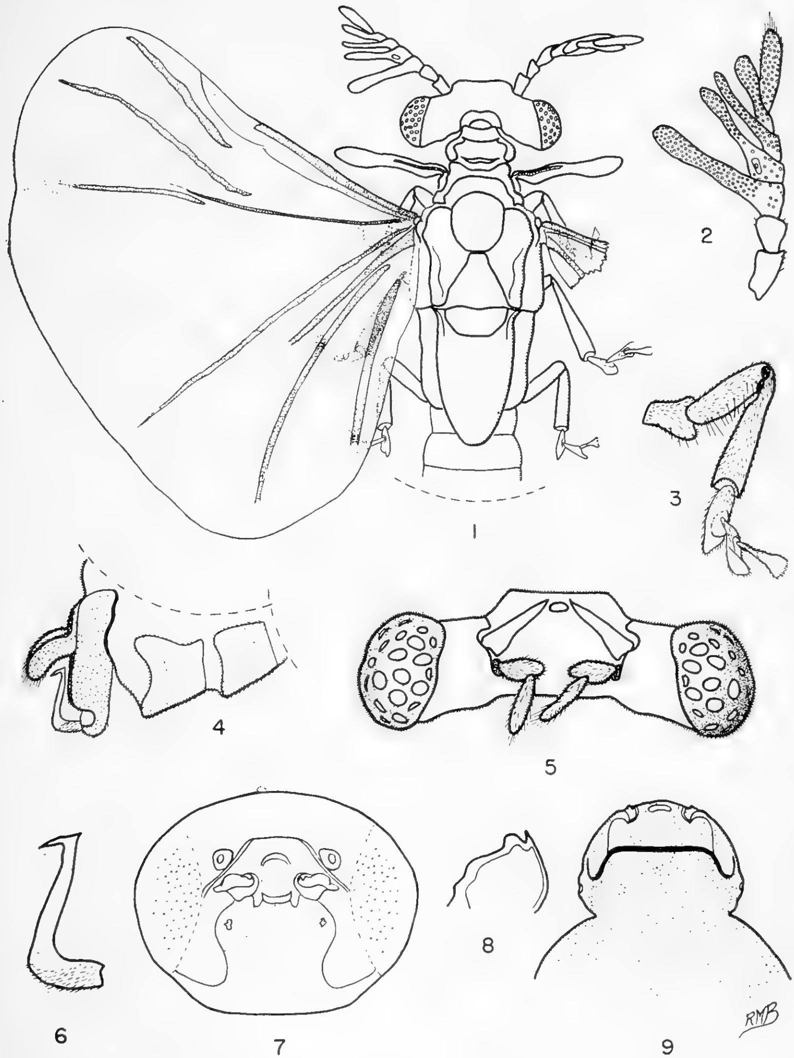
A NEW SPECIES OF HALICTOPHAGUS PARASITIC ON CERCOPIDAE

(Strepsiptera, Halictophagidae)

By RICHARD M. BOHART, *University of California, Davis California*

Three stylopized specimens of the spittlebug genus *Philaronia* were recently called to my attention by Dr. P. W. Oman. A mature male in its puparium and 2 female specimens were dissected from the cercopids and proved to be *Halictophagus* of a new species similar to the relatively common *H. americanus* Perkins, which parasitizes several genera of leafhoppers. I believe this is the first report of stylopization in the spittlebugs and, with many records from the membracids, cicadelloids, and fulgoroids, all the main groups of the Series Auchenorrhyncha except Cicadidae are now known to be hosts of Strepsiptera. No records have been made of stylopization in the Series Stenorrhyncha.

The discovery of parasites in Cercopidae is of particular interest as it arouses speculation as to the manner in which the Strepsiptera enter the host. Presumably, in all of the species on Homoptera the first larvae must attack the nymphal host. In the cercopids this would involve penetration of the "spittle" mass.



Figures 1-9, *Halictophagus philaroniae*, n. sp. Figure 1, male, with right wing and end of abdomen omitted, antennae shown in 2 views; 2, left antenna showing disposition of sensoria; 3, right hind leg; 4, side view of genital capsule and last 2 sternal plates; 5, ventral view of head; 6, aedeagus; 7, end view of cephalotheca; 8, ventral view of left female mandible; 9, cephalothorax and basal collar of female, ventral view.

Type material of the species described below is in the U. S. National Museum.

Halictophagus philaroniae, new species

MALE.—Antenna moderately compact, segments 3-6 with basal lengths nearly equal, first two segments with a few bristles but no sensoria, other segments with many sensoria, third segment with only a few sensoria in a single irregular row around base (fig. 2); mandible tapering to a point; palpus a little longer than mandible, without obvious sensoria; compound eye with about 25 facets visible in dorsal aspect. Thoracic structure in dorsal view and wing venation as shown in figure 1; fore tibia about 4.5 times as long as wide at apex, about as long as either fore coxa or fore femur; fore metatarsus pyriform in outline; middle coxa about three-quarters as long as middle femur which is equal in length to tibia; hind leg as in figure 3, all coxae with conspicuous bristles, especially toward base beneath. Sternites II-V with partially fused pigmented median spots, sternites VI-VIII with single median spots; terminal segments of abdomen and aedeagus in lateral view as in figures 4 and 6. Length of antenna 0.55 mm., breadth of head 0.61 mm., length of metanotum 0.96 mm.

MALE CEPHALOTHECA.—Proportions as in figure 7. Upper mouth margin not reaching mandibles laterally; mandible with a moderate apical tooth opposed by a broad hump. Breadth of cephalotheca 0.58 mm.

FEMALE.—Cephalothorax orange brown; collar orange brown toward base, yellowish brown toward apex. Mandible with a sharp tooth at inner apex opposed by a prominent hump (fig. 8); brood passage opening with a thick lip-like margin, connected with lateral margins of cephalothorax by thickenings; basal collar cape-like, two-thirds as long as cephalothorax. Abdomen apparently with 2 brood passage openings. Width of cephalothorax 0.42 mm., proportions as in figure 9.

TYPE (U. S. National Museum No. 57982).—Male, Valentine, Nebraska, July 23, 1945, dissected from puparium in *Philaronia bilineata* (Say) collected on grass.

PARATYPES.—One female, same data as type; 1 female, Fort Robinson, Nebraska, July 23, 1945, dissected from *Philaronia bilineata* (Say) collected on grass.

In my key to *Halictophagus** this species runs to *americanus* Perkins. In the male, *philaroniae* is somewhat larger (1.4 mm. long to apex of postscutellum instead of about 1.0 mm.); the postlumbium is longer; the third antennal segment has fewer sensoria toward the base, with only a single irregular row around the base instead of 2 rows or more in *americanus;* and the scutellum is narrowly separated from the prescutum. The female differs primarily in the narrower and more definite hump opposite the apical mandible tooth.

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*Bohart, R. M. 1943. New species of *Halictophagus* with a key to the genus in North America. Ann. Ent. Soc. Amer. 36:341-359.

NOTES ON HAPLAXIUS FOWLER WITH DESCRIPTIONS OF NEW SPECIES

(Homoptera, Cixiidae)

By John S. Caldwell, *Circleville, Ohio*

The genus *Haplaxius* Fowler, with *laevis* Fowler herewith designated genotype, will contain the North American forms that have been formerly included in *Myndus* Stål. The genotype of *Myndus, musivus* (Germar), has a transverse carina, at the center of the vertex in addition to the apical carina, frons narrow and not expanded apically, mesonotum transversally angulate with the lateral compartments sharply descending from the median tablet, elytra relatively short and broad as in *Cixius,* and aedeagus of different form and pattern than in *Haplaxius. Myndus* is probably not represented in the Western Hemisphere.

Haplaxius, as based on *laevis,* has a single apical carina on the vertex, frons greatly expanded apically, mesonotum very broadly transversally convex, elytra long and narrow, and aedeagus of same general form and pattern as illustrated by the new forms in this paper. Since the North American forms are congeneric with *laevis* the new combinations are: *beameri* (Ball), *catalinus* (Ball), *cocois* (Fennah), *crudis* (Van D.), *delicatus* (Van D.), *enotatus* (Van D.), *fulvus* (Osb.), *impiger* (Ball), *lunatus* (Van D.), *mojavensis* (Ball), *nigrifrons* (Ball), *nolinus* (Ball), *occidentalis* (Van D.), *ovatus* (Ball), *pictifrons* (Stål), *pusillus* (Van D.), *radicis* (Osb.), *rubidus* (Ball), *slossoni* (Ball), *sordidipennis* (Stål), *truncatus* (Metc.), *viridicatus* (Ball), *viridis* (Ball), and *yuccandus* (Ball).

I have seen only the Ball, Metcalf, and Osborn types. My interpretation of the Van Duzee and Stål material has been largely taken from specimens identified by the late Dr. E. D. Ball and by Professor Herbert Osborn. *Auratus* (Ball) is a synonym of *viridis* (Ball) (new synonymy). Specimens of *musivus* (Germar) have been examined through the courtesy of Dr. Paul W. Oman and the interpretation of *laevis* Fowler is based on topotypic specimens identified from the description and figures in the "Biologia." I have examined specimens of *Paramyndus cocois* Fenn. through the courtesy of Ronald G. Fennah and can not concur that they are generically distinct from *Haplaxius. Catalinus* (Ball) and *rubidus* (Ball) strain the generic limitations of *Haplaxius* much more than *cocois* (Fenn.) and seem to grade toward other undescribed forms that are a stepping stone toward *Nymphocixia* or *Diastrocixius.*

All types of the new forms in this paper are in the writer's collection.

Haplaxius pallidus, new species (Pl. 29, Figs. 1, 1A)

Length, male 4.5 mm., female 4.8 mm. Dull yellow over all, (probably green in life), female darker than male. Elytra clear except for small black tubercles on veins.

Vertex transversally flat, longitudinally convex; lateral margins little elevated, almost parallel apically, divergent toward base. Elytra approximately four times as long as broad. Pygofer in male broadly produced pasteriorly on either posterior margin. Anal segment straight, with small mediobasal projection. Forceps enlarged and flattened apically, pipe-shaped in lateral aspect. Aedeagus with two apical processes; left process short, curved; right process elongate, hooked apically.

Male holotype, female allotype, and one male and one female paratype from Miami, Florida, 2-2-34, (Caldwell).

Superficially resembling *viridis* (Ball) but more slender in form and with different genitalia.

Haplaxius serratus, new species (Pl. 29, Figs. 2, 2A)

Length, male 4.8 mm., female 5. mm. General color of male yellow, mesonotum brownish-yellow with yellow carinae. Female brownish-yellow, lateral compartments of mesonotum brown. Elytra in either sex clear, veins yellow to light brown, stigma clear, commissural margin brown.

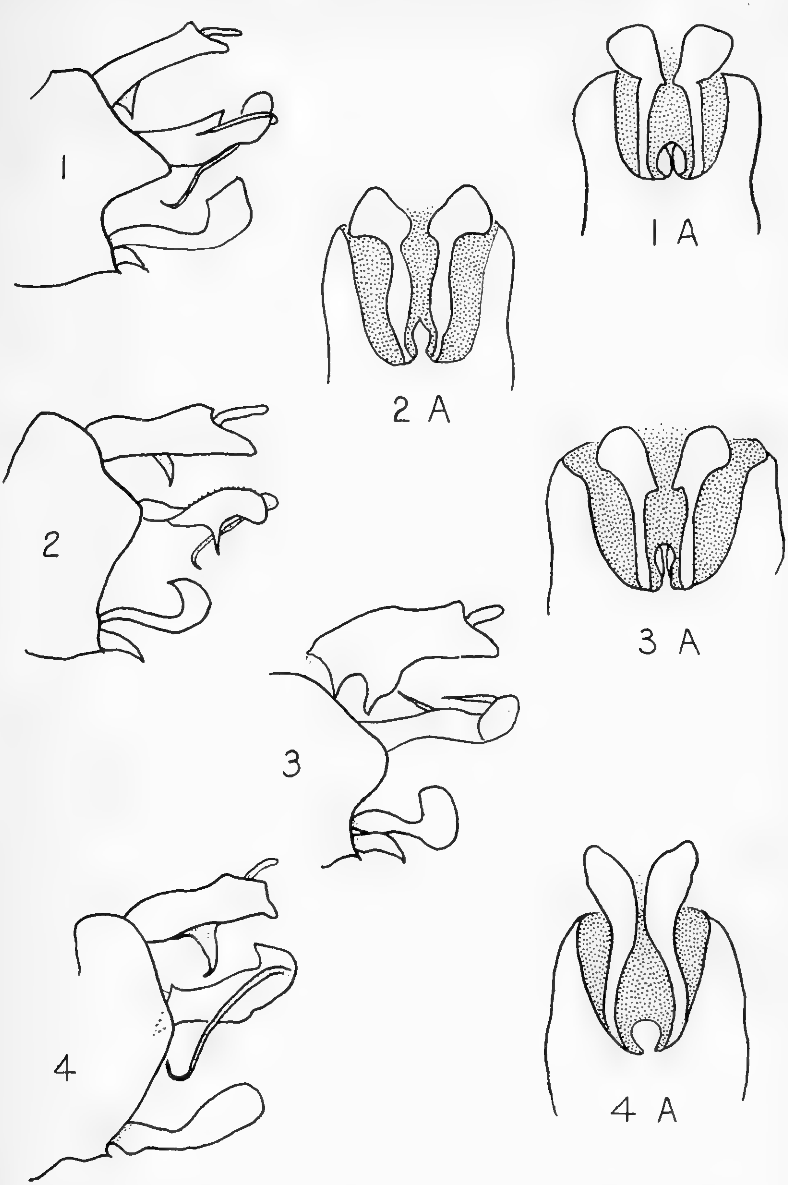
Robust in form. Vertex longitudinally convex, lateral margins little elevated, almost parallel apically, divergent toward base. Carinae of mesonotum very distinct. Elytra less than four times as long as broad; tubercles on veins dense, prominent. Medioventral process of male pygofer narrow basally, broadly expanded apically. Anal segment straight; either ventral margin near base folded inward thence produced ventrad into ventrally projecting tooth. Forceps slender basally, broadly clavate apically in ventral aspect. Aedeagus with apical process on right side; periandrium or theca finely serrate dorsally, with a spine-like projection ventrally near apex.

