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STUDIES IN THE GENUS *EPICAUTA* OF THE NORTH AMERICAN CONTINENT (COLEOP., MELOIDAE) I—THE CAVICEPS-GROUP.

By FLOYD G. WERNER, Burlington, Vermont

The author intends to present in this series a treatment of the Mexican and Central American species of *Epicauta,* in relation to the fauna of the United States and Baja California, already covered. Supplementary notes may be added to the discussion of United States species when additional information is available.

North America, south to the Isthmus of Panama, is a much more convenient unit to handle than any artificially delimited region within the continent. Mrs. Vaurie has already shown the very close relationship between the Meloid fauna in North-Central Mexico and our Southwestern fauna. Champion's coverage of the Central American and Mexican species shows that there is a considerable overlap from Southern Mexico to Central America. And some species range from Southwestern U. S. to Southern Mexico. Panama has a rather poor representation in the genus, with closer affinities to northern South America than to the more northern fauna. All of the species known from Panama, except *E. flagellaria* (Er.) and *E. dohrni* (Haag), also range well into the area treated, however.

Some of the species groups found in North America are not known from outside the continent. Part have a species or two in extreme northern South America and these extraterritorial species will be included. The author prefers handling the genus group by group to attempting a separate Mexican and Central American coverage, which would involve guessing which of the U. S. species have ranges extending into Mexico and which have restricted ranges. Keys or tables for all the species in the separate groups will be

prepared, to supplement already existing keys and aid in the identification of the species. An attempt will be made to show relationships rather than simply to provide the easiest possible means of identifying all specimens.

Adequate series are not available for many of the species and it may be expected that additional variation will be discovered when more collections are made. In some cases it is impossible to assign a species to a group unless a male specimen is available. In these cases the species will be mentioned in the groups to which it might belong. The decision to break up the genus and handle it piecemeal is to some extent necessary because of the nature of the available material. In some groups all the species can be worked out with little trouble; in others nothing can be said at this time that has not already been said. If specimens of critical species become available during the course of the study, these groups will be included.

The species groups are sometimes difficult to define. They follow the groupings already established (Werner, 1945, Bull. M. C. Z. 95: 424–425.), with some alterations, which will be taken up in the individual cases. As exact a definition of each group as is possible at this time will be given. The Diversicornis-Group has already been treated. (Werner, 1949, Psyche 56: 74–80.)

The specimens for this study come from a variety of sources. Mr. J. Balfour-Browne has very kindly sent a good part of the Biologia specimens and offers to send anything except holotypes from the British Museum collections. Fragments of the Dugès collection remain in the collection of the Instituto de Biologia in Mexico City. These specimens have been studied, as well as a very small lot of Meloidae, probably determined by Dugès, in the museum of the university at Morelia, Michoacan. Some of the Dugès species are in the Sallé collection, now with the Biologia Centrali-Americana series. A very few specimens from Dugès in the U. S. National Museum complete the known remnants. The great bulk of the Dugès collection is said to have been destroyed by insect pests while it was in the Museo Nacional in Mexico City. The specimens in the Instituto de Biologia represent what could be salvaged. Many of the Dugès species are not represented in any of these places and in very few cases is it possible to ascertain whether a "holotype" exists.

Fresh material is available from the M. C. Z., A. M. N. H., U. S. N. M., Cal. Acad., Chicago Nat. Hist Mus., and the Carnegie Museum. Drs. C. Bolivar and F. Bonet of the Instituto Politechnico in Mexico City, and Mr. F. H. Parker of Globe, Arizona have made the Mexican specimens in their collections available also. The

author has spent part of two seasons in Mexico and has series of some of the species with host plant and other information. In his collection are scattered specimens from other sources, including European dealers.

The total amount available is still far from adequate. The American Museum collection from Northern Mexico is by far the most impressive, but undoubtedly lacks many as yet undescribed species from that area. The total collections available from Southern Mexico are much smaller and the gaps must be correspondingly larger.

The Caviceps-Group

The Caviceps-Group, equivalent to group "B" of Horn, has become more difficult of definition as it has grown larger. In the present paper fourteen species are included, one being described as new. When *caviceps, rileyi* and *straba* were the only known species, it was possible to say that the group consisted of all of the species of *Epicauta* with unusual modifications of the head. Horn used the form of the antennae as a distinguishing characteristic. The antennae taper gradually from the base and are not greatly different in the sexes. They are very uniform throughout the group but many species elsewhere in the genus have antennae similar or identical to those found in this group. Several of the species now included have the heads not at all modified; so it is necessary to seek new criteria for their inclusion.

The group contains all of the species of our fauna, and probably of the World fauna, in which the meso- and meta-femora and trochanters of the male are more or less denuded behind, the denuded area being fringed above with longer hairs. The tibiae do not have long hairs and the denuded areas on the femora and trochanters are not fringed both above and below with long hairs. The two species, *californica* Werner and *alphonsii* Horn, not included in the group, have similar leg characters in the male but the meso- and meta-femora are fringed both above and below and are conspicuously flattened in the denuded area. *Stuarti* Lec. is also excluded, even though the male leg characters are similar. In this species the partially denuded area has some long hairs included in it and the male meso-tibiae have fairly abundant long hairs, which are not found in any of the Caviceps-Group.

One characteristic that is diagnostic when it is present is the arrangement of some black spots on the abdomen. One set of small rounded spots is found on the anterior part of the lateral edges of the sternites. These are partially glabrous and contain some short, black pubescence. Another set, which is more variable, is a series

of posterior median sternal spots. These are small, and may be round or squarish, or elongated when found on the posterior sternites. They may be on any or all of the visible sternites except the last. The tergites have anterior median black marks; in this case they are usually elongate. They may be found on any of the sclerotized tergites. The only species outside the group that might be considered as having these abdominal markings, even in a modified condition, is *stuarti*. This enigmatic species has large antero-lateral spots on the sternites, a broad postero-median, black, partially denuded zone on the sternites, and tergites that are all black and might be considered as showing greatly expanded tergal spots. Some of the species included in the Caviceps-Group do not possess the abdominal spots at all and, of course, the species with solid black abdomens cannot be placed on this character.

The elytra have characteristic black markings in some species. A squarish spot near the scutellum is found in these; in some cases it extends along the far anterior edge and reappears as a narrow humeral spot. Here again some species do not have it and pure black species may have it and not show it.

A very peculiar characteristic that is expressed in varying degree in most of the species is an elevation of the suture of the elytra at about one-third from the base. In extreme cases this takes the form of a quite noticeable bump, which may become abraded. The suture may be somewhat elevated from this bump to one-fourth from the apex. In some cases this elevation terminates in a smaller bump. The only species assigned to the group that lacks the sutural character completely is *aspera*. In some of the others its expression is slight and it may be absent in part or most of the specimens. The character does not appear in any other part of the genus. Since its expression is variable, it is not a good key character. But it adds evidence that the Caviceps-Group is monophyletic.

The definition of the Caviceps-Group now becomes cumbersome. It includes (1) all the species with the characters of the suture of the elytra as outlined above; (2) it includes all the species with the abdominal markings, except *stuarti*, which might possibly be considered to have the markings in an extremely modified condition; and (3) it includes all of the species with the characteristics of the legs of the male as outlined above, excluding other species with further modifications in the same area. All the known species fit on two or more of these criteria and all other species are excluded by any one. Of the three criteria, perhaps the sutural character should be taken as the most definitive in assigning future species to the group

In addition there are certain tendencies exhibited. All the known species are similar in size and shape, ranging from about 7 to 12 mm., with most specimens near 10 mm. and all being moderately narrow. None of the species departs radically from the others in either size or shape. There is a strong tendency toward head and eye modifications. In the most extreme cases the head may have

Table 1

Characteristics of the various species in the Caviceps-Group

	aspera	wheeleri	rehmi	occipitalis	singularis	diversipubescens	cicatrix	excavatifrons	straba	afoveata	impressifrons	caviceps	rileyi	insueta
Characteristic elytral suture elevation		X	X	X	X	X	X	X[1]	X	X[2]	X	X	X	X
Male legs fringed	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Characteristic spots on abdomen	X	X		X	X	X	X		?[3]		X	X	X	?[3]
Scutellar spots on elytra	X	X		X		X	X		?[3]	X	X	X	X	?[3]
Pronotal pubescence not all directed backward		X	X	X	X	X	X	X	X	X	X	X	X	X
Some short, velvety pubescence on pronotum				X		X							X	
Pronotum humped on disc					X			X						X
Conspicuous margin next to eyes								X	X	X	X	X	X	
Eyes oblique and narrow									X	X	X	X		X
Pit at posterior inner margin of eye											X	X	X	

[1] In a modified condition.
[2] Very faint, absent in some specimens.
[3] Pubescence all black in area.

conspicuous knobs or excavations and the eyes may be extremely oblique and narrow. There is also a tendency toward smoothing of the eye facets, at its extreme in *rileyi* and *excavatifrons*, in which the eyes are almost completely smooth. The pronotum tends to have the anterior angles more distinct than in other species and also tends to have the pubescence directed out from the middle, in whorls, or even directed anteriorly over part of the area. In the most highly modified species there is some very short, erect, velvet-like pubescence on the pronotum. In several species the pronotum has a distinct hump; in others it has a longitudinal bulge with lateral depressions. These tendencies help to set the group off from all others in the genus, even on a World basis, but are not too useful in its definition because they are so variable in expression. Table 1 summarizes the presence or absence of these characters in the known species.

In the following key the known species are arranged so that the least modified appear first. The species following are arranged as nearly as possible in sequence from the less to the more complex. The species *aspera* is the least modified of any; it has a simple head and pronotum. All of the rest are modified in some degree. *Wheeleri, occipitalis, singularis* and *diversipubescens* form a quite homogeneous group. *Afoveata, impressifrons, caviceps* and *rileyi* form another quite homogeneous assemblage, with progressively greater modification. Of the remaining species, *cicatrix* would fit near *singularis* were it not for the unique modification of the second antennal segment. *Straba* is most probably allied to the species around *caviceps*. *Excavatifrons* stands isolated, as does *insucta*. It is interesting to note that the two species most isolated structurally are the two most isolated geographically.

Key to Species

A. Mandibles of normal size, not enlarged and directed angularly backward.
  B. Eyes not margined by a conspicuous glabrous area.
    C. Second segment of antennae normal, without a scar-like area.
      D. Pronotum without denuded areas at the anterior angles.
        E. Occiput truncated or rounded, not bulging.
          F. Elytra with black scutellar spot; abdomen with the black spots typical of the group.
            G. Pubescence on pronotum of same color as on rest of body, cinereous to dull luteous, directed

backward. Colo. to W. Texas and E. Ariz. (White Mts.) ..... *aspera* Werner

GG. Pubescence on pronotum orange, on rest of body cinereous to dull luteous. Ariz. (Sabino Cn., Globe, Superior, Phoenix); Calif. (Morongo Valley near Palm Springs, Whitewater); Nev. (Glendale); Utah (St. George) *wheeleri* Horn

FF. Elytra without black scutellar spot; abdomen without black spots. Pubescence dull luteous. Ariz. (Chiricahua Mts. to Baboquivari Mts. N. to Phoenix) ..... *rehni* Maydell

EE. Occiput bulging conspicuously. Pubescence dull luteous.

F. Pronotum of normal shape, bulging slightly. Vizcaino Desert in Baja California. *occipitalis* Werner

FF. Pronotum with a conspicuous hump. Monterrey, N.L. and Saltillo, Coahuila .. *singularis* Champ.

DD. Pronotum with the anterior angles, and often the posterior angles, denuded and opaque, with some very short, erect, black pubescence on the margins of the denuded areas. Pubescence cinereous to dull luteous. Rio Grande region of New Mexico and El Paso, Tex. ..... *diversipubescens* Mayd.

CC. Second segment of the antennae with a conspicuous, glabrous, scar-like area. Presidio, Tex. *cicatrix* Werner

BB. Eyes with a conspicuous denuded margin, at least behind.

C. Head without a pit-like depression at the inner posterior margin of each eye.

D. Pronotum conspicuously humped. Elytra without scutellar spots; abdomen without black spots. Pubescence cinereous. N. Fla. and coastal Ala. and Miss. *excavatifrons* Mayd.

DD. Pronotum not humped.

E. Pubescence black; elytra sometimes with narrow white margins. Legs and underside often with some white pubescence. Eyes oblique, narrow and pointed at the inner margin, of very unusual shape. S. Calif. ..... *straba* Horn

EE. Pubescence cinereous. Eyes oblique but not con-

spicuously modified. S. Calif. . . *aforeata* Werner

CC. Head with a pit-like depression at the inner posterior margin of each eye.

D. Depressions shallow, more or less indistinct. Occiput with a broad, median impression which leaves a conspicuous bump behind the inner margin of each eye.

E. Pubescence on pronotum similar to that on elytra, sparse. Disc of pronotum bulging. Occipital impression not deep. Pubescence cinereous. S. Calif. *impressifrons* Van Dyke

EE. Pubescence on pronotum dense, erect, much different in length and texture from that on elytra. Occipital impression deep. Pubescence cinereous to dull luteous. Southwest Ariz. to southw. Utah *caviceps* Horn

DD. Depressions very deep, appearing to limit the inward extent of the reniform eyes. Pubescence luteo-cinereous to dull luteous. Ariz. (Chiricahua Mts. to Baboquivari Mts. N. to Phoenix) *rileyi* Horn

AA. Mandibles much enlarged, bent backward at an angle, meeting along their cutting edges. Pronotum conspicuously humped; head broadly triangular. Pubescence black except for some cinereous hairs on the legs and underside of head. Toluca, Mexico, Mex. . . . . *insueta* sp. n.

The Caviceps-Group is restricted to the North American continent and, within this area, to the region from Colorado to southern California and south onto the northern part of the Plateau Central of Mexico and halfway down Baja California. Two species are found outside this region, *excavatifrons* in northern Florida and along the coast of Alabama and Mississippi, *insueta* at Toluca, near the southern extension of the Plateau Central. In all known cases the adults are to be found on flowers in very late summer and fall. Since most collectors have other duties to attend to during this period, the group is poorly represented in collections. Most of the species appear to have rather restricted ranges, though more intensive collecting will probably result in recorded ranges more extensive than those used in this paper, and in the discovery of additional species, particularly on the northern part of the Plateau Central.

Following is a redescription of *singularis* Champ. and a description of *insueta* sp.n. Descriptions or redescriptions of the other species in the group will be found in the papers listed at the end

Epicauta singularis Champ.
Figs. 4–6

Epicauta singularis Champion, 1892, Biol. Cent.-Am., Coleop. 4 (2): 427, pl. 19, f. 25, female. Vaurie, 1950, American Museum Novitates No. 1477: 30.

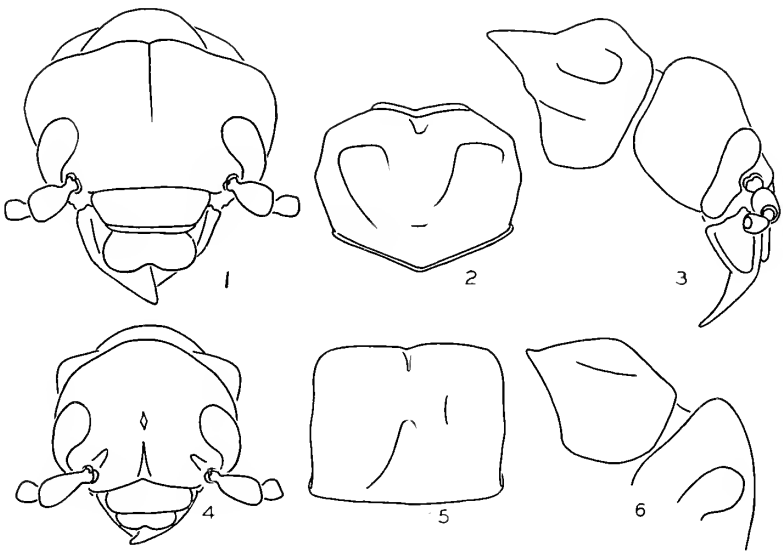
A male and a female paratype, loaned by Mr. Balfour-Browne, are the only specimens I have seen of this interesting species. The opportunity is taken here to make some additions to Champion's description.

The species very definitely belongs to the Caviceps-Group. The only species in the group with which it might be confused is *cicatrix* Werner, which differs greatly in the form of the second antennal segment.

Black, moderately densely clothed with yellow-cinereous pubescence. Head (figs. 4, 6) suboval, widest just behind the eyes, bulging at the occiput, very similar to that of *occipitalis* Werner. Surface densely punctured, strongly microreticulate; pubescence moderately long, and uniform except on the antennal calluses, which are narrow, glabrous and without punctures or microretriculation. Midline slightly impressed, narrowly denuded at the level of the eyes, partly denuded from these anteriorly to the clypeus. Eyes normal, moderately narrow, excavated, with a narrow, inconspicuous denuded margin. Mandibles normal for *Epicauta*. Antennae 2½ as long as an anterior tibia, black, with a little pale pubescence at the apex of segment I. Segment I reaches 1/3 across the eye; II is short, 2/5 as long as I, stout, slightly shortened behind; III and following slightly flattened, slightly broader at apex than at base, the broadening gradual; III 1/4 longer than I, IV to X subequal in length, about as long as I, tapering gradually in width; XI slightly longer than X, the narrowest segment. Proportions (in relation to a total length of 1000 units) of segments of male antenna: 124/58, 45/45, 130/52, 97/55, 97/49, 97/47, 84/42, 84/39, 81/38, 72/36, 88/33. Antennae of female similar to those of male, slightly more slender.

Pronotum (figs. 4–6) quadrate, 1.5 broader than long; disc elevated into a distinct hump at the middle, a shallow median impression extending onto the hump from behind and another, smaller, one from the front. In the male paratype this hump is truncated in front view; in the female paratype the apex appears pointed in all views. This probably represents individual difference rather than a secondary sexual character. The pubescence is normal, not thickened, and is whorled around a pair of centers before the middle of the disc.

Elytra unicolorous, without black markings at the base. The female paratype has a sutural elevation at 1/4 from apex but does not have this elevation denuded as it is indicated in Champion's figure. Underside with pubescence slightly sparser than above. In the male paratype there are midventral black spots on sternites III, IV and V. (The rest of the segments have been eaten.) The pubescence on these spots is short and sparse, practically invisible. The female paratype lacks these abdominal markings. The middle and hind femora and trochanters of the male are denuded and slightly flattened behind, with the denuded area fringed dorsally by sparse long hairs. The femora of the male are not bowed, the tibial spurs are spiniform on all legs in both sexes. Type locality: Monterrey, Nuevo Leon, designated by Vaurie, l.c. As far as I can determine this species has not been collected since it was reported by Champion. Redescribed from Monterrey paratypes.



All of the figures were made with the aid of a camera lucida. Fig. 1. *Epicauta insucta* sp.n., anterior view of head, holotype. Fig. 2. Same, dorsal view of pronotum. Fig. 3. Same, lateral view of head and pronotum. Fig. 4. *Epicauta singularis* Champ., male paratype, anterior view of head. Fig. 5. Same, dorsal view of pronotum. Fig. 6. Same, lateral view of pronotum and dorsal part of head.

Epicauta insueta sp.n.
Figs. 1–3

Within the Caviceps-Group this species could hardly be confused with any other. The only other black species known, *straba* Horn, has narrow and very oblique eyes, and has normal mandibles. From other black species of *Epicauta* in North America it can be distinguished readily by the form of the mandibles, which are long and bent back at a 30 degree angle (fig. 3), somewhat like the mandibles of *E. mimetica* (Horn).

Entirely black, opaque, the pubescence black except on the mandibles, underside of head and on part of the legs, where it is cinereous. Head triangular; pronotum noticeably broader than long, with lateral impressions and a conspicuous anterior hump. Length of holotype: 9½mm. Width: Head 2.7, pronotum 2.1, and elytra at humeri 3.0 mm.

Head triangular, broad, ¼ broader than long to apex of clypeus, widest at temporal angles. The occiput bulges slightly (fig. 1) and there is a pair of small impressions near the midline between the eyes. Surface moderately densely and deeply punctured, appearing almost glabrous at low magnification because the pubescence is short, sparse and decumbent. It is longer and more prominent along the margins. The intervals between the punctures are opaque because of the deep microreticulation. Midline impressed down to the level of the eyes. The middle of the front has a narrow rufous spot in all four specimens. Antennal calluses small, not elevated, with a small impunctate area. Eyes narrow, not prominent, excavated. Clypeus separated from front by a strong transverse suture. Labrum slightly excised at middle. Clypeus and labrum with longer pubescence than rest of head. Mandibles large (figs. 1, 3), bent back at a 30 degree angle at the level of the apex of the labrum, meeting along the almost straight cutting edges. Maxillary palpi slightly enlarged in male; labial palpi with both segments elongate and tubular in both sexes.

Antennae reaching basal fourth of elytra, moderately slender, tapering gradually. Segment I short, stout, reaching 2/3 across the narrow eye; it is sharply constricted at the base, almost quadrate, tubular, slightly flattened behind. Segment II short, 7/10 as long as I; III 1.7 as long as I, slender, gradually thicker apically; IV 2/3 as long as III; V to X slightly shorter than IV, decreasing gradually in thickness; XI as long as IV. The segments beyond III are slightly flattened, slightly swollen beyond the middle. Proportions of segments in holotype (to total length of 1000 units): 93/61, 56/42, 144/44, 98/47, 88/51, 88/47, 84/47,

84/47, 82/42, 82/40, 102/40.