Male holotype, female allotype, and female paratype from Orizaba, Veracruz, Mexico, 10-8-41, and one female paratype from Fortin, Veracruz, 10-9-41, (DeLong, Good, Caldwell, and Plummer).

Resembling *laevis* Fowler in form but with a shorter, broader vertex and different genitalia.

Haplaxius simplicatus, new species (Pl. 29, Figs. 3, 3A)

Length, male 4.7 mm., female 4.8 mm. General color of male greenish-yellow, female yellow, (both sexes probably green in life). Elytra clear; veins yellow, tubercles light brown.



Lateral and ventral views, respectively, of abdominal apex of male. Fig. 1, 1A, *H. pallidus*, n. sp.; Fig. 2, 2A, *H. serratus*, n. sp.; Fig. 3, 3A, *H. simplicatus*, n. sp.; Fig. 4, 4A, *H. rubidus* (Ball.).

Vertex transversally flat, longitudinally convex; lateral margins little elevated, rather evenly narrowed from base to apex. Frons narrow, greatest width little over twice the width at base. Mesonotal carinae prominent. Tubercles on veins small, dense. Medioventral process of male pygofer elongate, compressed laterally at base. Anal segment with a pair of ventral spurs. Aedeagus with a pair of apical processes; right process twice as long as left.

Male holotype, female allotype, and female paratype from San Miguel, El Salvador, 3-19-42, (Plummer).

Easily confused with any of the forms that lack facial or elytral marking but differing from any known species by the distinct male genitalia. The female can probably be differentiated from other nondescript species only by direct comparison of the form and proportions of vertex and face with determined material.

Haplaxius rubidus (Ball) (Pl. 29, Figs. 4, 4A)

Myndus rubidus Ball. Jour. Wash Acad. Sci. 23:483, 1933 (Holotype).

Length, male 4.6 mm. Vertex white; lateral margins black. Face white; frons with large, rectangular, orange-red spot on median carina extending from apex half way to base. Pronotum white; lateral extensions below and behind eyes light brown. Mesonotum yellow-orange: median compartment white with yellow stripe on either side of median carina. Elytra whitish-hyaline clouded apically with light fuscous; longitudinal veins white; cross veins broadly fuscous; heavy black mark present on posterior extremity of M_3 extending on cross strut to Cula: stigma black.

Form elongate, slender. Vertex trough-like, narrowed to almost half its basil width at apex; lateral margins greatly elevated. Elytra approximately three and a half times as long as broad; setae on veins long, slender. Medioventral process of male pygofer small, rounded. Anal segment with very long ventrally projecting spine at center of right ventral margin. Forceps long, slender in either lateral or ventral aspect. Aedeagus with single long, slender apical process on left side shaped like a button hook.

Male allotype, and 19 paratypes from Brownsville, Texas, 2-22-46; paratypes same locality March 20-22, 1946. Specimens of both sexes were present in large numbers on the underside of palmetto leaves.

A NEW SPECIES OF NICROPHORUS FROM THE PHILIPPINE ISLANDS (Coleoptera, Silphidae)

By Ross H. Arnett, Jr., *Ithaca, N. Y.*

The following species described as new is the first reported species of *Nicrophorus* from the Philippine Islands and establishes the occurrence of this genus in that region.

Nicrophorus benguetensis, new species

Female: General form and shape as of other members of the subgenus *Nicrophorus;* medium size, black, marked with reddish orange; antennae with the last three segments of the club orange, first segment of the club black; front marked with a small red spot between the eyes; clypeal membrane yellow; pronotum glabrous, black, suboval with feebly sinuate lateral margins, disc finely and sparsely punctuate; elytral shoulders with short yellow hairs which extend the length of the hypomera and end in longer "flying hairs" on the posterior margin; elytral markings reddish orange, the anterior bands interrupted at the suture but extending to the elytral epipleura, with an anterior isolated black spot on each elytra, posterior band interrupted at the suture and elytral epipleura, with an isolated black spot very close to the anterior edge of the band; elytral epipleura totally reddish orange; elytral punctation sparse and shallow, but more dense and sharp than that of the pronotum; metasternal pubescence golden yellow, without black hairs intermixed; metaepimeron black with very short, sparse, yellow hairs; abdominal pubescence black except at tip and base of the first abdominal sternite; hind tibiae straight, posterior angle acute, ending in several short spines. Length 20 mm.

Female genitalia (fig. 1) with the proctiger lobe narrow, without a ridge, with an apical spatula greatly curved dorsally-ventrally and with setae at the apex; paraprocts of normal shape[1] with an apical ridge; lobe of the claw of the valvifer longer than broad; the portion of the claw beyond the lobe about one-fourth the length of the valvifer; coxite with the stylus terminal, one and one-half times as long as broad; external lateral margin of the coxite with a row of heavy setae extending three-fourth the length of the coxite.

Type: Female collected at light on the 10th of June 1945 at Baguio, Mountain Province, Luzon Island, Philippines, by John G. Franclement.

Allotype: Male, same data. Agrees with type in all essential respects, except the eyes are placed well forward on the head; clypeal membrane large, fore tarsal segments expanded. Length 23 mm.

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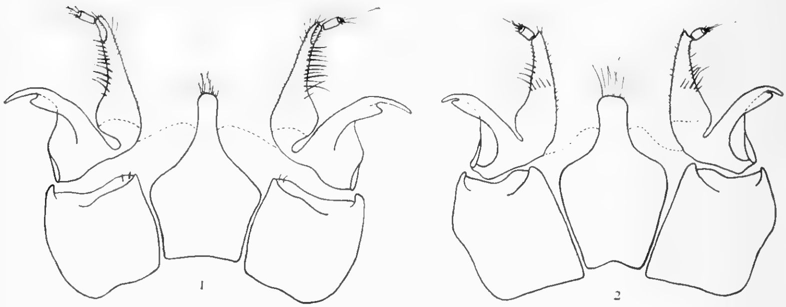
[1]Arnett, R. H., Jr., Jn. N. Y. Ent. Soc., 52:10, 1944.

Paratypes: 2 males, 3 females, same data. Agree with type and allotype and show very little color variation. Length 18-24 mm.

Type locality: On grounds of the Brent School, Baguio. Elevation approximately 4,800 feet.

Named after the subprovince, Benguet. Types in the author's collection.

This species closely resembles *Nicrophorus nepalensis* Hope.[2] But may be separated by the punctation of the elytra. *N. nepalensis* have the elytra deeply and densely punctate, while *benguetensis* have the elytra punctation shallow and sparse. In addition the pronotum and elytra of *benguetensis* are dull in comparison with the shine of *nepalensis*. A less constant character is found in the coloration of the hairs on the elytral epipleura, being yellow the entire length in *benguetensis* and



FEMALE GENITALIA (Dorsal view after dissection)
Fig. 1.—*Nicrophorus benguetensis* n. sp.
Fig. 2.—*Nicrophorus nepalensis* Hope

in *nepalensis* yellow on the basal half and black towards the apex.

The type series of *benguetensis* have a constant color pattern. But specimens of *nepalensis* examined show some variation in the isolated black spot at the apex of the elytra. Some have the spot well isolated, while others have the spot merged into black at the anterior portion of the reddish orange band.

Nicrophorus nepalensis Hope

Description of the female genitalia (fig. 2): Proctiger lobe broad, without a ridge, with an apical spatula greatly curved dorsally-ventrally and with setae at the apex; paraprocts of normal shape with a slight apical ridge; lobe of the claw of the valvifer longer than broad; por-

[2]For figure of this species see Fowler 1912, p. 84.

tion of the claw beyond the lobe about one-eighth the length of the valvifer; coxite with the stylus terminal, twice as long as broad; external-lateral margin with a row of heavy setae extending only one-third the length of the coxite.

Based on the female genitalia the two species, *nepalensis* and *benguetensis*, are related to the Nearctic *pustulatus* Hers.[3] These three species have the following characters in common: a prominent lobe on the claw of the valvifer; lobe longer than broad and without setae; proctiger lobe rounded and greatly curved dorsally-ventrally.

[3]For a figure of the female genitalia of *pustulatus* see Arnett, 1. c. pl. III, fig. 4.

THE LARVA OF PSOROPHORA (JANTHINOSOMA) COFFINI DYAR AND KNAB AND A KEY TO THE PSOROPHORA LARVAE OF THE UNITED STATES AND THE GREATER ANTILLES (Diptera, Culicidae)

By HARRY D. PRATT, *U. S. Public Health Service*

Psorophora coffini Dyar and Knab was described in 1906 from female specimens collected on June 22 and 23, 1903 at Nassau, Bahamas by T. H. Coffin. On Nov. 5, 1920 Dr. E. Pederson collected the larvae of this species in pools following heavy rains at St. Thomas, Virgin Islands, and reared two males and four females which were sent to the late Dr. H. G. Dyar of the U. S. National Museum. Dr. Dyar described this male in 1921 (1) and keyed and figured the male in 1928 (2).

The female is a rather small mosquito, 1.5 mm long, with the toothed claws and beautiful, blue-violet, iridescent color typical of the subgenus *Janthinosoma*. The proboscis is entirely black; the occiput is black, clothed with black setae and whitish scales of two types, some flat and depressed, others erect and forked. The mesonotum has many small, yellowish scales, thickest at the margins, but none of the black scales centrally as in *Psorophora varipes* (Coquillett) of southeastern United States. Abdomen with apical, lateral, yellow or whitish, triangular spots. Legs black with violaceus reflections, basal three-fourths of hind femora whitish, fourth segment of hind tarsus white. Wings with dark narrow scales only.

This species is most closely allied to *Psorophora* (*Janthinosoma*) *johnstonii* Grabham originally described from Jamaica and its synonym *P. schwarzii* Dyar and Knab from Cuba. *Coffini* has the "hind femur indistinctly white- tipped," while *johnstonii* is separated by Dyar (2) by having the "hind femur distinctly white-tipped." The writer has in his collection specimens which were collected by G. A. Thompson, Jr., at Portland Ridge, Jamaica, B.W.I. some forty miles west of the type locality of *johnstonii,* one female from Ponce, P. R., collected by J. Maldonado Capriles, and a series of females from Culebrita, P. R. These are considerably larger and stouter mosquitoes, 3 mm. long, with the more distinctly white tip on the hind femur characteristic of *johnstonii.* Moreover, they all were collected within a mile of coastal mangrove-pickleweed swamps. The *coffini* larvae and females described in this paper from St. Croix, and compared with the type series of *coffini* in the U. S. National Museum by Dr. Alan Stone, are noticeably smaller and were collected three miles inland under quite different ecological conditions. Until larvae and males of both species are known from the type localities, it seems wisest to call the present species *coffini* following the usage of Dr. Dyar for the St. Thomas specimens (1). If the two species are later found to be synonymous, the correct name is *johnstonii* Grabham which was described in 1905 whereas *coffini* Dyar and Knab dates from 1906.

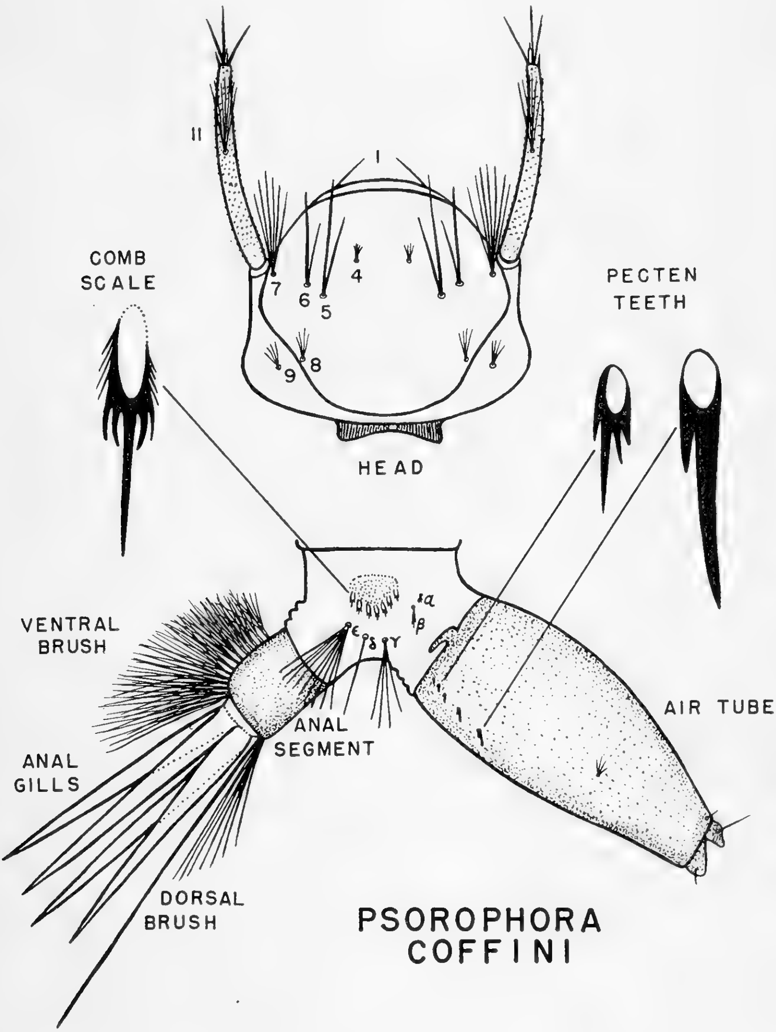
The hitherto unknown larvae of this species is now described from specimens reared in St. Croix, Virgin Islands. Notes on the biology are added with a key to the larvae of *Psorophora* known from the United States and the Greater Antilles.

Biology

On Dec. 18 and 19, 1945, H. D. Pratt collected 8 larvae and reared seven females from a collection made in the Upper Love section of Fredericksted, St. Croix, Virgin Islands. The pool was located in a depression in a dry valley, densely shaded by a thick growth of *Ficus*-like trees with long aerial roots trailing almost to the ground and overgrown with the spiny leguminous vine *Guilandia crista* (L) Small. The pool itself was absolutely devoid of vegetation, full of cattle hoof prints, and grossly polluted. Associated mosquito larvae were *Psorophora confinnis* (L.A.), *Culex nigripalpus* Theobald, *Aedes tortilis* (Theobald), and *Anopheles grabhamii* Theobald. No larvae were found in sunlit pools 25 feet away, which suggests that *coffini* larvae, like other *Psorophora* (*Janthinosoma*) larvae, are found most frequently in densely shaded places. Third and fourth larval stages were each completed in a day or two and the pupal stage in 36 to 48 hours. This suggests six to ten days are required from hatching of the egg to emergence of the adults under optimum conditions.

Description of Larva

The larva of *Psorophora* (*Janthinosoma*) *coffini* is very similar to the larva of *Psorophora* (*Janthinosoma*) *horrida* (Dyar and Knab) as redescribed and figured by Roth (5).



Head broader than long. Antenna eight or nine-tenths as long as the median length of head, spinulate throughout, slightly curved, antennal tuft (No. 11) slightly beyond middle, 6- to 12-branched; postclypeal hairs (No. 4) small, fine, multiple; upper head hairs (No. 5) double, lower head hairs (No. 6) double or triple, both with inner branches shorter than the outer branches; anteantennal tuft (No. 7) multiple.

Integument smooth. Lateral abdominal hairs composed of two large, multiple tufts on segments I and II, on segments III to VI, the lateral hairs vary from single to multiple, usually multiple, with a large, single hair on segment VII. Eighth abdominal segment with 6 or 7 comb scales arranged in an arc at the posterior and of a weakly sclerotized plate. Each scale has a long central spine flanked on each side by one or two smaller teeth and several progressively smaller denticles. Pentad group of hairs behind comb scales present, the *alpha* and *beta* hairs very small and inconspicuous, between comb scales and air tube, *gamma* and *epsilon* hairs large and multiple-branched; *delta* hair long and single.

Air tube inflated, 2.5 to 3.5 times as long as basal width, usually about 2.8 times as long as basal width, with 3 to 8 short pecten teeth. These may have one to several basal denticles on one or both sides as in Roth's (5) illustrations of these structures in larvae of *Psorophora horrida* and *longipalpis*. A minute multiple ventral tuft, whose branches are usually shorter than the length of the apical pecten tooth arises ventro-laterally on the apical third of the air tube. Dorsal preapical spine about half as long as last pecten tooth, and one-third as long as dorsal apical hair.

Anal segment slightly longer than wide, ringed by sclerotized plate, ventral brush consisting of 13 to 14 hair tufts which perforate the plate along the mid-ventral line; dorsal brush a long, stout hair and shorter multiple tuft on each side; saddle hair small and multiple, branched a short distance from the base. Four tapering anal gills two to four times as long as anal segment.

The length of the upper and lower head hairs (Nos. 5 and 6), which Roth (5) used as a primary character in separating *horrida* and *longipalpis* larvae, vary considerably in *coffini* larvae. Whole larval mounts show these hairs to extending to the clypeus, as drawn in Plate I, while larval skins show these same hairs extending barely to the preclypeus as in Roth's (5) drawing of *horrida* larvae. The difference apparently is due to the convexity of the head in whole mounts and flattening of the preparations in cast larval skin mounts.

The larvae of *Psorophora* (*Janthinosoma*) are separated by rather fine characters. In order to show the relationship of the previously undescribed larva of *coffini* to the other species, and to Roth's (5) recently described *longipalpis*, the following key has been constructed for the species of *Psorophora* known from the United States and the Greater Antilles. This key is adapted from those of Dyar (2), King, Bradley and McNeel (3) and Matheson (4).

Key to Larvae of Psorophora in the United States and the Greater Antilles

1. Pecten of air tube with numerous teeth (20 or more) which are prolonged into hairs; mouth brushes prehensile, consisting of stout hairs hooked at tip and with a row of comb-like teeth along the side; tuft of air tube a single long hair 2
   Pecten of few teeth (less than 10) which are not prolonged into hairs; mouth brushes not prehensile, consisting of long hairs only; tuft of air tube never a single long hair 3
2. Lateral hair of anal segment 3- or 4-branched; pecten reaching about the middle of air tube .... *ciliata* (Fabricius)
   Lateral hair of anal segment single or forked some distance from base; pecten not reaching middle of air tube *howardii* Coquillett
3. Antenna very large, inflated apically, two long bristles at outer third in addition to central hair tuft; air tube short, not inflated, with large, multiple tuft .... *discolor* (Coquillett)
   Antenna not as described above; air tube strongly inflated, the tuft small or obsolete 4
4. Both upper and lower head hairs multiple 5
   Upper and lower head hairs not both multiple 6
5. Upper and lower head hairs usually with 5 or more branches; anal gills always longer than wide .... *confinnis* (L.A.)
   Upper and lower head hairs usually 3-branched; anal gills bud-like, about as long as wide .... *insularius* (Dyar and Knab)
6. Upper and lower head hairs single 7
   Upper head hairs double or triple 9
7. Air tube with a pair of long hairs at tip (dorsal apical hair) 3 to 8 times as long as distal pecten tooth 8
   Air tube with these hairs 1 to 3 times as long as distal pecten tooth .... *pygmaea* (Theobald)
8. Antennal and preantennal hair tufts multiple, conspicuously feathered; tip of antenna with three short apical spines and two longer subapical spines; six to eight comb scales *signipennis* (Coquillett)
   Antennal and preantennal hair tufts with two or three branches, some of which may be secondarily divided, sparsely feathered; antenna with 3 or 4 stout spines arising at tip; three or four comb scales .... *cyanescens* (Coquillett)
9. Antenna distinctly longer than median length of head 10
   Antenna shorter than, or rarely as long as, median length of head 11

10. Long lateral hairs on abdominal segments IV, V, and VI multiple .... *longipalpis* Roth
    Long lateral hairs on abdominal segments IV double, on V and VI single .... *ferox* (Humboldt)
11. Eighth abdominal segment with four or five comb scales *varipes* (Coquillett)
    Eighth abdominal segment with five or eight comb scales 12
12. Upper and lower head hairs extending anteriorly to about base of antenna, never beyond preclypeous; air tube usually more than three times as long as basal width (Eastern United States) .... *horrida* (Dyar and Knab)
    Upper and lower head hairs extending anteriorly to beyond base of antenna, often beyond preclypeus; air tube usually 2.5 to 3 times as long as basal width (Bahamas, Greater Antilles, Virgin Islands) .... *coffini* (Dyar and Knab)

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A KEY TO THE AEDES FEMALES OF AMERICA NORTH OF MEXICO (Diptera, Culicidae)

By C. M. GJULLIN, *United States Department of Agriculture, Bureau of Entomology and Plant Quarantine*[1]

Females of the genus *Aedes* are usually more easily collected than the larvae or males, but they are frequently more difficult to identify. In many instances positive species determination cannot be made without males or larvae. Since the economic importance of these insects is due entirely to the activities of the females, more effective means of identifying them directly seemed desirable.

Examination of the females of this group in the U. S. National Museum and in collections made in the Northwestern States have revealed a number of new characters, which are used in the present key to facilitate species determination. Some of these characters are minute, but are, nevertheless, valuable aids in identifying the species involved.

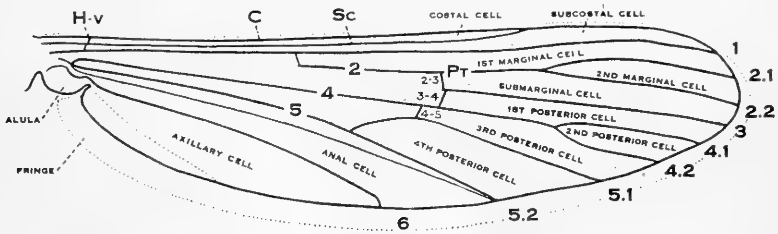

Figure 1.—Wing of *Aedes* mosquito, illustrating venation. (Modified from Ross and Roberts (*10*). *H-v*, humeral cross-vein; *C*, costa; *Sc*, subcosta; *Pt*, petiole of vein 2; 1, 2.1, 2.2, 3, 4.1, 4.2, 5.1, 5.2, and 6, numbered longitudinal veins and their branches.

The presence of white scales on the base of the costal vein of the wing has been used by Peus (*9*) for separating *Aedes punctor* (Kirby) and *A. communis* (DeGeer). This character

[1]The writer wishes to thank Alan Stone, of the Bureau of Entomology and Plant Quarantine, for many valuable suggestions and for assistance during the course of this investigation and in the preparation of the key.

has been found to be useful in differentiating a number of other species in this group. Only one or two pale scales at the very base of the vein may be present in some specimens, but this is sufficient to separate these species from the species in which the wings are entirely dark-scaled.

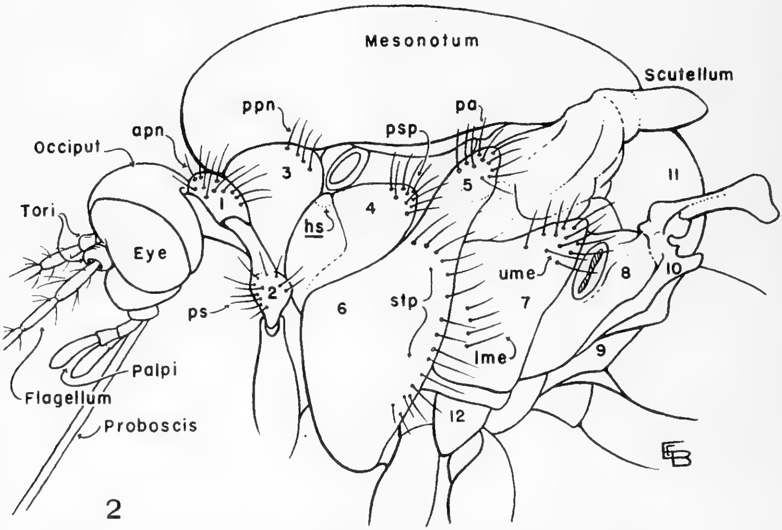

Figure 2.—Lateral view of *Aedes* head and thorax. *hs*, Hypostigial spot of scales. Sclerites of the thorax: 1, anterior pronotum; 2, proepisternum; 3, postpronotum; 4, mesanepisterum; 5, prealar area; 6, sternopleuron; 7, mesepimeron; 8, metepisternum; 9, meteusternum; 10, metepimeron; 11, postnotum; 12, meron. Setae: *apn*, anterior pronotal; *ps*, proepisternal; *ppn*, postpronotal; *psp*, postspiracular; *pa*, prealar; *st*, sternopleural; *ume*, upper mesepimeral; *lme*, lower mesepimeral.

In North America the genus *Aedes* has included several species of doubtful validity. The material comprising these species has been examined, and those that have been found to be identical with other well-established species have been listed as synonyms. Sixty species of this genus are now known to occur in America north of Mexico.

Key to Aedes Females

1. Tarsal segments ringed with white 2
   Tarsal segments not ringed with white 23
2. Tarsi with white rings at both ends of segments 3
   Tarsi with white rings at bases of segments only 8
3. Wing scales black and white intermingled 4
   Wing scales uniformly dark or with some white scales on anterior veins 5

4. Wing scales uniformly mottled black and white .... *campestris*
Wing scales not uniformly mottled; third vein with more dark scales than second and fourth .... *dorsalis*
5. Base of costa with white scales 6
Base of costa dark-scaled 7
6. Palpi marked with white bands; scutellum with broad white scales .... *varipalpus*
Palpi dark brown; scutellum with narrow yellow scales .... *atropalpus*
7. Mesonotum uniformly golden brown; tarsus of hind leg distinctly white-banded, the apical segment entirely white-scaled .... *canadensis*
Mesonotum with narrow median line of golden brown and border of black scales; sides yellowish white; tarsus of hind leg narrowly white-banded, the apical segment predominantly dark-scaled .... *mathesoni*
8. Proboscis of female ringed with white 9
Probosis of female not ringed with white 12
9. Abdomen without a longitudinal, pale dorsal stripe of scales .... *taeniorhynchus*
Abdomen with a longitudinal pale dorsal stripe of scales 10
10. Wing scales dark (mesonotum golden yellow, with narrow border of dark-brown scales at the sides) .... *mitchellae*
Wing scales black and white intermingled 11
11. First segment of hind tarsus with broad median ring of white scales in addition to basal white ring; lateral spots of tergites usually not conclorous with median stripe; last segment of hind tarsus white .... *sollicitans*
First segment of hind tarsus without median white ring; basal ring usually broadly extended by scattered white scales, lateral spots of tergites usually conclorous with median stripe; last segment of hind tarsus not all white .... *nigromaculis*
12. Mesonotum marked with silvery-white scales in definite lines or areas 13
Mesonotum without definite lines or areas of silvery scales 14
13. Mesonotum with curving lyre-shaped lines of silvery scales .... *aegypti*
Mesonotum broadly silver-scaled on anterior half with faint median golden brown stripe; posterior half mostly dark-brown .... *zoosophus*
14. Basal white rings of tarsal segments broad, especially on the hind legs 15
Basal white rings of tarsal segments narrow 22
15. Scales of the wings broad and triangularly shaped, with dark and pale scales evenly distributed over wings 16
Scales of wings long and narrow, with dark and pale scales unevenly distributed or with pale scales absent 17