Pronotum (figs. 1–3) of rather unusual form, broad, roughly hexagonal. A median hump before the middle is limited behind by a weak transverse crease; from the anterior part of the hump there extend two lateral ridges and these in turn unite with ridges along the lateral margins. A pair of lateral sharp-sided depressions with flat bottoms result. Surface deeply microreticulate, densely and rather deeply punctured, the punctures denser on the hump. Pubescence short, fine, suberect on the hump, decumbent over rest of surface. Median impressed line distinct, widest anteriorly. Basal and apical impressed lines distinct.

Elytra subparallel, with the suture elevated slightly at the basal third. In the female allotype this elevation continues to the apical fourth. Surface smoother than that of head or pronotum but still quite opaque, moderately densely and finely punctured. Pubescence longer than on head and pronotum, moderately sparse and decumbent, not conspicuous. Underside with some cinereous pubescence, on the underside of the head, on the anterior side of the pro-coxae, femora and tibiae, a few hairs on the posterior side of the meso- and meta-coxae, trochanters and femora. In the male the meso- and meta-femora have the posterior surface slightly flattened but not glabrous, and margined above with sparse, long, cinereous pubescence. The meso- and meta-trochanters also have similar pubescence. The female allotype lacks these long hairs and has normal legs. The tibial spurs are slender and spiniform, except on the meta-tibiae, where they are slender and more sticklike. Underside of abdomen of male with no sign of denuded spots.

The female allotype has the punctures on the head finer than do the males. It, the holotype and one male paratype have an indication of a small smooth area in the middle of the discal depressions of the pronotum. The other male paratype lacks these.

Holotype: male, Toluca, Mexico, MEXICO, Aug. (19)03. W. L. Tower Collection (AMNH).

Allotype: female, cutopotypical (AMNH).

Paratypes: 2 males, cutopotypical (AMNH & Werner).

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Werner, F. G., 1945, Bull. Museum of Comparative Zoology 95: 423, 425–435, 481–489. (see for redescriptions and references to original papers)

————, 1949, Psyche 56: 103–108, fig. 2 A, B. (*afovcata* Werner, *impressifrons* Van Dyke, *occipitalis* Werner)

————, 1951, Psyche 57: 131–133, fig. 5. (*cicatrix* Werner)

MISCELLANEOUS PREY RECORDS OF SOLITARY WASPS. I. (HYMENOPTERA: ACULEATA).

By Karl V. Krombein,[1] Washington, D. C.

It is my intention to publish from time to time, under this general title, prey records of solitary wasps which have not been included in my separate faunistic studies of limited areas, or which have not been the subject of separate biological notes. In general, the data given will consist of the following: The name of the wasp as determined by the author, except where credited in brackets to another worker; a code number referring to the observation; the locality, date, and time; and name of the prey followed, in brackets, by the authority responsible for that identification.

So far as possible I am depositing these wasps and associated prey in the collection of the U. S. National Museum, so that the identifications may be checked at later dates, should altered taxonomic concepts make this desirable. Each wasp and its prey bear the same code number, which is placed on the pin bearing the insects or, in the case of material preserved in alcohol, in the vial containing them.

It is important that predator and prey remain associated and that they be placed on permanent deposit in an institutional collection. Our taxonomic concepts occasionally change as the years bring us added material, or refined techniques for differentiation, or a more critical approach to the study of a given population. What we recognize today as a single species of wasp may on some future tomorrow be interpreted as several sibling species, or subspecies distinguishable largely on an ethological basis or difference in host preference. It must also be remembered that many solitary wasps store their nests with prey in an immature stage, which today we may be able to determine only to genus, subfamily, or family. Further study of immature forms in subsequent years may make it possible to provide specific identifications for many of these immature specimens.

Bethylidae

Laelius trogodermatis (Ashmead)

A female of this species (81653 A) was captured in Arlington, Va., at 5 p. m. on August 16, 1953. She was dragging over the vertical surface of an unpainted, weathered board a paralyzed der-

[1] Entomology Research Branch, Agricultural Research Service, United States Department of Agriculture.

mestid larva much larger than herself which she held in her mandibles. The dermestid larva, a species of *Trogoderma* [det. W. H. Anderson], was 4.1 mm. long as compared with 2.8 mm. for the wasp. The board over which the wasp was dragging her prey was part of the exterior wall of a disused cowshed attached to my garage, and was 4 feet above the surface of the ground.

The type series of *L. trogodermatis*, consisting of one male and one female, was stated to have been reared from a larva of *Trogoderma tarsale* Melsh. Judging from the disparate size of the prey and wasp recorded above, it seems likely that several eggs would have been deposited eventually on the single larva. Multiple oviposition on one larva of *Anthrenus vorax* (Waterhouse) has been reported recently (Ayyappa and Cheema, 1952. Proc. Indian Acad. Sci., Sect. B, 36: 215–222) for a probable undescribed species of *Laelius* from India.

Since some of the observations recorded below were made on other wasps nesting in the wall of this disused cowshed, it might be well to mention the composition of this nesting area. The south wall is attached to the garage, the east and west walls have stucco exteriors with no nesting sites, and the north wall is composed of unpainted, weatherbeaten boards of Virginia pine, ¾ inch thick and 4 to 6 inches wide, nailed to the studding. At some time in the past these boards had a very heavy infestation of an anobiid beetle, *Xyletinus peltatus* (Harris) [det. W. H. Anderson], the larvae of which left a complicated system of anastomosing galleries stuffed with frass. There are now scarcely any of these beetles working in the wood, but their abandoned frass-filled burrows provide an easily excavated site for various xylicolous wasps. Dermestid larvae are found occasionally in the burrows which have been utilized as nesting sites by various wasps, and probably they feed on the mummified remains of prey which have not been consumed by the wasp larvae.

The present prey record for *L. trogodermatis* is of more than ordinary interest because the wasp was dragging the dermestid larva over the surface of the board. Under ordinary circumstances the larva would be paralyzed in the burrow and eggs deposited on it *in situ*. Perhaps in this case the dermestid larva was able to reach the surface before being paralyzed by the wasp's venom.

Pompilidae

Auplopus architectus (Say)

A female (92553 A) was captured by my wife on the ground

in Arlington, Va., at 2:15 p. m. on September 25, 1953. The wasp was carrying a paralyzed spider, venter to venter, with the spider's spinnerets grasped in her mandibles. All the spider's legs had been amputated at the apices of the coxae. The spider was a young female salticid, *Phidippus princeps* (Peckham) [det. B. J. Kaston].

Auplopus mellipes (Say)

A female (91750 A) was captured on a screen in my house at Arlington, Va., at 4 p. m. on September 17, 1950. She was dragging a paralyzed salticid spider, *Marpissa undata* (DeGeer) [det. B. J. Kaston], which had all the legs amputated beyond the coxae.

Auplopus nigrellus (Banks)

A female (71853 B) was taken crawling up the side of my house at Arlington, Va., at 2 p. m. on July 18, 1953. She was dragging a young paralyzed clubionid spider, *Trachelas* species, probably *tranquillus* (Hentz) [det. B. J. Kaston]. All the spider's legs except the left foreleg had been amputated at the tips of the coxae.

Ageniella (*Ageniella*) *partita* Banks

I caught a female (81350 A) [det. H. K. Townes] on the ground in open woods at Dunn Loring, Fairfax County, Va., on August 13, 1950 about 3 p. m. It was being closely pursued by two females of the cleptoparasitic pompilid, *Ceropales hatoda* Brimley [det. H. K. Townes]. The *Ageniella* was not carrying a spider.

Ampulicidae

Dolichurus greenei Rohwer

A female was captured at Dunn Loring, Fairfax County, Va., at 2 p. m. on August 22, 1948, dragging over leaf litter on the ground in open woods a paralyzed third instar blattid nymph of a species of *Parcoblatta* [det. A. B. Gurney].

Sphecidae

Diodontus atratus parcnosas Pate

This form nests in abandoned anobiid burrows in the habitat described above under *Laelius trogodermatis* (Ashmead). One female (72653 A) was captured as she hovered in the air before her burrow entrance at 4:30 p. m. on July 26, 1953. She carried in her mandibles an alate viviparous female aphid, *Drepanaphis acerifoliae* (Thos.) [det. L. M. Russell]. Three additional females (92653 C, 92653 D, 92653 F) were taken under similar circumstances at

11:15 and 11:20 a. m. and 3:30 p. m. on September 26, 1953. One of them was carrying an alate viviparous female of *Drepanaphis acerifoliae*, and the other two had nymphal aphids which Miss Russell thought probably belonged to the same species.

Stigmus americanus Packard

This species nested in large numbers in deserted anobiid burrows in the habitat described above under *Laelius trogodermatis* (Ashmead). Each of the following females was captured, at the time and date indicated, while crawling on the board near her burrow entrance and carrying in her mandibles an aphid nymph, probably *Drepanaphis acerifoliae* (Thos.) [det. L. M. Russell]:

72553 J—4 p. m., July 25, 1953
9753 A—3 p. m., September 7, 1953
91253 A—3 p. m., September 12, 1953
91253 B—3:15 p. m., September 12, 1953
91953 A—11 a. m., September 19, 1953
91953 D—3:30 p. m., September 19, 1953
92053 A—1:30 p. m., September 20, 1953

One of them (9753 A) clutched the rear end of the aphid in her mandibles, and two (91953 A, 91953 D) held the aphid by the head. Two additional *americanus* were captured in the same habitat, each with a nymphal aphid belonging to a species either of *Aphis* or *Anuraphis* [det. L. M. Russell], one of them (72553 I) at 4 p. m. on July 25, 1953, and one (72653 B) at 4:15 p. m. on July 26, 1953. Still another specimen (61651 B) was taken while carrying a nymphal aphid, probably a species of *Chaitophorus* [det. L. M. Russell], on the surface of a standing dead tree with punky wood at Dunn Loring, Fairfax County, Va., at 3 p. m. on June 16, 1951.

Passaloecus annulatus (Say)

This species nested in rather limited numbers in deserted anobiid burrows as described above. One female (92653 A) was captured at 9:30 a. m. on September 26, 1953, while carrying in her mandibles a nymphal aphid, probably *Drepanaphis acerifoliae* (Thos.) [det. L. M. Russell].

Chlorion pennsylvanicum (Linnaeus)

One female (82952 A) of this species was captured at 10 a. m. on August 29, 1952, while flying near the entrance to her burrow in a perpendicular bluff at Kenwood Beach, Chesapeake Bay, Md.

She was carrying a paralyzed, adult male tettigoniid, *Microcentum retinerve* (Burmeister) [det. A. B. Gurney]. About a dozen of these wasps had their burrows in a limited area in this bluff.

Crabro latipes Smith

A female was captured on October 4, 1934, at Ithaca, N. Y., while flying with a paralyzed female house fly, *Musca domestica* L. [det. C. W. Sabrosky].