16. Proboscis predominantly dark-scaled; mesonotum with broad median dark-brown stripe changing to golden brown in front, the stripe greatly widened posteriorly; sides white ...... *grossbecki*
    Proboscis predominantly pale-scaled, mesonotum with broad median brown stripe, widened posteriorly; sides yellowish white ...... *squamiger*
17. Abdomen without bands and clothed with yellow scales; mesonotum yellowish brown with darker median area ...... *flavescens*
    Abdomen dark-scaled with white or gray dorsal bands 18
18. Lower mesepimeral bristles absent 19
    Lower mesepimeral bristles present (mesonotum with a broad median brown stripe or varied pattern of brown and yellowish white scales; sides yellowish white) 20
19. Tori with inner surfaces predominantly dark-scaled; mesonotum with golden brown scales ...... *riparius*
    Tori with inner surfaces predominantly white-scaled; mesonotum with a median brown stripe, a variable pattern of brown and white, or completely reddish brown-scaled ...... *excrucians*
    ...... *fitchii* (in part)
20. Torus without white scales on dorsal half; palpus without hairs on basal half of apical segment at inner ventral edge ...... *increpitus*
    Torus with white scales on dorsal half or with apical segment of palpus completely covered with large hairs at inner ventral edge, or with both 21
21. Lower mesepimeral bristles rarely more than two; torus with white scales on dorsal half ...... *fitchii* (in part)
    Lower mesepimeral bristles three or more; torus with or without white scales on dorsal half ...... *stimulans*
22. Lower mesepimeral bristles absent; occiput with patch of flat black scales bordering top edge of flat white lateral patch ...... *vexans*
    Lower mesepimeral bristles present; occiput without patch of flat black scales bordering top edge of flat white lateral patch ...... *cantator*
23. Postspiracular bristles absent ...... *purpureipes*
    Postspiracular bristles present 24
24. Mesonotum with integument marked with a pair of black spots on posterior half 25
    Mesonotum with integument not marked with black spots 26
25. Pleura of thorax with one black spot; abdomen with apical triangular black-scaled areas on tergites ...... *fulvus pallens*
    Pleura of thorax without a back spot; abdomen almost entirely covered with yellow scales ...... *bimaculatus*
26. Mesonotum marked with a median silvery white stripe or patch, or with sides and anterior margins clothed with silvery white scales 27
    Mesonotum not marked with silvery white scales 30

27. Mesonotum with a central area of dark-brown scales broadening posteriorly; the sides and anterior margins clothed with silvery white scales .... *triseriatus*
Mesonotum with a median stripe or patch of silvery white scales 28

28. Mesonotum with a broad median silvery patch not reaching to the scutellum .... *infirmatus*
.... *scapularis*
Mesonotum with narrow median stripe of silvery white scales extending over scutellum 29

29. Coxa of front leg covered with white scales .... *dupreei*
Coxa on front leg with central patch of brown scales on anterior surface .... *atlanticus*
.... *tormentor*

30. Mesonotum with two parallel white or yellowish white stripes separated by a brown median stripe of about the same width; sides brown; (abdomen without basal white bands or infrequently with narrow ones) .... *trivitattus*
Mesonotum not marked with two white stripes 31

31. Tergites of abdomen with median basal triangular white spots (mesonotum clothed with pale-yellow scales with or without a median light-brown stripe) .... *thelcter*
Tergites of abdomen with complete or partial basal pale bands or without bands 32

32. Wing scales distinctly bicolored 33
Wing uniformly dark or nearly so 35

33. Wing scales dark and pale intermixed, the dark predominating; lower mesepimeral bristles present .... *niphadopsis*
Wing veins alternating black and white; lower mesepimeral bristles absent 34

34. Abdomen with dorsal pale stripe or more or less completely covered with pale scales .... *spencerii*
Abdomen without median dorsal pale stripe .... *idahoensis*
.... *klotsi*

35. Mesonotum without lines or stripes 36
Mesonotum with lines or stripes 43

36. Lower mesepimeral bristles absent 37
Lower mesepimeral bristles present 39

37. Coxa of front leg with central area of brown scales on anterior margin (mesonotum uniformly brown) .... *cinereus*
Coxa of front leg with anterior surface clothed with white scales 38

38. Mesonotum brown with margin of yellowish scales .... *ventrovittis*
Mesonotum dark brown with margin of gray scales .... *cacothius*

39. Torus with integument of outer side yellow to light brown or rarely darker 40
Torus with integument of outer side dark brown or black 41

40 Venter of abdomen with all segments white-scaled; mesotonum uniformly bronzy brown to light brown; rarely with indications of median brown lines .... *intrudens*
Venter of abdomen with some segments black-scaled apically mesonotum reddish brown with dark brown stripes or without stripes .... *punctor* (in part)
.... *implacabilis* (in part)

41. Scutellum with bronzy brown scales (mesonotum with bronzy brown scales) .... *nigripes*
Scutellum with pale yellowish scales 42

42. Mesonotum gray around the sides with golden brown scales in the middle, which sometimes show faint dark lines .... *cataphylla*
Mesonotum with dark-brown or bronzy scales, sometimes with a pair of lighter spots centrally .... *nearcticus*

43. Lower mesepimeral bristles absent 44
Lower mesepimeral bristles present 48

44. Abdomen with basal white bands on more than half of the segments 45
Abdomen without basal white bands or with narrow bands on less than half of the segments 46

45. Hypostigial spot of scales absent; mesonotum with two golden brown stripes with or without a faint pale median line; sides yellowish white .... *sticticus*
Hypostigial spot of scales present; mesonotum with definite median white stripe and parallel dark-brown stripes; sides white .... *muelleri*

46. Abdomen with venter completely white-scaled (mesonotum with a brown stripe gradually broadening posteriorly; sides yellow) .... *aurifer*
Abdomen with some of the segments of the venter brown-scaled apically 47

47. Mesonotum with a median dark-brown stripe widening sharply just behind the middle; sides lemon yellow .... *thibaulti*
Mesonotum with two narrow brown stripes separated by a faint line of yellow scales; sides yellow .... *diantaeus*

48. Wings with base of costa and also sometimes base of vein 1 with white or yellowish white scales 49
Wings with base of costa and vein 1 dark-scaled 53

49. Hypostigial spot of few to many white scales 50
Hypostigial spot of scales absent 51

50. Torus with integument of outer side dark-brown or black; mesonotum with a bare median line, and slightly wider parallel brown stripes with bordering stripes of darker brown; sides yellowish brown .... *pullatus*
Torus with integument of outer side usually yellow to light-brown; mesonotum with median brown stripe expanded in

width behind the middle; sides grayish white .... *trichurus*
.... *impiger* (in part)

51. Proboscis with yellowish gray scales on ventral side; (mesonotum with paired bronzy brown stripes separated by a wider golden brown stripe; sides light brown) .... *schizopinax*
Proboscis with brown scales on ventral side 52

52. Mesonotum golden brown with paired dark-brown stripes which are sometimes joined; integument of tori black or dark-brown .... *hexodontus*
Mesonotum yellow or rarely gray with paired brown lines or variable pattern; integument of tori varying from yellow to black .... *communis*
Mesonotum yellow or rarely gray, with dark broad stripes narrowed at the back and extending to the scutellum .... *pionips*
Mesonotum with median broad brown stripe, paired brown stripes, or variable pattern; margins grayish white .... *impiger* (in part)

53. Mesonotum with sides gray to pale grayish yellow (median area with a reddish brown stripe extending back three-fourths) .... *prolixus*
Mesonotum with sides yellowish to reddish brown 54

54. Mesonotum yellowish to light golden brown with dark-brown stripes and posterior half-lines .... *aboriginis*
Mesonotum reddish brown with dark-brown stripes or without stripes .... *implacabilis* (in part)
.... *punctor* (in part)

DISTINGUISHING CHARACTERS

Subgenus **Ochlerotatus** Lynch Arribálzaga

Aedes (O.) campestris Dyar and Knab

Aedes campestris Dyar and Knab, Jour. N. Y. Ent. Soc. 15:213, 1907.

Mesonotum yellowish white with median brown stripe, the sides with a narrow brownish margin. Abdomen black with median white line, and apical and basal white bands forming small paired segmental dark areas. Wing scales pale and dark, evenly intermixed. Legs with dark and pale scales, tarsi dark with basal and apical white bands except on last two segments of mid tarsus and last three segments of fore tarsus.

Aedes (O.) dorsalis (Meigen)

Culex dorsalis Meigen, Syst. Beschr. Bek. Eur. Zweifl. Ins. 6:242, 1830.
Aedes melanimon Dyar, Ins. Ins. Mens. 12:126, 1924.

Mesonotum yellowish white with a median brown stripe or with only a few brown scales medianly; posterior brown half-lines and side lines may or may not be present. Abdomen with apical and basal white bands and complete or partial median white line; the last one or two segments may be entirely white-scaled. Wing scales black and white; the costa, first, third, and fifth veins with more black scales than the others. Legs with dark and pale scales; tarsi dark with apical and basal white bands on all but last two segments of mid tarsus and last three segments of fore tarsus.

Aedes (O.) canadensis (Theobald)

Culex canadensis Theobald, Mon. Culic. 2:3, 1901.

Mesonotum reddish brown with pale yellow scales around the margins. Abdomen black without basal white bands or with narrow indistinct ones; the sides with triangular white spots. Wing scales all dark. Legs black; hind and mid tarsal segments apically and basally white banded; fore tarsus banded on first and second segments; last segment of hind leg entirely white-scaled.

Aedes (O.) mathesoni Middlekauff

Aedes mathesoni Middlekauff, Proc. Ent. Soc. Wash. 46:42, 1944.

Mesonotum with narrow median line of golden brown and border of black scales; yellowish white scales at the sides, front, and middle. Abdomen black without basal white bands, the sides with triangular white spots. Wing scales dark. Legs black; basal and apical white bands on all first tarsal segments and on bases of second; hind tarsus white banded at apex of second and base of third segment, the last segment sometimes with a line of white scales.

Aedes (O.) taeniorhynchus (Wiedemann)

Culex taeniorhynchus Wiedemann, Dipt. Exot. p. 43, 1821.

Proboscis of female ringed with white. Mesonotum golden brown with grayish white scales around the antescutellar space. Abdomen with basal segmental white bands. Wing scales dark. Legs black with tarsi white-banded except on the last segments of the hind tarsus, which is all white, and the last fore and mid tarsal segments, which are all black.

Aedes (O.) mitchellae (Dyar)

Culex mitchellae Dyar, Jour. N. Y. Ent. Soc. 13:74, 1905.

Proboscis of female with a white ring. Mesonotum with golden yellow scales and brown ones on the sides, the colors somewhat blended. Abdomen black, with narrow segmental basal white bands and a median line of white scales. Wing scales dark, with a few white scales near the base of the costa. Legs black; femora and tibiae with mixture of white scales; tarsi with basal white bands.

Aedes (O.) nigromaculis (Ludlow)

Grabhamia nigromaculis Ludlow, Geo. Wash. Univ. Bul. 5:85, 1907.

Proboscis of female ringed with white. Mesonotum with varying stripe of yellowish scales; the lateral spots usually concolorous with the brown sides. Abdomen black with basal segmental bands and median stripe of yellowish scales; the lateral spots usually concolorous with the median stripe. Wing scales pale and dark, the dark predominating. Femora and tibiae partially pale-scaled; tarsi black with basal white bands; the last segment of the hind tarsus rarely all white, the white band on the first segment broadly extended by scattered white scales.

Aedes (O.) sollicitans (Walker)

Culex sollicitans Walker, Ins. Saund. p. 427, 1856.

Proboscis of female ringed with white. Mesonotum with golden brown scales and faint paired lines of lighter brown. Abdomen black with basal segmental bands and median lines of yellowish white scales; the lateral spots usually not concolorous with median stripe. Wing scales pale and dark intermixed, the dark predominating. Femora and tibiae partially pale-scaled; tarsi black with basal white bands except on the last segment of the hind tarsus, which is all white; the first segment of the hind tarsus with a broad median ring of white scales, in addition to the basal white ring.

Aedes (O.) grossbecki Dyar and Knab

Aedes grossbecki Dyar and Knab, Jour. N. Y. Ent. Soc. 14:201, 1906.

Proboscis dark-scaled with a few pale scales near the base. Mesonotum with broad median dark-brown stripe changing to golden brown in front, the stripe greatly widened posteriorly, the sides white. Abdomen black with basal white bands. Wings with pale and dark scales which are broad, triangularly shaped and evenly intermixed. Legs pale and dark-scaled; tarsi black with basal white bands on all but last segments of the fore and mid tarsi.

Aedes (O.) squamiger (Coquillett)

Culex squamiger Coquillett, Proc. U. S. Natl. Mus. 25:85, 1902.

Proboscis predominantly pale-scaled with a mixture of darker scales toward the ends. Mesonotum with more or less distinct median brown stripe widening behind the middle; margins grayish white; sides mottled brown and white. Abdomen black with basal medianly expanded white bands. Wings with pale and dark scales which are broad, triangularly shaped and evenly intermixed. Legs with femora, tibiae, and first tarsal segments black- and white-scaled; the other tarsal segments black with basal white bands except on the last two segments of fore tarsus and last segment of mid tarsus, which are all black.

Aedes (O.) flavescens (Muller)

Culex flavescens Muller, Faun. Ins. Fried. p. 87, 1764.

Mesonotum yellowish to brown with a broad median stripe of slightly darker-brown scales. Abdomen covered with dull yellow scales or with a dark median line and sides partially black-scaled anteriorly. Wing with a mixture of black and yellow scales. Legs brown with a mixture of yellow scales; tarsi with broad basal white bands.

Aedes (O.) riparius Dyar and Knab

Aedes riparius Dyar and Knab, Jour. N. Y. Ent. Soc. 15:213, 1907.

Tori with inner surfaces predominantly dark-scaled. Mesepimeral bristles absent. Mesonotum golden brown scaled with a few yellowish white scales around the margins. Abdomen black with evenly intermingled white scales and basal white bands. Wings predominantly dark-scaled with pale scales intermixed. Femora, tibiae, and first tarsal segments largely pale-scaled; tarsi with basal white bands, which are broader on the hind legs.

Aedes (O.) excrucians (Walker)

Culex excrucians Walker, Ins. Saund. p. 429, 1856.
Aedes aloponotum Dyar, Ins. Mens. 5:98, 1917.

Tori with inner surfaces predominantly white-scaled. Mesonotum yellowish white with a median brown stripe, varied pattern of brown and white scales or completely reddish brown-scaled. Mesepimeral bristles absent or rarely there may be one. Abdomen black with basal segmental white bands and frequently with scattered white scales. bristles absent or rarely there may be one. Abdomen black with basal Wings predominantly dark-scaled with pale scales intermixed. Legs black; tarsal white bands broad on hind legs and usually absent on last segment of mid tarsus and last two segments of fore tarsus.

Aedes (O.) stimulans (Walker)

Culex stimulans Walker, List Dipt. Brit. Mus. 1:4, 1848.

Torus with or without white scales on dorsal half. Palpus with ventral side of apical segment completely covered with hairs as long as adjoining scales or longer. Mesonotum yellowish white to light brown with a broad median brown stripe or variable pattern of brown and light scales Mesepimeral bristles three or four, rarely one or two. Abdomen black with basal segmental white bands. Wings completely dark-scaled or with an admixture of white ones along the costa. Legs black, tarsi with basal white bands on all except the last two segments of fore tarsus and first segment of mid tarsus, the white bands broader on the hind legs.

Aedes (O.) fitchii (Felt and Young)

Culex fitchii Felt and Young, Science (n.s.) 20:312, 1904.

Torus with white scales on dorsal half. Palpus with ventral side of apical segment usually covered with hairs as long as adjoining scales or longer. Mesonotum yellowish white to light brown with a broad median brown stripe or variable pattern of brown and light scales. Wings dark-scaled, usually with an admixture of white scales along the costa. Mesepimeral bristles none to two, rarely three or four. Abdomen black with basal white bands, and sometimes with apical white scales which may extend into a median white line. Legs black, tarsi with basal white bands on all except the last two segments of fore tarsus and first segment of mid tarsus, the white bands broader on the hind legs.

Aedes (O.) increpitus Dyar

Aedes increpitus Dyar, Ins. Ins. Mens. 4:87,1916.

Torus without white scales on dorsal half. Palpus without hairs on a narrow strip bordering the scales on inner ventral edge of the apical segment, or with hairs near the apex of this strip only. Menosotum yellowish white to light brown with a broad median brown stripe or variable pattern of brown and light scales. Mesepimeral bristles one to five. Wing dark with white scales along the costal area. Legs black, tarsi with basal white bands on all except the last two segments of fore tarsus and first segment of mid tarsus, the white bands broader on the hind legs.

The absence of white scales on the dorsal surface of the torus easily distinguishes this species from *A. fitchii.* The characters of the palpus serve to separate it from those *A. stimulus* specimens that do not have the white scales on the dorsal surface of the torus.

Aedes (O.) cantator (Coquillett)

Culex cantator Coquillett, Can. Ent. 36:255, 1903.

Occiput with lateral patch of flat white scales bordered at the top edge by slender pale scales and dark upright forked-scales. Mesonotum reddish brown with faintly contrasting median stripe. Lower mesepimeral bristles one to three, or rarely with none. Abdomen black with basal white bands, narrow medianly and widening at the sides, the last two segments nearly all pale-scaled. Wing scales dark. Legs with brown and pale scales; tarsi dark with basal white rings

Aedes (O.) fulvus pallens Ross

Aedes fulvus pallens Ross, Proc. Ent. Soc. Wash. 45:148, 1943.

Aedes fulvus Dyar (in part), Mosq. of the Amer. p. 154, 1928.

Proboscis yellow-scaled with black tip. Mesonotum yellow with a pair of black spots on posterior half. Pleura of thorax with one black spot. Abdomen clothed with yellow scales except for black-scaled areas on apical half of first five tergites. Wing scales yellow on costa, auxiliary, and first vein to fork of second vein, the rest of the scales dark. Legs yellow with tips of femora, tibiae, and first tarsal segments black; the other segments with varying amounts of black.

Aedes (O.) bimaculatus (Coquillett)

Culex bimaculatus Coquillett, Proc. U. S. Nat. Mus. 25:84, 1902.

Aedes bimaculatus (Coquillett), Ross, Proc. Ent. Soc. Wash. 45:143, 1943.

Proboscis yellow-scaled with mixture of darker scales on apical half. Mesonotum with pair of black spots on posterior half. Pleura of thorax yellow. Abdomen golden-scaled with first two or three tergites partially dark-scaled. Wings dark except at the base of coastal vein. Legs yellow with femora and tibiae partially dark-scaled; tarsi mostly dark-scaled.

Aedes (O.) trivittatus (Coquillett)

Culex trivittatus Coquillett, Jour. N. Y. Ent. Soc. 10:193, 1902.

Mesonotum with two yellowish white stripes separated by a median brown stripe of approximately the same width; anterior margin yellowish white; lateral margins brown. Abdomen with basal segmental lateral white patches and usually without white bands or with narrow ones on some segments. Wing scales dark. Legs black with femora partially pale-scaled.

Aedes (O.) scapularis (Rondani)

Culex scapularis Rondani, Studi Ent. Baudi e Truqui, p. 109, 1848.

Mesonotum brown-scaled with a broad anterior median patch of silvery-white scales extending to the middle; the sides and front with a margin of brown scales. Abdomen black with basal lateral triangular white spots. Wing scales dark. Legs black with femora and tibiae partially white-scaled.

Aedes (O.) infirmatus Dyar and Knab

Aedes infirmatus Dyar and Knab, Jour. N. Y. Ent. Soc. 14:190, 197, 1906.

The characters of this species are the same as those of *A. scapularis*.

Aedes (O.) atlanticus Dyar and Knab

Aedes atlanticus Dyar and Knab, Jour. N. Y. Ent. Soc. 14:190, 198, 1906.

Tori with light brown hairs on inner margins. Occiput with a white stripe of scales medianly, bordered by a patch of brown and followed by light-brown scales on the sides. Mesonotum brown with a narrow median silvery stripe extending over scutellum. Coxae of front legs with a small patch of white scales on the top anterior surface followed by a large patch of brown scales and sometimes with a small patch of white scales below. Abdomen black with basal white lateral spots. Wing scales dark. Legs black.

Aedes (O.) tormentor Dyar and Knab

Aedes tormentor Dyar and Knab, Jour. N. Y. Ent. Soc. 14:189, 191, 1906.

The characters of the female of this species are the same as those of *A. atlanticus*.

Aedes (O.) dupreei (Coquillett)

Culex dupreei Coquillett, Can. Ent. 36:10, 1904.

Females of this species are similar in appearance to *A. atlanticus* and *A. tormentor* except for the completely white-scaled coxae of the front legs. The female is approximately 3 mm. long, as compared with 4 to 5 mm. for *A. atlanticus* and *A. tormentor*.

Aedes (O.) thelcter Dyar

Aedes (*Taeniorhynchus*) *thelcter* Dyar, Ins. Ins. Mens. 6:129, 1918.

Mesonotum clothed with pale yellow scales with or without a median light-brown stripe. Abdomen black with median basal triangular white spots. Wing scales dark. Legs black; femora, tibiae, and first tarsal segment pale-scaled beneath.

Aedes (O.) niphadopsis Dyar and Knab

Aedes niphadopsis Dyar and Knab, Ins. Ins. Mens. 5:166, 1918.

Mesonotum with a median brown stripe and usually with posterior half-lines; the margins, sides, and antescutellar space with white scales. Lower mesepimeral bristles two or three or rarely with none. Abdomen black with basal white bands with or without a median line of white scales. Wings with a mixture of pale and dark scales; the dark predominating. Legs with a mixture of pale and dark scales.

Aedes (O.) idahoensis (Theobald)

Grabhamia specerii var. *idahoensis* Theobald, Mon. Culic. 3:250, 1903.

Aedes idahoensis Howard, Dyar, and Knab, Mosq. N. and Cent. Amer. and W. I. 4:727, 1917.

Mesonotum with a broad reddish brown stripe, usually separated by a fine line of grayish scales; faint posterior half-lines present or absent; sides and antescuteller space with grayish white scales. Lower mesepimeral bristles absent. Abdomen black with broad basal white bands. Wing with costa, first, third, and fifth veins dark-scaled, the other vein with pale scales. Legs mostly pale-scaled; femora, tibiae, and some of apical tarsi partially dark-scaled outwardly.

Aedes (O.) spencerii (Theobald)

Culex spencerii Theobald, Mon. Culic. 2:99, 1901.

Mesonotum yellowish gray-scaled with a broad median stripe of brown and more or less developed posterior half-lines. Lower mesepimeral bristles absent. Abdomen black with median white stripe and apical and basal white bands, or the dorsum may be entirely white-scaled. Wing with costa; first, third, and fifth veins dark-scaled, the others with pale scales. Femora, tibiae, and first segments of tarsi partially pale-scaled; the other segments nearly all dark-scaled.

Aedes (O.) klotsi Matheson

Aedes klotsi Matheson, Proc. Ent. Soc. Wash. 35:69, 1933.

"Mesonotum almost black, clothed with numerous curved scales, yellowish-brown predominating on the median area and whitish to yellowish-white on the sides and anterior margin. . . . Abdomen brownish-black with broad, basal, segmental white bands widening at the sides; venter brownish, densely white scaled. Legs brownish-yellow, the tarsal segments being nearly black; femora heavily white scaled especially on the ventral surface; tibiae with a few white scales intermixed with numerous blackish-brown scales; all tarsal segments black. . . . Wing scales narrow, brownish-black to black.'' (Matheson.)

The larva of this species is unknown. Matheson (7) states that adults have been taken at Mountain Home Lake, Fort Garland, Colo.

Aedes (O.) ventrovittis Dyar

Aedes ventrovittis Dyar, Ins. Ins. Mens. 4:84, 1916.

Torus with integument of outer side varying from yellow to black. Mesonotum brown, darker centrally, a fringe of yellowish scales around the margin. Lower mesepimeral bristles absent. Abdomen black with basal white bands which may be narrow, or absent medianly. Wing scales dark, with or without a mixture of white scales extending outwardly from the bases of the veins. Legs black with a mixture of pale scales; the tarsi mostly black.

Aedes (O.) punctor (Kirby)

Culex punctor Kirby, in Richardson's Fauna Bor.-Amer. 4:309, 1837.

Torus with integument of outer side yellow. Mesonotum golden to reddish brown with dark-brown stripe or lines, or the mesonotum may be entirely reddish brown-scaled. Lower mesepimeral bristles one to five. Abdomen black with basal segmental white bands; venter white-scaled with apices of some of the segments black-scaled medianly. Wings completely dark-scaled, or very rarely with one or more pale scales on base of costa. Legs black, with femora partially pale-scaled.

Aedes (O.) implacabilis (Walker)

Culex implacabilis Walker, List Dipt. Brit. Mus. 1:7, 1848.

The characters of the female of this species are very similar to those of *A. punctor*. The larvae of these two species can be readily distinguished by means of the dorsal brushes on the anal segment, but no consistent differences have been found in the female characters.

Aedes (O.) intrudens Dyar

Aedes intrudens Dyar, Ins. Ins. Mens. 7:23, 1919.

Torus with integument of outer side yellow or light brown. Mesonotum uniformly bronzy or occasionally with indications of median brown stripes. Lower mesepimeral bristles one to five. Hypostigial spot of scales present or absent. Abdomen black with broad basal white bands; venter completely white-scaled. Wing scales dark with or without a small patch of pale scales at base of costa. Legs black with a mixture of pale scales; the tarsi mostly black.

Aedes (O.) cataphylla Dyar

Aedes cataphylla Dyar, Ins. Ins. Mens. 4:86, 1916.

Aedes pearyi Dyar and Shannon, Jour. Wash. Acad. Sci. 15:78, 1925.

Torus with integument of outer side dark-brown or black. Mesonotum gray around the sides with golden brown scales in the middle, which sometimes show faint dark lines. Scutellum with pale yellowish scales. Lower mesepimeral bristles two to seven. Hypostigial spot of scales usually present. Abdomen black with basal segmental white bands. Legs black with a mixture of pale scales; the tarsi mostly black. Wing scales dark with pale scales at base of costa and first vein.

Aedes pearyi Dyar and Shannon, which has been placed as a synonym of this species, was based on three female specimens from Hawks Harbor, Labrador. Males and larvae were unknown.

Aedes (O.) nigripes (Zetterstedt)

Culex nigripes Zetterstedt, Ins. Lapp. p. 807, 1838.

Aedes alpinus (Linneaeus) of authors (not Linnaeus).

Aedes labradorensis Dyar and Shannon, Jour. Wash. Acad. Sci. 15:78, 1925.

Mesonotum with reddish brown scales which extend over scutellum. Lower mesepimeral bristles one to five. Abdomen black with basal white bands. Wing scales dark with a patch of pale scales on base of costa and vein 1. Legs black with femora partially pale-scaled.

Aedes alpinus (L.) of Edwards (*4*) and Dyar (*2, 3*) has been placed as a synonym of *A. nigripes* Zetterstedt, on the basis of statements by Natvig (*8*) and Edwards (*5*) both of whom consider it a synonym of this species.

Females of *A. labradorensis* Dyar from which this species was described appear to be identical with *A. nigripes* and have been included here. Males and larvae of this species were unknown.

Aedes (O.) nearcticus Dyar

Aedes nearcticus Dyar, Rept. Can. Arct. Exp. 3 (C): 32, 1919.

Mesonotum bronzy brown with or without a mixture of yellowish white scales around the sides and two lighter colored patches of scales centrally; the entire surface with many black bristles. Scutellum with pale-yellowish scales. Lower mesepimeral bristles three to eight. Abdomen black with basal segmental white bands. Wing scales dark with a patch of pale scales on the base of the costa. Legs black with femora and tibiae partially pale-scaled.

Aedes (O.) cacothius Dyar

Aedes cacothius Dyar, Ins. Ins. Mens. xi, 44, 1923.

Mesonotum with indications of two median dark stripes; the sides with gray scales. Lower mesepimeral bristles absent. Hypostigial spot of scales absent. Abdomen black with basal white bands. Wing scales dark with patch of pale scales at the base of the costa. Legs black with femora and tibiae partially pale-scaled.

This species was named from six females taken near Shoshone Point in Yellowstone Park, Wyoming. Three of these females were *Aedes nearcticus.* These three specimens had seven or more lower mesepimeral bristles and other typical characters of this species. *Aedes cacothius* is now represented by the three remaining specimens which have no lower mesepimeral bristles.

Aedes (O.) sticticus (Meigen)

Culex sticticus Meigen, Syst. Beschr. Zweifl. Ins. 7:1, 1838.

Culex hirsuteron Theobald, Mon. Culic. 2:98, 1901.

Aedes gonimus Dyar and Knab, Ins. Ins. Mens. 5:165, 1918.

Aedes lateralis (Meigen), Edwards *in* Wytsman, Gen. Ins. 194:144, 1932.