First report of Aulacigaster leucopeza (Mg.) from Baja California, Mexico; California, New Mexico and Idaho: On November 6, 1953, nine larvae of *Aulacigaster leucopeza* (Mg.) were collected from cottonwood slime flux at San Jose, Baja California, by the authors assisted by C. C. Lindt. The larvae were reared to adults and sent to Willis W. Wirth, U.S.D.A., for identification.

This species has been reported from eight eastern states including Maryland, Virginia, New Jersey, New York, Pennsylvania, Indiana, Illinois, and Wisconsin, but has previously been collected only four times from the western United States. Through the kindness of Willis W. Wirth, the following four western records are included in this report: Las Cruces, New Mexico, June 1893, Cockerell, Cloudcroft, New Mexico, on *Pinus ponderosa* infested with *Dendroctonus*, C. J. Hay; from elm sap exudate, Council, Idaho, September 3, 1953, R. W. Portman, A. Dokoloff collected larvae and pupae of *Aulacigaster* (probably this species) from oak slime flux, Mather, California, July 1950.—Christian P. Christianson and Raymond E. Ryckman, Loma Linda, California.

NOTICE

Lepidoptera of New York and Neighboring States, Part III. Noctuidae, by William T. M. Forbes. 409 pp., food index 5 pp. Memoir 329, Cornell University Agricultural Experiment Station. 1954. Price: $1.50; Part II, $1.50; Parts II and III, $2.50. A few copies of Part I are still available for $1.75. Orders should be sent to:

The Mailing Room
Roberts Hall, Cornell University
Ithaca, New York

NEW OR LITTLE-KNOWN SPECIES OF CLADURA FROM JAPAN (DIPTERA, TIPULIDAE).

By C. P. Alexander, Amherst, Mass.

The genus *Cladura* Osten Sacken is represented by a relatively small number of forms in the United States and Canada, with a greater concentration of species in Eastern Asia, particularly in Japan. There are now known more than a score of species in Japan, the majority occurring in the mountainous areas of the island of Honshu. All known species of the genus are adult in the autumn, being most frequent from September into November. In the present report I am describing three novelties and furnishing additional records of distribution for two of the uncommon and little-known species.

Cladura (Cladura) alpicola Alexander

Shinano, Honshu: Mount Norikura, near Reisentoge, altitude 2,400 meters, September 8, 1951 (H. Hasegawa); Norikura, near Kwaigahara, altitude 2,600 meters, September 8, 1951 (Hasegawa); Sirahoneonsen, altitude 1,500 meters, September 9, 1951 (Hasegawa).

Cladura (Cladura) babai n. sp.

Belongs to the *megacauda* group, allied to *daimio;* general coloration yellow, including the antennae and legs, the tips of the femora narrowly darkened; wings subhyaline, unpatterned; abdominal tergites yellow, each segment with a ⊥-shaped dark marking; male hypopygium with the tergite produced into two spatulate blades; dististyle stout, expanded outwardly; mesal lobe of basistyle with its inner arm densely covered with microscopic setulae; each gonapophysis terminating in a strong recurved spine.

Male: Length about 7–7.5 mm.; wing 8.5–9 mm.

Rostrum testaceous yellow; palpi a little darker. Antennae yellow; flagellar verticils long and conspicuous. Head light gray, paling to yellow on the occiput.

Thoracic dorsum fulvous yellow, the pleura somewhat paler yellow. Halteres with stem yellow, knob weakly infuscated. Legs with the coxae and trochanters pale yellow; remainder of legs yellow, the tips of the femora and tibiae very narrowly blackened; tarsi passing into brownish black. Wings subhyaline, unpatterned; veins brown, those in the prearcular and costal fields more yellowed. Venation: R_2 faintly indicated; R_{1+2} and R_{2+3} subequal; petiole of cell M_1 more than twice m.

Abdominal tergites yellow, each segment with a ⊥-shaped brown area, including the median stem and the nearly terminal posterior margin; ninth tergite darker; sternites yellow with darkened posterior borders. Male hypopygium with the posterior border of the tergite produced into two conspicuous spatulate blades. Apical lobe of basistyle more slender and a little shorter than the dististyle, narrowed to the tip, the major setae grouped at apex; proximal lobe of basistyle distinctive, the entire major blade and its inner arm densely covered with microscopic setulae. Disistyle stout, expanded outwardly, the apex vaguely bilobed. Gonapophysis appearing as a powerful sclerotized structure, the tip bent backward into a powerful spine.

Most nearly allied to *daimio* which has the tergite, outer lobe of basistyle and dististyle somewhat the same; proximal lobe of basistyle with its inner arm a glabrous oval blade, without setulae, but with about six strong setae on outer half.

Habitat: Japan (Honshu).

Holotype: ♂, Kurokawa, Echigo, October 15, 1953 (Kintaro Baba). *Paratype:* ♂, Mount Chokai, Uzen, altitude 600 meters, October 17, 1950 (Kotaro Shirahata), through Dr. Baba; ♂, Morioka, Rikuchiu, October 6, 1934 (T. Kato).

I am pleased to name this fly for Dr. Kintaro Baba, to whom I am indebted for numerous Tipulidae from Echigo. Although it is closely allied to *Cladura* (*Cladura*) *daimio* Alexander, I regard the two flies as being distinct.

Cladura (Cladura) itoi n. sp.

Belongs to the *megacauda* group, allied to *alpicola*; size very large (wing, male, exceeding 10 mm.); general coloration yellow, including the palpi and antennae; legs yellow, the tips of the femora and tibiae very narrowly and gradually darkened; male hypopygium very large and complicated in structure; basistyle elongate, its basal lobe unequally bilobulate, the outer lobe very long and slender, subequal in length to the style itself; dististyle stout, a little more than one-half as long as the outer lobe of basistyle, bearing a slender erect rod near base, tipped with dense black setae; gonapophysis appearing as a flattened blade, the outer margin with microscopic denticles, the apical one largest.

Male: Length about 9 mm.; wing 10.5 mm.

Rostrum and palpi pale yellow. Antennae yellow, the conspicuous verticils black. Head above faintly infuscated, more yellowed behind, with long erect setae.

Thorax yellow, the dorsum slightly more fulvous. Halteres white, the base of the knob weakly darkened. Legs yellow, the tips of the femora and tibiae very narrowly and vaguely darkened; tarsi brown, passing into black. Wings subhyaline, the prearcular, costal and stigmal regions very faintly more yellowed; veins dark brown, paler in the brightened fields. Venation: Sc_1 relatively long, Sc_2 lying shortly before fork of R_{2+3+4}; R_2 distinct, R_{1+2} and R_{2+3} subequal; petiole of cell M_1 about twice m; m-cu a little less than its own length beyond the fork of M.

Abdomen obscure yellow, the posterior borders of the segments narrowly darkened, the midregion of the tergites less evidently so; hypopygium very large, yellow. Male hypopygium of the *megacauda* type but even more accentuated, representing the extreme of ornamentation as far as known in the genus. Ninth segment large and complex, the tergite and sternite fused into a continuous ring; tergal region produced into two relatively slender dorsally directed lobules; cephalad of these with a group of long erect pale setae; region of the sternite with abundant long erect pale setae. Basistyle elongate, erect, its ventral margin rounded, with a brush of very long setae; basal lobe of mesal face of style deeply bilobulate, the larger lobule foot-shaped, the appressed smaller one fingerlike, tipped with a few long setae; apical lobe of style subequal to or a little longer than the style itself, very slender, terminating in three or four long setae, with other scattered erect very long bristles down the outer margin. Dististyle stouter than the apical lobe of basistyle, a little more than one-half as long, near its base with a slender erect rod that is fully one-fourth as long as the style; apex of style with a dense brush of black setae, with fewer similar darkened setae on the cephalic and mesal faces. Gonapophysis about equal in length to the aedeagus, appearing as a flattened blade, the outer margin with microscopic denticles, the apical spine largest.

Habitat: Japan (Honshu).

Holotype: ♂, Sigakôgen, Shinano, altitude 1600 meters, September 11, 1953 (Ito).

This interesting crane-fly is dedicated to Professor Syusiro Ito, who has added vastly to our knowledge of the Japanese Tipulidae. It is the largest regional member of the genus so far discovered. The nearest ally is *Cladura* (*Ctadura*) *alpicola* Alexander, which has the details of structure of the hypopygium quite distinct.

Ctadura (*Cladura*) *megacauda* Alexander

Shinano: Sigakôgen, altitude 1600 meters, September 11, 1953 (Ito).

Echigo: Kurokawa, October 15, 1953 (Baba).

Kotsuke: Hatomati Toge, Oze, September 22, 1950 (Hasegawa); Hirami-no Tashiro, Oze, September 7, 1952 (Fuhuhara).

Uzen: Mount Chokai, altitude 600 meters, October 17, 1950 (Shirahata).

Cladura (Cladura) shirahatai n. sp.

Belongs to the *megacauda* group; size small (wing, male, 5.5 mm.); general coloration yellow, the mesonotum and ventral pleura vaguely patterned with darker; wings subhyaline, veins pale brown; *Sc* relatively short, Sc_1 ending some distance before level of fork of R_{2+3+4}; cell M_1 long-petiolate, subequal to its stem; male hypopygium with the apical lobe of the basistyle shorter than the clavate dististyle; gonapophysis foot-shaped.

Male: Length about 5mm.; wing 5.5 mm.

Rostrum yellow; palpi pale basally, the outer segments darker. Antennae with the basal segments yellow, the flagellum chiefly pale brown, the segments with very long verticils. Head light brownish gray.

Pronotum pale yellow. Mesonotal praescutum yellow with three darker stripes, the lateral pair and posterior end of the median stripe paler, posterior sclerites yellow, the scutal lobes conspicuously darkened; scutellum and mediotergite less evidently infuscated. Pleura and pleurotergite pale yellow, the ventral sternopleurite and meron vaguely darkened. Halteres with stem white, knob conspicuously infuscated. Legs with the coxae and trochanters pale yellow; remainder of legs yellow, the tips of the femora very vaguely more darkened; outer tarsal segments becoming brownish black. Wings subhyaline, the prearcular and costal portions a trifle more yellowed; veins pale brown. Venation: *Sc* relatively short, Sc_1 ending some distance before the level of fork of R_{2+3+4}, Sc_2 about opposite one-third the length of the latter vein; cell M_1 long-petiolate, the cell subequal in length to its stem.

Abdominal tergites pale brown, sternites more yellowed; ninth segment brownish black, forming a conspicuous ring; hypopygium brownish yellow. Male hypopygium with the tergite relatively large, its posterior border produced into two slender lobes that are separated by a U-shaped notch, with two further smaller and weaker lobules lying still more ventrad. Apical lobe of basistyle a little more than one-half the length of the style itself, shorter than the dististyle, the latter clavate, broader at apex than at base, provided with sparse setae; mesal lobe of basistyle stout, produced into

a slender apical lobule and a stouter more basal one. Phallosome distinctive, the gonapophysis foot-shaped, the apex or sole microscopically corrugated; aedeagus slender, subequal in length to the apophysis.

Habitat: Japan (Honshu).

Holotype: ♂, Sakata, Uzen, October 15, 1953 (Kotaro Shirahata); received through Dr. Kintaro Baba.

This small *Cladura* is named for the collector, Mr. Kotaro Shirahata. It is quite distinct from all other members of the *megacauda* group in the venation, as the short *Sc* and long petiole of cell M_1, and in the structure of the male hypopygium, especially the basistyle, dististyle and gonapophysis. This is the smallest member of the genus so far discovered in Japan.

Katydids in Southern Utah: On a recent trip to southern Utah, the writers were able to pick up several interesting katydids. Most were picked up in evening collecting at well lighted service stations and stores. Two very interesting medium-sized, striped specimens were thus taken, identified by J. A. G. Rehn as *Insara covillcae* Rehn and Hebard. These were picked up at St. George, Utah, about 9:00 p.m. on September 9, 1954. A few specimens of a large green katydid were taken about lights at our motor court and another on the well lighted wall of an ice cream store at St. George during the evenings of September 8 and 9. These were identified by H. J. Grant as *Microcentrum rhombifolium* (Sauss.). Another specimen of this species was collected on sunflower at Kanab during the afternoon of September 10. Several others were collected by sweeping low-growth poplars in the mouth of the canyon just above Cedar City, Utah on August 4, 1954, when Dr. D. W. Davis and I visited the area.—George F. Knowlton and K. Goodarzy, Logan, Utah.

A NOTICE OF INTEREST

A New Issue of **THE NATURALISTS DIRECTORY** has just been published, it is the 37th Edition and will be found very helpful to all those of our readers who are interested in the Study of Nature in any of its branches. The price is $5.00 postpaid and it is published by THE NATURALISTS DIRECTORY, 720 Fillmore Road, EAST MEADOW, NEW YORK. (formerly at Salem, Mass.)

A NEARCTIC RACE OF SYNGRAPHA MICROGAMMA HÜBNER, WITH REMARKS ON THE STATUS OF MONTANA PACKARD (LEPIDOPTERA: PHALAENIDAE).

By Douglas C. Ferguson,[1] Halifax, N. S.

Examination of both male and female genitalia indicates that *montana* Pack. is a species distinct from *Syngrapha microgamma* of Europe and North America. Packard described *montana* from the White Mountains, N. H. (Guide to the Study of Insects, 313, 1874), probably Mt. Washington, but no further specimens are known to have been taken in that area until 1951, when Mr. Donald J. Lennox of Whitefield, N. H. captured a female on the Bray Hill Bog near the town of Jefferson, and 1952 when I captured another at 5000 feet on the slopes of Mt. Jefferson, just below the Monticello Lawn on the Caps Ridge Trail. The lack of topotypical material, together with the apparent loss of Packard's type, made the identity of *montana* somewhat uncertain, although it was correctly assumed by Dr. J. McDunnough to be the same as the small dark species from the vicinity of Ottawa and from the Gaspé (McDunnough, Revision of the North American Genera and Species of the Phalaenid Subfamily Plusiinae, Memoirs S. Cal. Ac. Sci., II, No. 2, 1944). The two New Hampshire specimens before me, one from a bog lying in the bottom of the Jefferson Valley and the other from above timber-line a few miles away, agree perfectly, and are perhaps the closest thing to topotypical material seen since Packard's type. We may safely assume that these New Hampshire specimens represent the same species and the same population as the specimen Packard described.

Montana is rather a small and intensely colored species expanding from 22 to 26 mm. The silver mark on the primaries is formed a little differently from that of *microgamma*, and the t.p. line has a more pronounced inward curve below the cell. Underneath, the discal spots on both wings tend to be more distinct in *montana*, and the dark areas show through more strongly. Figures 4 and 5 illustrate the two New Hampshire specimens, and figure 6 is a specimen from Nova Scotia—the only record for that area. As well as the specimens known from these localities, from the Mer Bleue near Ottawa and from the mountainous interior of the Gaspé Peninsula, there are examples of *montana* in the Canadian National Collection from Harlan, Sask. where it apparently flies in company with the

[1] Nova Scotia Museum of Science.

nearctic race of *microgamma*. It normally flies by day, but the single Nova Scotian example was taken in a light trap. *Syngrapha montana* is a rare moth in collections.

Compared with *microgamma*, the male genitalia of *montana* are smaller, with differences in the shape of the valves, juxta and uncus. The pointed process of the harpe is somewhat shorter and stouter, just barely overlapping the costal margin, and the pointed apical process of the juxta is lacking. The vesica bears a huge curved and tapering apical spine with a broadened base, much larger than that of *microgamma*, but the minute one found in the bulbous end

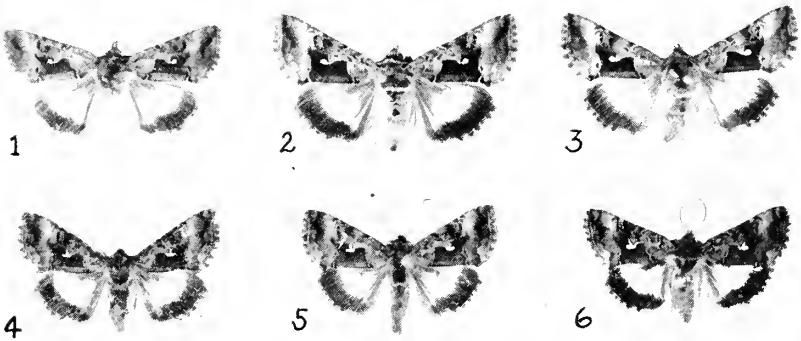

Fig. 1. *Syngrapha microgamma* Hbn. ♂. Tilsit, Germany, late June, 1942. Fig. 2. *S. m. nearctica* new race. Holotype. Fig. 3. *S. m. nearctica* new race. Allotype. Fig. 4. *S. montana* Pack. ♀. Mt. Jefferson, N. H., 5000′, July 8, 1952. Fig. 5. *S. montana* Pack. ♀. Bray Hill Bog, near Jefferson, N. H., June 10, 1951 (D. J. Lennox). Fig. 6. *S. montana* Pack. ♀. Glenholme, Colchester Co., N. S., June 19, 1953 (Walter Harrington). Figures natural size. Photographs by the author.

of the aedeagus appears to be similar. Figure 9 depicts the male genitalia of *montana*.

In the female genitalia the ostium of *montana* is of entirely different and much simpler form. The ductus bursae is considerably longer, entering the bursa lower down, and lacks the curves and the swollen portion conspicuous in *microgamma*. The smoothly rounded and spiculate apical end of the bursa where the ductus seminalis enters is more pronounced because of its increased length beyond the adjoining ductus bursae. The female genitalia of *montana* are shown in figure 10, but I suspect that in this specimen the

bursa was somewhat twisted out of its normal position. Presumably it should lie with the apical end and ductus seminalis on the right side, as in *microgamma*.

A series of these yellow-winged *Syngraphas* from Halifax Co., Nova Scotia did not agree well with *montana*, and further investigation revealed a very close relationship to the true *microgamma* of Europe. Both the male and female genitalia (Figures 7 and 8) are identical to those of European specimens but the moths are larger and more brightly colored. I describe this North American race as follows.

Syngrapha microgamma **nearctica** new race
Figures 2 and 3.

General pattern of the primaries in both sexes similar to *microgamma* except for a few minor but consistent differences. The t.p. line is usually waved but has not so pronounced a concavity below the cell. In one or two of the paratypes it is almost perfectly straight until it curves around the cell and inward to meet the costa. Both the t.p. and t.a. lines are more distinct in *nearctica*, tending to be quite sharp and silvery, or often partially suffused with reddish. Lobed silver spot always noticeably larger in the nearctic race.

Basal area of primaries light bluish-gray, confined by the t.a. line for the lower two-thirds of its length, diffusing outwardly in costal region and enveloping the orbicular. Outer area beyond the t.p. line similarly bluish-gray, with dentate subterminal marked by rather diffuse darker scaling. This pale outer area is also sharply confined in the lower two-thirds of the wing, but invades the median area opposite the reniform. Median area in lower two-thirds, except for silver lobe, entirely rich dark brown. Secondaries yellow with dark brown border as in *microgamma*.

Vestiture of head and thorax gray-brown fringed with pink or pale violaceous gray. Vestiture of abdomen straw colored, reflecting the yellowish hue of the adjacent secondaries, tinged with pink laterally and caudally in some specimens. Darker dorsal tufts on the first two segments.

Expanse: holotype 31 mm., allotype 30 mm., paratypes 28–31 mm.

Male and female genitalia identical in *microgamma* and race *nearctica*. A comparison with *montana* was made earlier in the discussion of that species, and the drawings illustrate the chief points of difference.

Holotype ♂—Sphagnous bog at Goodwood, on the Prospect Road, Halifax County, N. S., June 18, 1952.

Allotype ♀—Same locality, June 20, 1951.

Paratypes—7 ♂♂, 6 from the same locality and one from near Peggy's Cove, Halifax County, N. S., June 13–21, 1951–52.

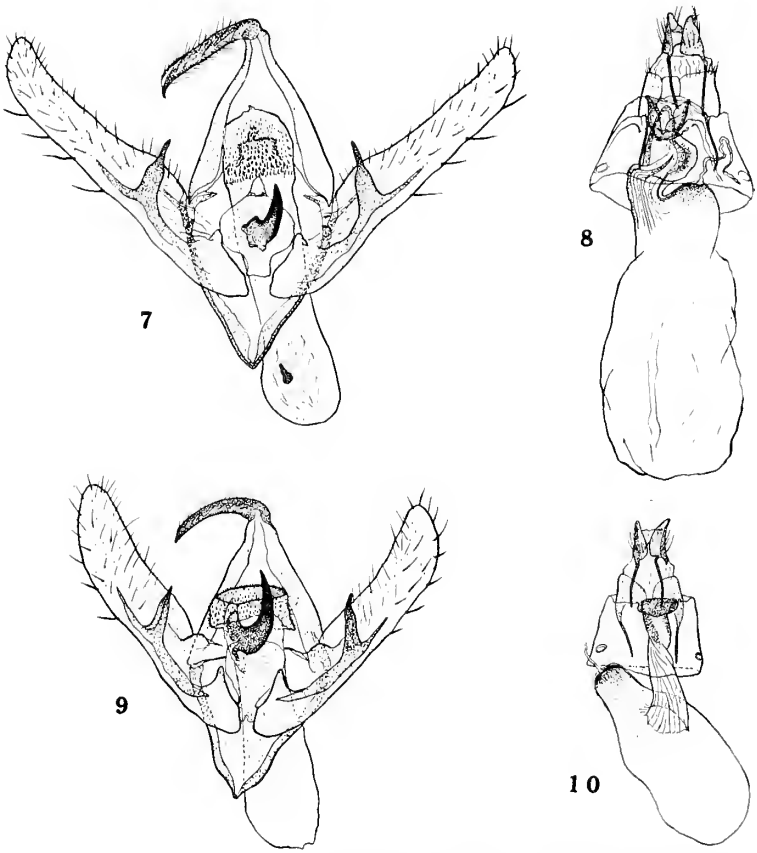

Fig. 7. Male genitalia of *Syngrapha microgamma nearctica* new race, paratype. Fig. 8. Female genitalia of *Syngrapha microgamma nearctica* new race, topotypical example too worn to be included in type series. Fig. 9. Male genitalia of *Syngrapha montana* Pack ., Cascapedia Road, Gaspé, July 15, 1950 (D. C. F.). Fig. 10. Female genitalia of *Syngrapha montana* Pack., from same specimen shown in figure 4. (The male genitalia are more highly magnified.)