Mesonotum yellowish white with two golden brown stripes and posterior half-lines; the anterior stripes separated by a narrow median line of pale scales which is sometimes indistinct or absent. Lower mesepimeral bristles absent. Abdomen black with basal white bands. Wing scales dark with or without a patch of pale scales on the base of the costa. Legs black with femora and tibiae partially pale-scaled.

Aedes gonimus Dyar and Knab, which was based on four female specimens from Kerrville, Tex., was found to have typical *A. sticticus* characters and has been included here.

Aedes hirsuteron, which was described by Theobald in 1902, has been considered to be a synonym of *A. sticticus* Meigen by several recent authors. *A. aldrichi* Dyar and Knab was synonomyzed with *A. lateralis* Meigen by Edwards (*6*) in 1932. Examination of North American specimens of *A. lateralis* and *A. sticticus* in the U. S. National Museum showed them to be the same species, but the true name of this species was somewhat in doubt, because type specimens were not available for comparison.

Specimens of *Aedes lateralis* from Oregon were, therefore, sent to the British Museum for determination. Dr. John Smart, who is in charge of this group, has very kindly examined these specimens for me. His letter states that type specimens of *A. lateralis* Meigen and *A. sticticus* Meigen are not available in the British Museum, and that the specimens were, therefore, compared with specimens that Dr. Edwards had named *A. sticticus.* Dr. Smart found that the Oregon *A. lateralis* specimens were the same as this species to which Edwards had applied the name *A. sticticus* Meigen.

There appears to be much uncertainty regarding the true identity of *Aedes lateralis*. *Aedes sticticus* has, therefore, been retained as the name for this species, even though *Aedes lateralis* is the older name.

Aedes (O.) aurifer (Coquillett)

Culex aurifer Coquillett, Can. Ent. 35:255, 1903.

Tori without white scales. Mesonotum with a brown stripe, gradually broadening posteriorly; the sides yellow. Lower mesepimeral bristles absent. Abdomen black with lateral basal segmental white spots. Wing scales dark. Legs black with femora partially pale-scaled.

Aedes (O.) thibaulti Dyar and Knab

Aedes thibaulti Dyar and Knab, Proc. Ent. Soc. Wash. 11:174, 1910.

Tori without white scales. Mesonotum with a median dark-brown stripe widening sharply just behind the middle; the sides lemon yellow. Lower mesepimeral bristles absent. Abdomen black-scaled without white bands but with basal lateral white spots. Wing scales dark. Legs black with femora partially pale-scaled.

Aedes (O.) diantaeus Howard, Dyar, and Knab

Aedes diantaeus Howard, Dyar, and Knab, Mosq. No. and Cent. Amer. and W. I. 4:758, 1917.

Tori with or without narrow brown hairs or scales. Mesonotum with narrow median brown stripes separated by a faint line of yellow scales; posterior half-lines sometimes present; sides pale yellowish. Lower mesepimeral bristles absent. Abdomen without basal white bands or occasionally with narrow bands on some of the segments. Wing scales dark. Legs black with femora partially pale-scaled.

Aedes (O.) muelleri Dyar

Aedes (*Heteronycha*) *muelleri* Dyar, Ins. Ins. Mens. 8:81, 1920.

Mesonotum with two dark-brown stripes separated by a narrower stripe of white scales; sides white; posterior half-lines present. Hypostigial spot of few to many scales. Lower mesepimeral bristles absent. Abdomen black with basal segmental white bands, or these may be absent posteriorly. Wing scales all dark. Legs black with femora and tibiae partially pale-scaled.

Aedes (O.) trichurus (Dyar)

Culex trichurus Dyar, Jour. N. Y. Ent. Soc. 12:170, 244, 1904.

Torus with integument of outer side yellow to light brown. Mesomotum with a median brown stripe expanded in width behind the middle; sides and margins with grayish white scales. Lower mesepimeral bristles three to six. Hypostigial spot of few to many white scales. Abdomen black with basal segmental white bands. Wing scales dark with patch of two or three to many pale scales at base of costa. Legs black with femora pale beneath.

Aedes (O.) pullatus (Coquillett)

Culex pullatus Coquillett, Proc. Ent. Soc. Wash. 6:168, 1904.

Torus with integument of outer side black to dark-brown. Mesonotum with yellowish brown scales; a narrow bare median line with parallel stripes of brown scales, each stripe bordered by a broader stripe with a few dark scales; with or without narrow, bare, curved posterior half-lines. Lower mesepimeral bristles one to five. Hypostigial spot of many white scales. Abdomen black with basal white bands. Wings dark-scaled with patch of pale scales at base of costa. Legs black with femora and tibiae partially pale-scaled.

Aedes (O.) impiger (Walker)

Culex impiger Walker, List Dipt. Brit. Mus. 1:6, 1848.

Tori with integument varying from black to yellow. Mesonotum with a median oblong area of brown scales, usually in the form of a broad stripe or paired stripes; margins grayish white. Lower mesepimeral bristles one to three, or rarely with none. Hypostigial spot with or without white scales. Abdomen with basal white bands. Wing scales dark with patch of two or three to many pale scales at base of costa. Legs black with femora pale beneath.

Aedes (O.) schizopinax Dyar

Aedes schizopinax Dyar, Proc. U. S. Nat. Mus. 75 (23):1, 1929.

Proboscis clothed with yellowish gray scales on ventral side. Mesonotum with paired bronzy brown stripes separated by a wider golden brown stripe with a bare median line. Lower mesepimeral bristles present. Wing scales dark with patch of two or three to many pale scales on the base of the costa. Legs black, femora partially pale-scaled.

Aedes (O.) hexodontus Dyar

Aedes hexodontus Dyar, Ins. Ins. Mens. 4:83, 1916.

Aedes cyclocerculus Dyar, Ins. Ins. Mens. 8:23, 1920.

Aedes leuconotips Dyar, Ins. Ins. Mens. 8:24, 1920.

Mesonotum yellowish to light golden brown with paired dark-brown lines and posterior half-lines. Lower mesepimeral bristles two or three. Abdomen black with basal segmental white bands. Wings dark scaled with patch of two or three to many pale scales at base of costa. Legs black with femora partially pale-scaled.

Aedes cyclocerculus Dyar and *A. leuconotips* Dyar were described from collections from the Barrier-Island region in Alaska and British Columbia. The two species could not be distinguished in the larval or adult stages. They have been included here as synonyms of *A. hexodontus* with which they were identical.

Aedes (O.) pionips Dyar

Aedes pionips Dyar, Ins. Ins. Mens. 7:19, 1919.

Tori with white scales. Mesonotum with dull yellow or white scales, two broad, well-defined, dark-brown stripes and posterior half-lines, the median stripes separated by a line of pale scales. Lower mesepimeral bristles one to four, or rarely with none. Abdomen with or without narrow basal white bands. Wing scales dark with small patch of pale scales at base of costa. Legs black with femora partially pale-scaled.

Aedes (O.) communis (De Geer)

Culex communis De Geer, Mem. des Ins. 6, pl. 17, figs. 2 and 5, 1776.

Mesonotum dull-yellow or gray-scaled with a narrow pale median line separating paired dark-brown lines, and with posterior brown half-lines. The coloration is variable and may be brown-scaled centrally with a mixture of pale scales and a border of grayish-yellow scales. Lower mesepimeral bristles two to five. Abdomen dark brown with basal white bands. Wings dark-scaled with a patch of two or three to many pale scales at base of costa. Legs dark with femora partially pale.

Aedes (O.) prolixus Dyar

Aedes prolixus Dyar, Ins. Ins. Mens. 10:2, 1922.

Mesonotum yellowish gray with a median reddish brown stripe. Abdomen black with narrow basal white bands. Wing scales dark. Legs black with femora partially pale-scaled.

The larva of this species is unknown. Adults have been taken in Alaska. The few specimens that are available from these areas are somewhat brushed. However, they appear to be distinct and the species is considered valid until further information is available.

Aedes (O.) aboriginis Dyar

Aedes aboriginis Dyar, Ins. Ins. Mens. 5:99, 1917.

Mesonotum yellowish to light golden brown with paired dark-brown stripes and posterior half-lines. Lower mesepimeral bristles one or two. Abdomen black with basal white bands widening at the sides. Wings entirely dark-scaled. Legs black.

Subgenus **Finlaya** Theobald

Aedes (F.) atropalpus (Coquillett)

Culex atropalpus Coquillett, Can. Ent. 34:292, 1902.

Palpi with dark-brown scales. Mesonotum with a broad median brown stripe widening posteriorly; the sides, anterior margin, and antescutellar margin with yellowish white scales; the scutellum with narrow yellow scales. Abdomen black with narrow basal bands of broad white scales. Wing scales dark with patch of white scales at base of costa. Legs black with femora partially pale-scaled; the tarsi black with narrow white bands covering both ends of the joints except on the last segment of the hind tarsus, which is white, and the last three segments of the fore and mid tarsi, which are black.

Aedes (F.) triseriatus (Say)

Culex triseriatus Say, Acad. Nat. Sci. Phil. Jour., 3:12, 1823.

Mesonotum with a median brown stripe broadening posteriorly; the sides, anterior margin, and margin of antescutellar space with silvery-white scales. Abdomen black with basal segmental lateral white patches. Wing scales dark. Legs black; femora partially pale-scaled.

Aedes (F.) varipalpus (Coquillett)

Culex varipalpus Coquillett, Can. Ent. 34:292, 1902.

Palpus black-scaled with the tip broadly white-scaled and a few white scales at apex of second segment. Mesonotum brown with a median anterior patch, and narrow posterior curved lines of yellow scales; the margins with a mixture of pale scales and scutellum with broad white scales. Abdomen black with median triangular dorsal and lateral patches of white scales. Wing scales dark with a patch of white scales at the base of the costa. Legs black, with white bands involving both ends of all but the last two joints of the fore and mid tarsi, which are black, and the last joint of hind tarsus, which is white.

Aedes (F.) zoosophus Dyar and Knab

Aedes zoosophus Dyar and Knab, Ins. Ins. Mens. 5:165, 1918.

Aedes alleni Turner, Ins. Ins. Mens. 12:84, 1924.

Mesonotum broadly silver-scaled on anterior half with a faint median golden brown stripe; posterior half dark-brown with silvery scales bordering antescutellar space; scutellum with broad white scales. Abdomen black with basal segmental white bands. Wing scales dark with base of costa and vein 1 white-scaled. Legs black; femora partially pale-scaled; tarsi black with basal white bands except on last segment.

The single female specimen from Kerrville, Tex., that was described and named *Aedes zoosophus* by Dyar and Knab in 1918 is identical with the type specimens of *A. alleni* described by Turner in 1924. The species name therefore becomes *A. zoosophus*, since this is the older name.

Subgenus **Aedes** Meigen

Aedes (A.) cinereus Meigen

Aedes cinereus Meigen, Syst. Beschr. Eur. Zweifl. Ins. 1:13, 1818.

Mesonotum clothed with reddish brown scales. Lower mesepimeral bristles absent. Abdomen black without white bands or with narrow partial or complete ones; the lateral spots usually joined to form a line. Wing scales dark. Legs dark-brown. Coxa of front leg with white scales at top and a central patch of brown scales on the anterior surface.

Subgenus **Aedimorphus** Theobald

Aedes (A.) vexans (Meigen)

Culex vexans Meigen, Syst. Beschr. Eur. Zweifl. Ins. 6:241, 1830.

Occiput with patch of flat black scales bordering top edge of flat white lateral patch. Mesonotum clothed with bronzy brown scales, paler at the base of the wings and around antescutellar space. Lower mesepimeral bristles absent. Abdomen black with centrally indented basal white bands. Wing scales brown. Legs black; all the segments of the hind tarsus, the first four segments of the mid tarsus, and the first three segments of the fore tarsus narrowly white-banded.

Subgenus **Stegomyia** Theobald

Aedes (S.) aegypti (Linnaeus)

Culex aegypti Linnaeus, Hass. Pal. Reise, p. 470, 1762.

Palpus black with apex white-scaled. Clypeus white-scaled. Mesonotum brown-scaled with two narrow median golden lines and a silvery line on either side, which broadens and curves outward on the anterior half. Scutellum with broad silvery white scales. Abdomen black with basal white bands or median rounded areas of white scales; the sides with white spots. Wing scales dark. Legs black; the segments of the hind tarsus with broad rings at the base, the last segment entirely white; the first two segments of the fore and mid tarsi with narrow basal white rings.

Subgenus **Kompia** Aitken

Aedes (K.) purpureipes Aitken

Aedes purpureipes Aitken, Pan-Pac. Ent. 17:82, 1941.

(From original description by Aitken (*1*), partly modified.)

Thorax with integument ochraceous orange; mesonotum golden yellow, with two dark submedian longitudinal stripes from anterior margin to scutellum, and with two dark lateral stripes extending from scutellum halfway to anterior margin, the two submedian dark stripes seperated anteriorly by a median line of golden scales half the width of each stripe; posteriorly by the bare antescutellar space which is lined laterally with silvery scales. Margins of mesonotum lined with pale setae. Postspiracular bristles absent. Abdomen with ochraceous integument and broad brown scales; the tergites with slight indications of narrow pale basal bands which expand laterally into triangular areas of silvery scales. Legs with scales varying from purple to blue; the femora partially pale-scaled. Wing clothed with narrow dark scales.

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A CORRECTION

Wyeomyia hirsuta, incorrectly named *Phoniomyia hirsuta*

In the Proceedings of the Entomological Society of Washington, Vol. 48, No. 2, 1946, pp. 39-41, we published a description of a new mosquito, under the title, "*Phoniomyia hirsuta*, a new Sabethine from Jamaica."

Due to a misunderstanding, the mosquito was incorrectly placed by us in the genus *Phoniomyia*. We have been informed by Dr. John Lane and by Dr. Harry D. Pratt that the correct genus is *Wyeomyia*.

Hence the correct name is *Wyeomyia hirsuta*.