The holo- and allotype will be deposited in the Canadian National Collection at Ottawa; paratypes to the American Museum of Natural History, the J. G. Franclemont collection at Cornell University and the collection of the author at the Nova Scotia Museum of Science, Halifax.

I have examined the specimens of *microgamma* from western Canada mentioned by McDunnough in his Revision of the Plusiinae, and find that they agree very well with *nearctica*.

The five European specimens that have been available for comparison—two from Tilsit, Germany, June, 1942 (Figure 1), one from the Ottolengui collection without data, and two Estonian specimens in the C.N.C.—agree perfectly, and are consistently smaller and less gayly colored than the new race described. *Montana*, on the other hand, is smaller still and much darker, with less contrast between the median, basal and outer areas of the forewing.

Nearctica frequents coastal heaths and barrens, or open sphagnous bogs that are overgrown with Ericaceae. Like *montana*, it is essentially a swift and elusive day flyer, behaving in flight much like an *Anarta*. About a dozen specimens are seen for every one captured. Although the bog where the types were taken is covered with flowering *Vaccinium* and *Kalmia* at that season, none were seen visiting flowers. It seems that both *nearctica* and *montana* will occasionally fly at night, as two specimens of the former, as well as the Nova Scotian example of *montana* mentioned previously, were taken at light.

I am indebted to Dr. Frederick H. Rindge of the American Museum of Natural History for the loan of material from the Ottolengui collection of Plusiinae in that institution, and to Mr. D. F. Hardwick and Dr. Eugene G. Munroe for placing at my disposal the material in the Canadian National Collection.

PUBLICATIONS RECEIVED

Hugh Roy Cullen, A story of American Opportunity, by Ed Kilman and Theon Wright. 376 pp. 6 × 9 ins., cloth bound. 1954. Prentice-Hall Inc., New York, N.Y. (Price, $4.00)

An Unusual Ant Collection Record: Recently I received for determination a dealate female and a worker of the ant, *Smithistruma clypeata* (Rog.) which were collected at Midway Point, Luray Caverns, Virginia, May 27, 1952 by Kathryn Sommerman who stated, "These were taken way down underground in the big room about half way through the cave. The guide called the room "Midway Point" and gave us a rest period, 5 or 10 minutes. The ants were collected from the walls along with some psocids. I had a flashlight and aspirator for collecting. The guide assured me there were no insects within the cave, and although he did not prohibit collecting he wasn't very enthusiastic about the idea. Since we had only one rest period there was no other chance to collect because I did not want to be conspicuous by failing to keep up with the rest of the group. The room was lighted when sightseers were being conducted through there, but otherwise the lights were turned off, and then it was in total darkness. However, the lights were on enough so that the green growths of algae or moss were found near the lights."

Although several other species of ants have been collected from caves in other sections of the world, this is the first species, to my knowledge, that has been reported from a cave in the United States. Another dacetine ant, *Strumigenys* (Pyramica) *gundlachi* (Rog.) was stated by Weber, 1952., Amer. Mus. Novitates No. 1554, p. 5 to have been found in a dark cave in Trinidad, 200 meters from the entrance.

Brown, 1953. Amer. Midl. Nat. 50: 59 says that *clypeata* ranges from southern Pennsylvania to central Illinois south to Florida and Louisiana. According to him abundant records show that the species will nest in the soil cover, beneath stones, or in rotten logs, usually in forested areas, and that although it has not been directly reported feeding on springtails, it almost certainly does. Future collecting in caves may thus yield more species of dacetine ants and springtails than we are now aware live under those conditions.—Marion R. Smith, Washington, D. C.

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This page is limited to exchange notices and to small For Sale advertisements from members of the Society and from actual paid subscribers to the Bulletin exclusively. *Exchange notices* from members of the Society and from subscribers are limited to *three (3) lines each,* including address; beyond 3 lines, there will be a charge of $1.00 for each 3 lines or less additional. *For Sale* ads will be charged at $1.25 for each 3 lines or part of 3 lines. *Commercial or business* advertisements will not be carried in this page, but will go in our regular advertising pages at our regular advertising rates to *everybody.*

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WANTED—Psyche, vols. 11, 13, 15; Trans. Amer. Ent. Soc., vols. 1–5. C. F. dos Passos, Mendham, New Jersey.

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Female Genitalia of Culicidae, with Particular Reference to Characters of Generic Value, Coher. 38 pp. 1948. $ 2.00

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Vol. L APRIL, 1955 No. 2

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BULLETIN

OF THE

BROOKLYN ENTOMOLOGICAL SOCIETY

VOL. L APRIL, 1955 No. 2

CONCERNING COLEOPHORA MURINELLA TENGSTRÖM AND ALLIED SPECIES IN THE CANADIAN FAUNA (LEPIDOPTERA, COLEOPHORIDAE).

By J. McDUNNOUGH,[1] Halifax, N. S.

For some time the author has been of the opinion that certain Coleophorid species occurring in northern Europe would be found, when more intensive collecting was done, to have representation in our Canadian fauna.

Recently, through the kind cooperation of Dr. Walter Hackman, the well known Coleophorid specialist of Helsingfors, Finland, specimens have been received of two Finnish species, *viz. ledi* Stainton and *murinella* Tengström. In addition some of the specimens collected in Newfoundland in 1949 by H. Krogerus, a member of a Swedish entomological expedition, have been submitted for examination. Based on this material a study of some of our unidentified material, taken at light by Douglas Ferguson, has been undertaken and the results are incorporated in the present article.

Coleophora ledi Stainton

Coleophora ledi Stainton, 1860, The Natural History of the Tineina, Vol. 5, pp. 210/217, pl. 16, fig. 3 (*partim*). Hering, 1932, Tierwelt Mitteleuropas, Schmetterlinge, Vol. 6, Suppl. p. 82, Fig. 174. Benander, 1939, Opuscula Entomologica, Vol. 3, p. 58 (*partim, nec* fig.). Hackman, 1945, Notulae Entomologicae, Vol. 25, p. 31, pl. 3, fig. 24, pl. 5, fig. 53 (genitalia), pl. 1, fig. 13 (larval case).

As pointed out by Hackman Stainton's original description was evidently based on several species although the name applied was taken from a specimen received from Zeller (*vide op. cit.* p. 216). Based on the name the species has very correctly been restricted

[1] Research Associate, Nova Scotia Museum of Science.

to the *Ledum* feeder and the figure given by Hackman of the larval case must therefore be considered as correct, the case figured by Stainton being that of some other species feeding on lime (*Tilia*).

The genitalic figures given by both Benander and Hackman are rather crude and incomplete in several important details and consequently difficult of interpretation. Hackman notes further that Benander's figure of the male genitalia is not that of *ledi* but belongs to the closely allied species, *plumbella* Kanerva. In general the male genitalia show considerable similarity to those of *murinella*. The distinctive feature is found in the aedeagus which is thickened apically by a small chitinous plate on the left dorsal side, the outer margin of which is furnished with four or five small teeth. Based on a Finnish specimen a figure is given of the entire male genitalia (fig. 5). In the adult the antennae are definitely annulate and the forewings unicolorous black-brown with a decided metallic tinge; the size is quite small.

As regards the occurrence of the species in the maritime provinces two males have been examined which were taken by Krogerus at South Beach, west Newfoundland, on July 3 and 4. These were determined by Hackman as *ledi* and in coloration of the forewings and also in genitalia appear to agree with the single Finnish male before me. At Purcell's Cove in the vicinity of Halifax a single mature case was found on *Ledum* on May 14, 1951, which matched quite well Hackman's figure. Unfortunately a parasite was hatched from this case and no further cases have been discovered in spite of frequent searching. At White Point Beach, Queens County, Nova Scotia a single, very immature case of the same type was found on *Ledum* but this failed to mature. The presence of the species in the province seems to be, however, definitely established, although adult material is still lacking, a deficiency which, it is hoped, may be soon remedied.

Coleophora murinella Tengström

Coleophora murinella Tengström, 1847, Bidrag till Finlands fjarilfauna, p. 140. Hackman, 1945, Notulae Entomologicae, Vol. 25, p. 29, pl. 3, fig. 22, pl. 5, fig. 50 (genitalia).

As noted by Hackman (*op. cit.* p. 3) the abdomen of Tengström's type specimen is missing and identification is therefore based solely on similarity of color and maculation of specimens compared with this type. This determination should, in the author's opinion, stand as correct. A pair of Finnish specimens are before the author and the male genitalia from one of these is figured (fig. 4). In the

adults the antennae are sharply annulate as in *ledi* but the coloration of the forewings lacks entirely the metallic sheen of *ledi* and is an even fawn-brown of varying intensity.

Among the Newfoundland material examined was a single female collected by Krogerus at Woody Point, west Newfoundland, July 16, 1949; this had been determined by Hackman as *murinella* and its genitalia agree very closely with those of my Finnish female. At White Point Beach in 1953 a single female was collected on July 5, the genitalia of which are practically an exact match of those of the Newfoundland specimen; these are figured (fig. 6). The above two female specimens represent the only known occurrences of the species in the Canadian fauna. The larva is said to be a *Vaccinium* feeder and the case to be elliptical and flattened; no such cases are as yet known as occurring on this food plant. A more detailed description of the genitalia of both sexes follows.

Male Genitalia: (Based on a specimen from Muonio, Finland.) Sacculus curving slightly dorsad and quite concave in its distal portion, terminating in a rather sharp point, well separated from the clasper which is rather narrow and projects only slightly beyond the end of the Sacculus. Valvula large, with rounded apex and a clothing of numerous, moderately long setae. Gnathos upright, nearly globular and quite small. Aedeagus membranous, without apical armature, slightly strengthened by a chitinous strip at the extreme base. Vesica furnished with a comb-like group of closely appressed, thin cornuti.