ROLLA B. HILL
and
CLAIRE MCDOWELL HILL

THE LARVA OF AEDES (OCHLEROTATUS) MATHESONI MIDDLEKAUFF (Diptera, Culicidae)

By Roy W. Rings[1] and Samuel O. Hill[2]

Fourth Service Command Medical Laboratory,[3] Fort McPherson, Georgia[4]

An apparently new species of *Aedes* from central and southern Florida was described by Middlekauff (1944) from one male and three female specimens. The new species, *Aedes mathesoni,* closely resembled *Aedes canadensis* Theobald but differed in being more darkly pigmented both qualitatively and quantitatively. The dark brown mesonotal vestiture and iridescent black tarsal markings in particular departed considerably from homologous patterns in *canadensis.* The larval form of *mathesoni* was not known until the present authors received two collections of the species from northern Florida and one collection from southern Georgia.

SOURCE OF MATERIAL

Aedes mathesoni larvae were secured from two military installations in Florida and Georgia by request of the Department of Entomology, Fourth Service Command Medical Laboratory after adult specimens of the species had been received in routine collections. Two collections totalling 25 larvae were collected and submitted by Pvt. Austin E. Graham of the Mosquito Control Section, Camp Blanding, Starke (Clay County) Florida in February and March of 1946. Twenty-five larvae were collected, reared and submitted by Lt. Robert M. Russel of the Mosquito Control Section, Camp Gordon, Augusta, (Richmond County) Georgia in June 1946.[5] Larval specimens from Camp Blanding were received alive in five-gallon glass jugs and were isolated for rearing in the laboratory. The reared adults were determined as *Aedes mathesoni* and were numbered to correspond with the cast larval skins numbered to correspond with respective emerged adult specimens by Lt. Robert M. Russel at Camp Gordon.

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[2]Major, Sanitary Corps, A. U. S.

[3]Now designated Seventh Army Medical Laboratory, Fort McPherson, Ga.

[4]Acknowledgment is made to the Mosquito Control Sections of Camp Blanding, Florida and Camp Gordon, Georgia for the collection of material; to Dr. Alan Stone of the United States National Museum, to Captain Virgil I. Miles and Miss Winona Gilstrap, P-2 of the Fourth Service Command Medical Laboratory for their helpful suggestions.

[5]The Camp Gordon, Georgia collection represents a new state record for this species.

LARVAL HABITAT

This species apparently prefers the same type of aquatic environment as *Aedes canadensis.* The breeding sites at which the *mathesoni* larvae were collected were quite similar in Georgia and Florida. Floridian specimens were collected from an abandoned foxhole, located in a low area of flatland. The hole was deep, shaded, and protected by overhanging grass at the margins. The collection from Camp Gordon, Georgia was obtained from an abandoned fox-hole, partly shaded by overhanging grass, on a sloping hillside. The water depth was eight inches, normally eighteen, and the pH was found to be 6.6. The appearance of the water in both situations was stated to be clear. The Georgian specimens were associated with the larvae of *Anopheles punctipennis, Culex apicalis* and *Culex restuans.* In Florida *Aedes mathesoni* larvae were collected with the immature stages of *Aedes vexans, Anopheles crucians, Anopheles georgianus, Culex apicalis* and *Culiseta melanura.*

DESCRIPTION OF LARVA

Aedes mathesoni, larva: (Figure 1). Head wider than long; antennae curved, shorter than head, prominently spined and more darkly pigmented on distal half. Antennal tuft situated slightly proximal to the midline, densely branched and slightly penniform. Head hair tufts densely branched, slightly penniform; upper head hairs with 6 to 14 branches, lower head hairs with 4 to 9 branches. Lateral abdominal hairs double on segments one to five, single on the sixth segment. Lateral comb on eighth segment of many scales in a triangular patch, individual comb scale elongate, fringed with spines, apical spine slightly if any longer than others. Anal segment slightly longer than wide, finely spicular; dorsal plate not encircling segment. Dorsal tuft of anal segment a long single hair and a brush on either side; ventral brush well developed. Lateral hair of anal segment single. Air tube finely spiculate, about three times as long as wide, tapering; tuft of air tube multiple, penniform, situated beyond pecten. Pecten teeth evenly spaced, long and pointed with two large spines and a smaller one near base. Dorsal preapical spine shorter than terminal pecten tooth.

A comparison of larval specimens and cast skins of *Aedes mathesoni* with *Aedes canadensis* larvae showed the two types to be remarkably similar, the only apparent difference being in the degree of branching in the head hairs and antennal tufts. In a series of eighty-nine individuals of *Aedes cana-*

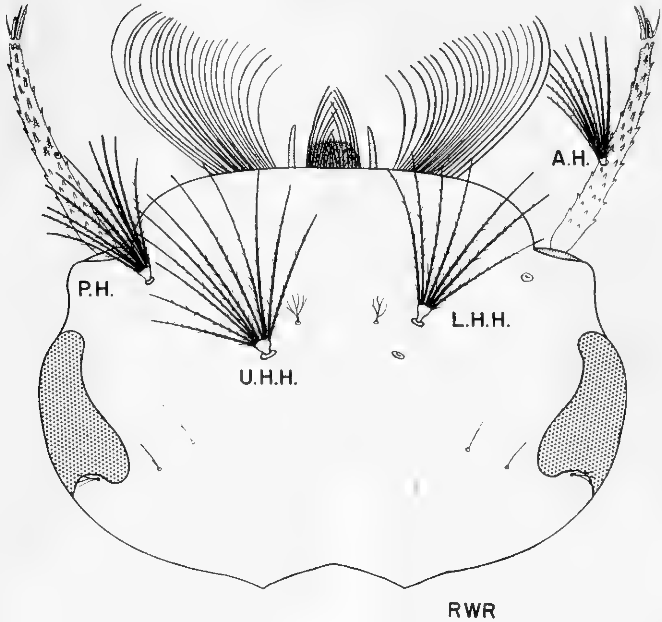

Figure 1. Head of *Aedes mathesoni* larva, dorsal aspect. The upper right head hair tuft, lower left head hair tuft, right preantennal tuft and left antennal tuft have been removed for clarity. U. H. H., upper head hair tuft; L. H. H., lower head hair tuft; P. H., preantennal hair tuft; A. H., antennal hair tuft.

densis examined the lower head hairs averaged 5.06 branches and the upper head hairs averaged 6.77 branches. These larvae represent specimens from British Columbia, Ontario, New York, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi and Florida. In the thirty-three specimens of *mathesoni* examined the upper head hairs averaged 9.8 branches while the lower head hairs averaged 7.1 branches.

Since the character of head hair branching intergrades in the two forms it is impossible to give an absolute means for their separation. For instance the upper head hairs in *canadensis* may vary from 4 to 10 and in *mathesoni* the range is from 6 to 14 branches.

A comparison of the Georgian and Floridian *mathesoni* larvae showed further that individuals collected in the more southern portions of the geographical range showed relatively more branching than those from the north. Larval specimens from southern Georgia averaged 8.9 upper head hair branches and 7.0 lower head hair branches while the northern Florida specimens averaged 10.7 upper head hair branches and 7.2 lower head hair branches.

TAXONOMIC RELATIONSHIPS

The examination and comparison of the larvae of *Aedes mathesoni* with *Aedes canadensis* show that there is a very close phylogenetic relationship between the two forms and that these forms do not possess differences of specific rank. Further studies of this phylogenetic relationship are being conducted with adults and larvae of both forms and it is expected that these results will be published in the near future. The mounted larval and adult series have been deposited in the United States National Museum, Washington, D. C.

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ULPHIAN CARR LOFTIN

1890-1946

Early in the night of January 16, Ulphian Carr Loftin, for the past 15 years an active member of this Society, died suddenly of a heart attack. This abrupt ending of a useful and happy life was a shock to all who knew him, for he seemed to be in sound health and had been conducting his normal activities on the day of his death.

His entomological career covered a period of 35 years, devoted chiefly to the economic and biological study of insects attacking cotton and sugar cane. On these subjects he was recognized as a leading authority.

He was born at Mount Olive, North Carolina, July 2, 1890, graduated from the North Carolina State College in 1910, and in 1913 received the degree of Master of Science from the University of Florida. From 1910 to 1913 he served with the Florida Agricultural Experiment Station. The following eight years were spent in research on cotton and sugar-cane insects for the United States Department of Agriculture in

Ulphian Carr Loftin

Louisiana and Texas. From 1921 to 1928 he was entomologist and field manager of the Tlahualilo (Mexico) Agricultural Company, and in 1929 chief entomologist of the Cuba Sugar Club Experiment Station at Baragua, Cuba. Early in 1931 he returned to the Department of Agriculture to conduct entomological investigations in Puerto Rico and the Virgin Islands and that same year was called to Washington to become assistant leader of the Division of Cotton Insect Investigations of the Bureau of Entomology and Plant Quarantine. This position he held to the time of his death.

Carr Loftin was an able, efficient administrator, a conscientious student and a recognized authority in his entomological field; but he was also much more. He was a loyal friend, a congenial companion, and a fine man in every human understanding of that term. He had a genial, even temper that won men to him and held them in unchanging friendship. Those who knew him best and longest prized him most. Some entomologists are remembered chiefly or only for their contributions to science, but Carr Loftin will be held in the memory of his colleagues first for his qualities as a man. No better tribute could be paid to any of us.

He is survived by his wife, Mae LeBeuf Loftin, a son, Lieutenant Ulphian Carr Loftin, Jr., of the United States Army Air Corps, a daughter, Aimee M. Loftin, his mother, Mrs. J. O. Loftin, Sr., five sisters and three brothers.

In addition to his membership in the Entomological Society of Washington he was a member of the American Association for the Advancement of Science, the American Association of Economic Entomologists, The Entomological Society of America, the Florida Entomological Society, and the Texas Entomological Society.

A bibliography of his published works follows:

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—CARL HEINRICH, R. W. HARNED and D. L. VAN DINE.

BOOK REVIEW

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Fascicle IV: Fulgoroidea, Part 8: Dictyophoridea. By Z. P. Metcalf, D. Sc. 246 pp. ($3.00.)

Fascicle V: Polyctenidae. By R. L. Usinger, Ph. D. 18 pp. ($0.60.) 9x6 inches, paper cover. Smith College, Northampton, Mass. 1946.

The managing editor and the authors are to be congratulated upon the recent publication of two new sections of the General Catalogue. Fascicle IV, part 8, is the latest of a series by Dr. Metcalf each of which treats one of the fulgorid families. Fortunate indeed is the student interested in this large and important superfamily, for no other comparable group of the Hemiptera is so adequately catalogued. It is of interest that Dr. Metcalf has been responsible for 1,410 of the 2,173 pages of the General Catalogue so far published. One hundred twenty-five genera and subgenera and 491 species and varieties are treated in part 8. It is noted that the endings of specific names conform in gender with their generic name. This is in contrast with earlier parts of fascicle IV in which the original orthography of the specific names was retained regardless of gender. Genotype citations are given and species are listed under every known combination so they may be found without recourse to an index. References are briefly annotated and provide an indication of the information contained. Geographical distribution, usually to countries or island groups, is indicated in the margin and linked to the appropriate references by index figures.

Since no section of the General Catalogue treating the suborder Heteroptera has appeared since 1929, fascicle V is certain of a warm welcome from those directly interested in this suborder. The family treated in this fascicle is small, involving only 5 genera and 18 species; however, its highly specialized adaptation to an ectoparasitic life on bats makes this family one of unusual interest. The introduction to the catalogue is of more than usual importance since it involves an elaboration of an earlier interpretation of geographical distribution and host relationships. Scientific names of recorded hosts are included in the margin under geographical distribution. This would seem to be a desirable addition to the otherwise uniformly excellent style of the other fascicles of the series.—R. I. SAILER.

TWO NEW BITING MIDGES OR CULICOIDES FROM WESTERN UNITED STATES (Diptera, Ceratopogonidae)

By IRVING FOX
Department of Medical Zoology, School of Tropical Medicine, San Juan, P. R.

In the course of arrangement of the entomological collections of the Department of Medical Zoology, School of Tropical Medicine, San Juan, Puerto Rico, there were discovered two new species of *Culicoides* which are herewith described. Thanks are due to Dr. Maurice T. James for his kindness in presenting determined material which made necessary comparisons possible.

Culicoides jamesi, new species

Female—Length of body about 1.25 mm. Head, proboscis, palpi and antennae dark brown; occiput with a gray pubescence. Eyes widely separated (32 μ). Antennae with last five segments about equal to the first eight. Palpi (Fig. 1C) with second segment shorter than the third, third swollen with a sensory pit, fourth two-thirds as long as the fifth. Mesonotum (Fig. 1A) as in *hieroglyphicus* Malloch; with a dark brown ground color and lighter gray markings, the latter forming a broad longitudinal band on each side of a dark median band and having transverse extensions on each side of the humeral pits. Prescutellar depression and scutellum gray. Spermathecae unsclerotized, not visible in the usual preparation. Legs dark brown, without distinct annulations but darker at the junction of the femora with the tibiae. Wing (Fig. 1B) 1.40 mm long and .60 mm in the widest place without light and dark spots, well provided with macrotrichia which occur particularly in the distal portion. Radial, median up to its forking and radiomedian veins brown and prominent. Veins M_1, Cu_1 and Cu_2 light and indistinct; vein M_2 replaced by horizontally directed macrotrichia. Anal cell well provided with macrotrichia.

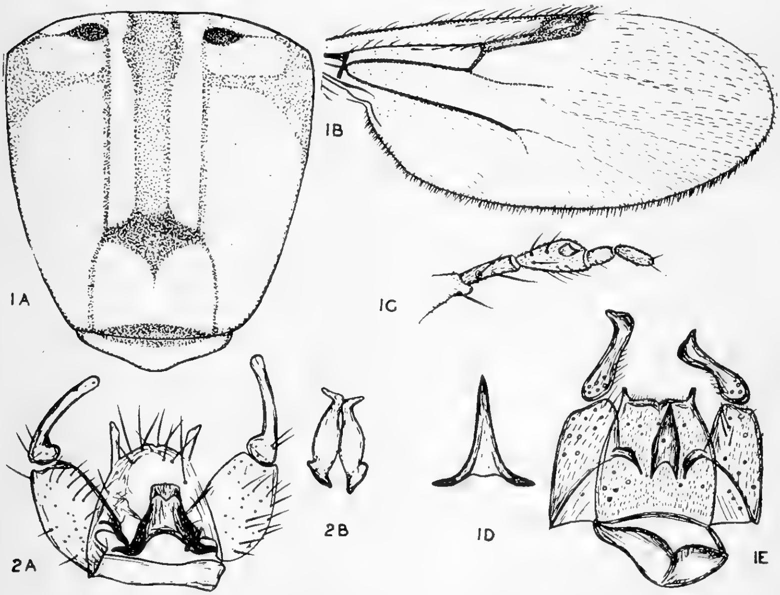

Fig. 1, *Culicoides jamesi*, n. sp.: 1A, mesonotal pattern of female; 1B, wing of female; 1C, palpus of female; 1D, harpes; 1E, hypopygium. Fig. 2, *Culicoides utahensis*, n. sp.: 2A, hypopygium; 2B, harpes.

Male Hypogygium—Distal portion of the clasper with a foot shaped expansion. Ninth sternite without projecting processes. Apicolateral processes long and slender. Aedeagus distally pointed, basally excavated deeply, the corners accuminated. Harpes large and prominent, distally fused completely, basally with more or less foot-like expansions. For further details see Figures 1D and 1E.

Type Material—Male holotype and two male paratypes (mounted on slides), female allotype (mounted on a slide) and three female paratypes (pinned) from Hamilton, Montana, collected in August, 1940.

The females of this new species and of *C. hieroglyphicus* Malloch are not distinguishable. The males, however, may be readily separated by outstanding differences in the hypopygia. The aedeagus and harpes are very different in the two species, and *jamesi* lacks the long processes present on the ninth sternite of *hieroglyphicus.*

Culicoides utahensis, new species

Male—Length of body about 1.25 mm. Mesonotum brown with a gray pruinescence, appearing to go into the group with a distinct mesonotal pattern, although this is not clear because of the poor condition of the specimen. Scutellum yellowish brown. Legs yellowish, the tibia darker at the junction with the femora. Wing 1.60 mm long and .50 mm at the widest place. Macrotrichia present over most of the wing, being most dense in cell R_5. The light and dark spots are not well defined. Hypopygium with long apicolateral processes on the ninth tergite, which bears eight to ten long, robust setae. Aedoeagus arched at the base, the tip broadly truncate with basally directed acuminated projections. Harpes with expanded foot-shaped bases, broad median portions and curved tips. For further structural details see Figures 2A and 2B.

Type Material—Male holotype (mounted in balsam and Berlese mixture on two slides, one bearing the abdomen and a wing and the other bearing the thorax and legs) from Logan, Utah, collected May 2, 1938, by G. E. Knowlton and D. E. Hardy.

This new species differs so much from the other members of its genus in the structure of the hypopygium that no hesitation is deemed indicated in describing it from a single specimen. The hypopygium resembles that structure in *C. simulans* and *C. copiosus* Root & Hoffman, but may be readily separated from both of these by the form of the aedeagus.

A NEW SPECIES OF MYRMOSA (Hymenoptera, Tiphiidae)

By Karl V. Krombein
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

One female specimen of the new species described below was received recently for identification following inspection of a shipment of Costa Rican plants by the Foreign Plant Quarantine service at Brownsville, Texas. The specimen was found among the roots of a *Bromelia* (sens. lat.) plant along with several ants of various castes which have been identified by M. R. Smith as *Crematogaster nigripilosa* Mayr, a Central American species.

The question immediately arises as to whether the *Myrmosa* should be considered a species native to Costa Rica or to Texas with the association with the plant occurring after the latter was received at Brownsville. I have tried to obtain additional information as to the shipment, but it is not possible to give a definite locality for the origin of the plant in Costa Rica, nor is it possible to determine at this time whether the bromeliad was an epiphytic or terrestrial species. However, the *Myrmosa* could have become associated with the plant after the latter was received at the inspection station at Brownsville. The association with the *Crematogaster* probably should be regarded as accidental since, so far as is known, species of *Myrmosa* are parasitic in the nests of terricolous solitary wasps and bees.

In my opinion the type locality should be regarded as Brownsville, Texas, at least until field collected material is available which would disprove such a contention. My opinion is based on the facts that the other known species of the subgenus *Myrmosula* are confined to the Austral and Sonoran regions within the United States, and that association with the plant could have occurred at Brownsville.

Myrmosa (Myrmosula) peregrinatrix, new species

Type. ♀; Brownsville, Texas. March 29, 1946. (Among roots of *Bromelia* sp. from Costa Rica, in association with the ant, *Crematogaster nigripilosa* Mayr). [United States National Museum, Type No. 58044].

Female.—6.0 mm. long. Ferruginous; tip of mandible and a narrow apical band on first three tergites (that of the second widely interrupted medianly), darker; second tergite with a pair of anterolateral, rounded, whitish, integumental spots.

Head shining, clothed with abundant, short, decumbent glittering hairs and scattered, erect longer ones; mandibular lamella emarginate medianly below, present on basal third of inferior margin; hypostomal tooth as in *parvula* Fox; apical margin of clypeus in frontal view slightly more arched than in *parvula;* antennal tubercles large and prominent, with a strong, oblique dentate crest above; viewed from above the area between antennal tubercles is almost U-shaped, the tubercles separated basally by a distance equal to three-fourths the basal width of a tubercle; front and vertex with small punctures, those of the genae much smaller; punctures above antennae separated by two to four times the width of a puncture, those of middle of front much sparser and those on vertex almost contiguous.

Thorax less shining than head, clothed with abundant, short, decumbent glittering hairs and scattered, erect longer ones; with dense, fine punctures dorsally which are finer than those of front and vertex and separated by the width of one to two punctures; pleura equally finely, but less closely punctured than dorsum.

Abdomen shining, very finely punctate, clothed dorsally with short, abundant erect hairs which are silvery and glittering on the ferruginous and white areas of the first five tergites and brownish on the darker bands, the hairs of the last segment longer, denser and ferruginous; venter, except last sternite, with pale, glittering decumbent hairs and scattered, longer erect ones.

Legs finely punctate, with abundant, short, decumbent glittering pubescence and scattered, longer erect hairs.

Male.—Unknown.

This interesting little species, the fifth known from the female sex in this subgenus,[1] is most closely related to *parvula* Fox from which it is readily distinguished by the crested antennal tubercles, the almost U-shaped area between the antennal tubercles when viewed from above (this area is more shallowly emarginate in *parvula*), the antennal tubercles separated basally by a distance equal to three-fourths the basal width of a tubercle (this distance equal to basal width of a tubercle in *parvula*), the more strongly arched apical margin of the clypeus and the denser pubescence of the entire body. It is readily separated from the other species known from the female sex, *rutilans* (Blake), *exaggerata* Krombein and *pacifica* Mickel, by the more prominent antennal tubercles and the lack of an interantennal elevation.

[1]For discussion of other species of *Myrmosa* (*Myrmosula*) see Krombein, K. V. Trans. Amer. Ent. Soc. 65:456-462, 1940, and Mickel, C. E. Pan-Pacific Ent. 16:132-134, 1940.

THE IDENTITY OF CHERMES ALNI LINNÉ, 1758 (Homoptera, Psyllidae)

By Louise M. Russell

Bureau of Entomology and Plant Quarantine, United States Department of Agriculture

The purpose of this paper is to establish the zoological identity of *Chermes alni* Linné, 1758, as a psyllid, and to show that the names *Psylla* and Psyllidae are available for the groups generally known by these names. The presentation of such a paper seems desirable because of two recent publications by J. S. Caldwell (N. Y. Ent. Soc. Jour. 1944, 52: 335, and Ohio Jour. Sci. 1946, 46: 71-72) which state that *Chermes alni* Linné, 1758, is an aphid, and that *Psylla* and Psyllidae must be replaced by *Psyllia* and Psylliidae. Caldwell's contention that *alni* is an aphid appears to be based upon the erroneous assumption that the zoological identity of the species is to be determined entirely from the Kalm reference.

Linné described *Chermes alni* in Systema Naturae, 10th edition, 1758, p. 454, as follows:

> "Alni. 8. C. Betulae Alin. *Fn. svec.* 698. *Kalm. it.* 2. *p.* 275.
> "*Frisch. ins.* 8. *t.* 13. Vermis suctorius Alni.
> "*Reaum. ins.* 3. *t.* 25. *f.* 1. 2. 3.
> "*Habitant in Betulae* Alni *ramulis Larvae, caudis plumosis tectae; in* America *septentrionali. Kalm.*"

From a nomenclatorial standpoint *Chermes alni* Linné dates from this description, and the name is validated by the descriptive matter contained in the citations as well as by that actually published in 1758. The descriptive matter published in 1758 is not adequate for the recognition of a species, and study of all the citations shows that more than one species was described, and that the insects in question occurred in Europe as well as in America. A careful search of the literature does not reveal that any author has fixed the zoological identity of *alni* by analysis of all the forms originally included and restriction of the name to one of the species covered by the original citations. Such analysis and restriction is therefore made by the present writer.

The *Chermes alni* described by Linné in Fauna Svecica, 1746, p. 214, no. 698, is a psyllid and has been so recognized by all workers quoting the citation. From Kalm's En Resa til Norra America, 1756, 2, p. 276, it is clear that Kalm believed he had observed the species described by Linné in 1746, for he stated, "*Chermes alni Linnei* Faun. Svec. 698."

It appears from present knowledge of North American insects, and especially from recent observations by Caldwell (Ohio Jour. Sci. 1946, 46: 71-72), that the insect referred to by Kalm was the aphid now known as *Prociphilus tessellatus* (Fitch). The insects illustrated by Frisch in Beschreibung von allerlen Insecten, 1730, 8: 29, table XIII, plate II, numbers 1, 2, 3, and not named, were psyllids. Their identity is positive if the figures are compared with the description (pp. 28-29). The insects from "hêtre" not named, but illustrated by Reaumur in Memoires pour servir a l'histoire des insectes, 1737, 3: 346-347, plate 26, figures 1, 2, 3, appear to be aphids.

It is evident that Linné's 1758 concept of *alni* included a member or members of the Aphidae as well as the Psyllidae. The present writer here restricts the zoological application of the name to the most definitive description, which is that of a psyllid in Fauna Svecica, 1746. Thus fixed, the zoological application of the name is in agreement with general usage since 1758.

Since *Chermes alni* Linné is the type of *Psylla* Geoffrey by designation of Latreille, the names *Psylla* and Psyllidae should be retained for the groups which they have represented.

MINUTES OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, 564TH REGULAR MEETING, MAY 2, 1946

The 564th regular meeting of the Society was held on May 2, 1946 at 8 P. M. in Room 43 of the U. S. National Museum. President Weigel presided and there were 36 members and 13 visitors present. The minutes of the previous meeting were approved as read.

New members were elected as follows:

Ralph W. Bunn, Office of Chief of Engineers, U. S. War Department.
Carlos S. Carbonell, Graduate Student, University of Maryland.
Curtis W. Sabrosky, U. S. Public Health Service.

Miss Elizabeth Haviland, speaking in behalf of Dr. Cory and the Staff of the University of Maryland, invited the Society to College Park in June. It was voted to accept the invitation and hold the regular June meeting in the form of a picnic.

President Weigel reminded the Society that increased printing costs for the PROCEEDINGS make it even more essential to increase the membership.

Those present were pleased to hear a report from Mr. Rohwer on letters received from the Honorary President, Dr. L. O. Howard.

Dr. E. L. Griffin, Assistant Chief, Insecticide Division, Production and Marketing Administration, gave the first paper on the regular program: Labeling Requirements for Insecticides under the Insecticide Act.

Dr. Griffin outlined the condition preceding the Insecticide Act of 1910, the scope of that Act, and the methods of enforcement. He next gave a resumé of H. R. 5645, designed to replace and expand it. The new bill includes herbicides, rodenticides, and devices. It stresses the prevention of injury to man and animals, increases the authority of the Secretary of Agriculture to require cautionary statements on labels, and provides for the coloration of white powders likely to be mistaken for flour or other food materials. Economic poisons must be registered before their introduction into interstate or foreign commerce, and labels must include adequate directions for use.

The paper was thrown open to discussion. Mr. Rohwer referred to the situation in regard to DDT, and the beneficial results to be expected from the new labeling requirements. He hoped that Entomologists would be compelled to give more attention to providing accurate and specific directions for the use of the insecticides they recommend. There was further comment by Snyder, McIndoo, and McGovran.

The second paper was presented by A. T. Davidson, Insecticide Testing Section, Production and Marketing Administration: Method of Handling and Testing Proprietary Insecticides.

Mr. Davidson outlined the history of the Testing Section and discussed the equipment and work of the Beltsville Laboratory. About 220 samples are tested a year, the majority being in the field of household insecticides. The Laboratory is not expected to undertake research unless it is connected with proprietary insecticides. In recent years, however, a certain amount of work has been done with DDT and Benzene Hexachloride. Mr. Davidson referred to the quick response of manufacturers to new materials.

In answer to a request from President Weigel, the speaker outlined the routine procedure followed on receipt of samples. Discussion followed by Rohwer, Griffin, and Porter.

Dr. S. B. Fracker, Agricultural Research Administration, spoke on: Proposed Organization of an Institute of American Biologists.

This project was discussed at a well-attended session held during the St. Louis meetings of the American Association for the Advancement of Science. It was felt that such an Institute could give Biology a more prominent place, and also function as a clearing house for international problems relating to the biological sciences. Dr. Fracker had been impressed by the interest shown during the meeting.

An animated discussion by Rohwer, Muesebeck, and Fracker dealt with: the definition of the term ''Biology''; the advantages and disadvantages of the proposed organization; and the relation of Entomology, or any other well-organized branch, to such a central Institute.

Dr. Neale F. Howard and H. C. Mason were introduced to the Society by President Weigel.

The meeting adjourned at 9:45 P.M.

INA L. HAWES,
Recording Secretary.

PICNIC MEETING (565TH REGULAR MEETING), JUNE 6, 1946

A joint picnic with the Insecticide Society of Washington was held on June 6, 1946. Through the courtesy of Dr. Cory and the Staff of the University of Maryland, over one hundred members and their families were again privileged to gather for a pleasant, friendly evening under the trees near Morrill Hall.

INA L. HAWES,
Rcording Secretary.

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