Female Genitalia: (Based on a White Point Beach specimen.) Genital plate much broader than high, the lobes widely separated in the median area, rounded apically with a few scattered setae along the margin. Ostium situated on the cephalic edge of plate, somewhat raised, broadly semi-circular and lightly chitinized. Ductus bursae moderately broad and membranous in its initial section with a weakly chitinized strip running through its central area; this section is followed by a much longer, somewhat twisted, strongly spiculate portion beyond which the tube becomes again membranous, bulbously broadened at first, and then narrowing gradually and weakly spiculate, the ductus seminalis arising from this portion. The final section of the ductus bursae is quite narrow, entirely membranous and forms a single convolution before entering the bursa. The membranous bursa is large, globular with a short proximal neck; its signum is a strong, pointed spine, arising from a large curved base, the whole somewhat anchor-shaped.

The following group of three species appears to be closely allied

to *murinella*, possessing in the male genitalia the same comb-like arrangement of cornuti in the vesica as occurs in this species; they show, however, individual differences in other features of the genitalia as well as in coloration of primaries. None of them appears to have been described from North American material nor, as far as can be told from a comparison with Hackman's inadequate genitalic figures, can they be assigned to any named European species. The risk of describing them as new from very scanty material is fully realized but, on the other hand, the genitalic figures given should render identification fairly easy. As, owing to the nature of the country where the specimens were obtained, it may be considerable time before any further material or data on the larval habits can be obtained, it seems advisable to describe them at the present time

Coleophora dissociella n. sp.

Male: Palpi slightly upturned, smoky, paler inwardly, the ventral hair-tuft at apex of second joint very small. Antennae with the basal joint pale smoky with little indication of tufting; remainder sharply annulate with alternating deep brown and white rings extending to the extreme apex. Head and thorax light smoky with a slight metallic tinge. Primaries evenly deep smoky with a quite definite metallic sheen; fringes deep smoky. Secondaries slightly paler than primaries with only faint sheen; fringes light smoky. Forelegs smoky with the tarsal joints finely ringed with white. Hindlegs pale fawn, the tarsi shaded with smoky. Expanse (from tip to tip of wings when spread) 12 mm.

Male Genitalia: (Fig. 3) Sacculus well chitinized, its apex curving dorsad and spoon-shaped, projecting somewhat over the ventral edge of the clasper. Clasper short and broad, extending only slightly beyond apex of sacculus. Valvula large with rounded apex and a clothing of scattered, quite long setae. Gnathos upright, oval, considerably larger than that of *murinella*. Aedeagus membranous, straight and rather broad, without armature except for

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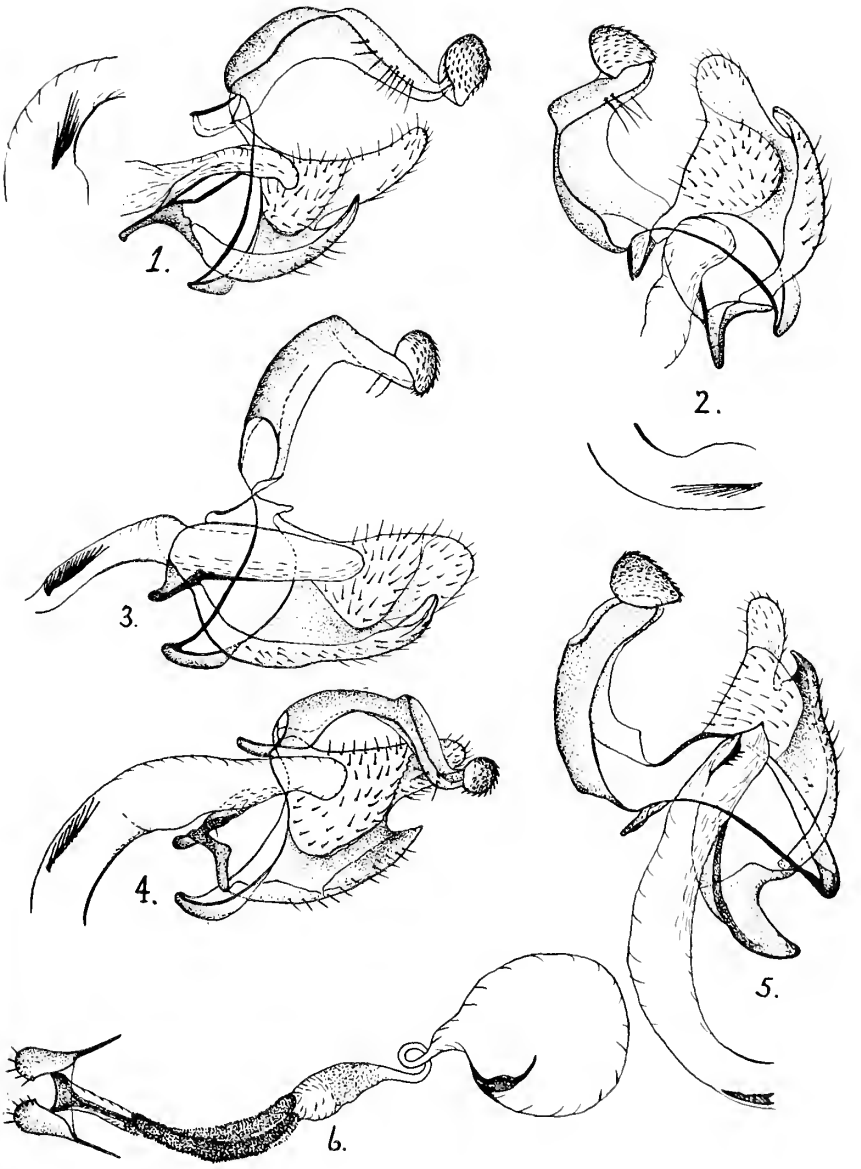
Explanation of Plate I

Male Genitalia of 1. *C. persimplexella* McD. (Holotype). 2. *C. rupestrella* McD. (Holotype). 3. *C. dissociella* McD. (Holotype). 4. *C. murinella* Tengst. (Finland). 5. *C. ledi* Stainton (Finland).

Female Genitalia of 6. *C. murinella* Tengst. (White Point Beach, N. S.).

BULL. B.E.S. VOL. L PLATE I



some chitinous strengthening on the ventral side of extreme base. Vesica with a comb-like group of closely appressed, fine cornuti, somewhat more numerous than in *murinella*.

Holotype: Male, Bog, Prospect Road, Halifax County, Nova Scotia, July 2, 1951 (D. Ferguson). In author's collection for the present.

Remarks: The metallic sheen of the primaries at once separates the species from *murinella*, and, from the smaller *ledi*, the much broader clasper with overlapping spoon-shaped apex of sacculus as well as the much stronger group of cornuti in the vesica form differential characters.

Coleophora rupestrella n. sp.

Male: Palpi porrect, pale whitish tinged with smoky outwardly, the ventro-apical tuft of hairs on second joint long and extending to half the length of the third joint. Antennae with the basal joints rather thin, pale fawn, slightly roughened with scaling along veneral edge but with no obvious tuft; balance of antenna sharply annulate with alternating white and brown rings. Head and thorax whitish. Primaries light fawn, the costal edge for half its length somewhat paler, the venation marked in light brown, especially in terminal section. Fringes concolorous. Secondaries pale smoky with similar fringes. Legs smoky fawn, the tarsi contrastingly paler, whitish. Expanse 11 mm.

Male Genitalia: (Fig. 2) Sacculus very similar to that of the preceding species but shorter, more narrowly spoon-shaped apically and with its apex not reaching the ventral edge of the clasper, being separated by a narrow clear space. Clasper considerably thinner than in *dissociella* and projected further caudad. Valvula large, broadly rounded apically and well clothed with setae which are slightly shorter than in the preceding species. Gnathos upright, oval. Aedeagus entirely membranous, rather short, bent ventrad and apparently somewhat bulbous apically, strengthened with the same type of chitinous strip on its ventral side at base as in the preceding species. Vesica with the comb-like cluster of cornuti fewer in number but individually slightly thicker than in *dissociella*.

Type: Male, Peggy's Cove, Halifax County, Nova Scotia, June 8, 1953 (D. Ferguson). In author's collection for the present.

Paratype: one male, same locality and collector June 22, 1952. Also in author's collection.

Remarks: In the paratype the veins lack almost entirely the marking found in the holotype but no obvious genitalic differences can

be observed. The coloration of the primaries separates the species at once from *dissociella*.

Coleophora persimplexella n. sp.

Male: Palpi light cream colored, tinged on the outer side with dull brown; small ventro-apical tuft on the second joint not nearly so long as in *rupestrella*. Antennae with basal joints dull creamy with a light smoky tinge; ventral edge roughened with scaling and terminating in a slight tuft. Balance of antenna sharply annulate with alternating rings of white and brown. Head and thorax dull cream colored. Primaries evenly light ochreous without maculation, the color deepening slightly toward apex of wing and on the fringes. Secondaries smoky with pale smoky fringes. The two anterior pairs of legs light smoky, hindlegs dull cream colored with somewhat paler tarsi, narrowly ringed with brown at joints. Expanse 11 mm.

Male Genitalia: (Fig. 1) At once separable from the two preceding species by the narrow claspers which are well separated from the apex of the sacculus and project much further caudad. Sacculus well chitinized, rather short, curving dorsad toward apex and terminating in a blunt point. Valvula moderately large, with the usual clothing of sparse, short setae. Gnathos upright, rather narrow; gnathos arms with rows of about eight setae along their ventral margins, a number much larger than usual, the normal number, as seen in the two preceding species, being two on each arm. Aedeagus rather thin and membranous, short and bent slightly ventrad at apex. The base appears to be supported by a chitinized fork. Vesica with the usual comb-like group of cornuti, rather fewer but slightly thicker than usual.

Holotype: Male, Port Wallis, Halifax County, June 21, 1952 (D. Ferguson). Retained in the author's collection for the present.

Remarks: The locality, Port Wallis, is not on the coast but is situated inland between Dartmouth and Waverley in the vicinity of Lake William.

HOW FAST CAN A COCKROACH RUN?[1, 2]

By Ellicott McConnell and A. Glenn Richards,
St. Paul, Minnesota

The rate of progression of walking or running insects has been determined in only a few instances. One of the reasons for this is that few insects will move at a constant rate for a sufficient distance to be timed by ordinary stop watch methods. As part of a larger study on the effects of temperature on various activities of the american cockroach, we have measured its speed of locomotion and found, as we had expected, that it is fast for so small an animal.

Previous data on running speeds of insects in relation to temperature have been on various ants which do indeed make excellent subjects for such determinations. Ants, however, are relatively slow, approximately 25–50× slower. German cockroaches are much faster but only about half as fast as the american cockroach.

Species	Temp. °C.	Cm./sec.	Miles/hr.	Authority
Lasius niger	24.0	1.6	0.036	Barnes + Kohn
Tapinoma sessile	25.2	1.67	0.037	Shapley
Iridomyrmex humilis	25.2	2.62	0.06	Shapely
Blattella germanica				
adult male	22.	29.3	0.65	Wille
adult female	22.	18.2	0.41	Wille
first instar nymph	22.	2.7	0.06	Wille
Periplaneta americana				
adult male	22.0	66.	1.47	herein
adult female	22.0	57.	1.27	herein
male + female, av.	25.0	74.	1.65	herein

[1] Paper No. 3160, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul 1, Minnesota.

[2] The work reported herein was supported under terms of a contract between the Office of the Surgeon General, U.S. Army, and the University of Minnesota.

At higher temperatures the ants run more rapidly. Thus, *T. sessile* reaches a maximum rate of 3.22 cm. per second at 35.8° C. (0.072 m.p.h.), and *I. humilis* reaches 4.22 cm. per second at 33.5° C. (0.095 m.p.h.). But the american cockroach also runs somewhat faster at higher temperatures; it attains on the average a speed of 91 cm. per second at 30–35° C. (2.0 m.p.h.), with our fastest racer at top speed attaining 130 cm. per second (2.9 m.p.h.).

Wille (1920) measured the speed of german cockroaches on various surfaces (all at 22° C.). The values copied in the above table were for rates on rough paper. Adults run 20–50% slower on linoleum or planed wood, and 50–80% slower on glass. However, the first instar nymphs were 50% faster on glass than on rough paper. Presumably the early nymphs rely less on setae and claws and more on adhesiveness for traction.

The top speed of slightly less than three miles per hour for american cockroaches may seem slow in an age adjusted to automobiles and aeroplanes. But, recall that a man can easily overtake a cockroach by walking even though the insect is fleeing headlong across the floor. To be sure, grabbing a cockroach calls for agility but this is due to the cockroach's rapid darting in various directions rather than to its velocity. Gray (1953) in his delightful little book points out, among other things, that this darting off for short distances in unexpected directions gives the illusion that small animals (e.g. minnows) progress at a considerably greater speed than they actually do. It is a good man who can walk much more than twice this speed (i.e. over six miles per hour) or run more than five times it; and no human has ever managed to run more than about eight times as fast as the cockroach's top speed.

Materials and Methods

Adult american cockroaches (*Periplaneta americana*) were obtained from our laboratory cultures by segregation of last instar nymphs. These were used as test insects over the period of about one week to three months after molting to the adult stage. During this period no significant change in speed was observed. Probably they are slower shortly after the molt. A single male tested the day after molting was relatively slow; it ran about 50% faster during the period 1–4 weeks later. Males weighed 1.0–1.2 grams, females 1.0–1.5 grams.

For reasonably short distances american cockroaches run too rapidly for accurate determination by a hand operated stopwatch. Accordingly a special race track was constructed. This consisted

simply of a grooved runway down which the cockroach ran, interrupting first one then another beam of light as it passed over narrow slits in the floor of the runway (Fig. 1). Interruption of the beams was detected by two photocells which were wired to activate a signal magnet writing on the drum of a precision synchronous-motor kymograph. Since the motor and gear-train of the kymograph were immersed in oil, the viscosity of which changed with temperature, a second writing lever for simultaneously recording time was added. The entire apparatus and animal cages were kept in a constant temperature room where the air temperature could be varied and yet, despite apparatus and operator, maintained to better than ± 1° C.

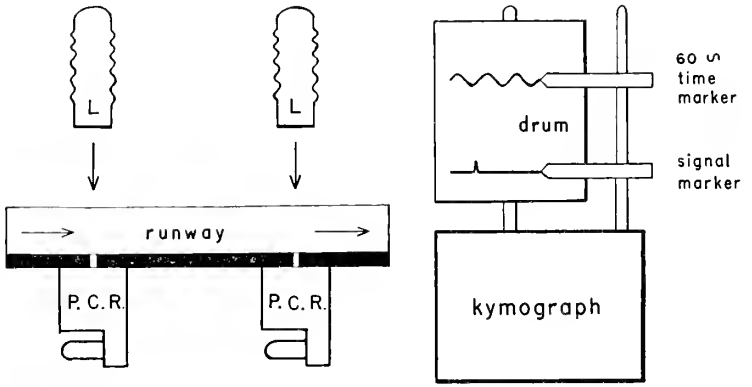


Fig. 1. Diagram (not drawn to scale) of the essential elements of the apparatus used for measuring running speed of cockroaches. Clamps and electrical wiring omitted. *L* = microscope lamps; *P.C.R.* = photocell-relay units ("Photobell," ES-1, Eby Sales Co.).

The runway was a board overlain with two steel strips (because at one stage we tried electrical shocking to stimulate the insects to run at full speed) and made flush with plastic wood. The surface had been leveled by rubbing with heavy emery paper and felt slightly rough (probably equal to Wille's "rough paper" rather than his smooth boards, linoleum or glass surfaces). The runway was 1 × 28 inches with slits for the light beams at 25 and 50 cm. intervals. Sides were vertical glass strips about 1½ inches high. Less difficulty with cockroaches attempting to climb the side walls was found when these glass side walls were covered with aluminum foil.

Our only serious difficulty was in learning how to handle the

cockroaches. Various methods of mechanical and electrical stimulations were tried and discarded. Finally, cockroaches were placed in small envelopes (about 1×2 inches) or other suitable containers, to keep them readily available and quiescent until run. They were then grasped by the wings with forceps, placed on the track, released and simultaneously the cerci flipped with a finger. Being released near one end of the track they attained full speed before interrupting the first light beam, and hence recorded speeds are always full speed without any complication as to how long it may take the insect to attain this speed. After considerable experience, individual cockroaches can be handled to give consistently reproducible results.

Most individual cockroaches behaved consistently and reproducibly but a few had to be discarded because they either ran hesitantly or tried to climb over the sides rather than run in a straight line down the groove.

At 13.5° C. a running distance of 25 cm. was used. At the other temperatures a distance of 25 or 50 cm. was used.

Results

Average values for a population of cockroach adults were obtained by recording the times for 51 runs at 13.5° C., 58 runs at 20°, 170 runs at 25°, 60 runs at 30° and 47 runs at 35° C. The frequencies of various times at the different temperatures are plotted in Figure 3. The peak of the curves obtained is taken as the average value for that particular temperature. The breadth of these curves is not an index of the experimental error or of range in values for an individual. Single individuals do, of course, show a certain amount of variation from one run to another run, but most of the spread in the curves drawn in Figure 3 is due to the presence of fast and slow individuals. One set of 4 ♂ and 5 ♀ that were run repeatedly over a period of several months consistently showed one particular male as the fastest racer (averaging 10% faster than the next fastest), and several females tied for slowest. The fastest individual was consistently about 50% faster than the slowest ones.

In general, males were found to average 15–20% faster than females but the fastest females outran the slowest males. A larger sex difference (about 50%) is reported for german cockroaches by Wille (1920). This sex difference is paralleled by a 3–4x difference reported by several laboratories for muscle enzyme activity in american cockroaches. But a 300–400% difference in muscle enzyme activity does not make a good correlation with a mere 15–20%

difference in speed. There is no obvious correlation between weight and speed in our data.

In temperature studies in biology one commonly makes an Arrhenius plot of the natural logarithm of the rate of whatever is being measured against the reciprocal of the absolute temperature. This is done in Figure 2. As for many biological processes, a straight line is obtained or approximated in the lower part of the temperature range. To be sure, few points are available for this curve but each of the points in the average curve (*B*) is based on a significant number of determinations (47–170) and further supported by numerous additional values on individual cockroaches, values from two such individuals being plotted as curves *A* and *C*.

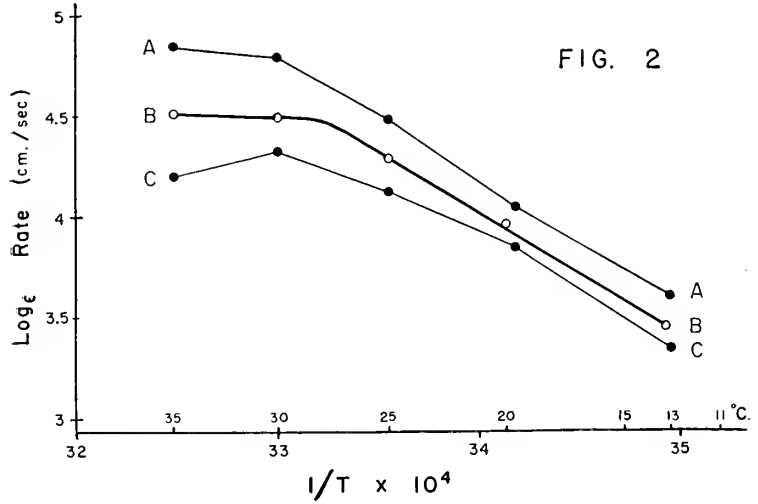


Fig. 2. An Arrhenius type plot of the natural logarithm of the running speed against the reciprocal of temperature. For convenience the corresponding centigrade temperatures are given above the abscissa. Curve *B* is based on peaks of curves of Fig. 3; curves *A* and *C* are corresponding determinations for respectively a single fast and a single slow individual.

Unusual and unexpected in this curve is that it levels off to an approximately constant maximum rate in the upper portion of the normal temperature range. It is common for rates to level off and even decrease near the upper thermal limit but the highest temperature used here is well within the normal viable range for american cockroaches. This species has been kept in the laboratory here at 35° C. for months without apparent harmful effects. It seems that

the running machinery can operate just so fast, and that this maximum rate is reached at 27–28° C. We have found only one other such record in the arthropod literature and that as an individual rather than a specific trait. Crozier (1924) recorded that some specimens of a millipede (*Parajulus pennsylvanicus*) were incapable of crawling faster than they go at 15° C. though others (presumably most) increased in rate regularly over the range 8–30° C.

Average values for the american cockroach at 35° C. were similar to those at 30° C. However, individual values were erratic above 30°. Of 7 cockroaches run individually and repeatedly at these

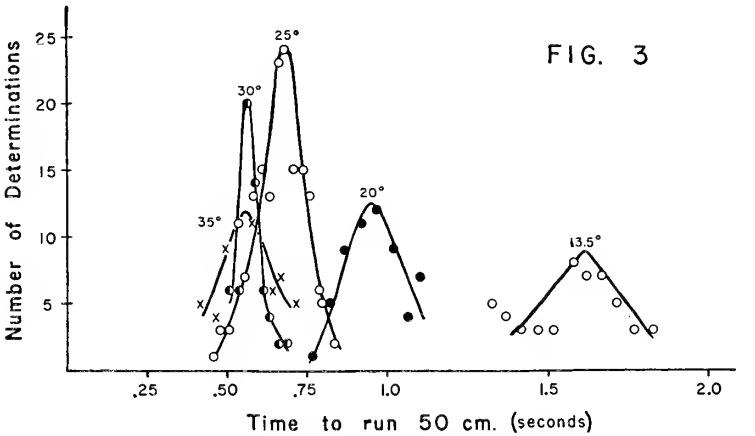


Fig. 3. Frequency of running speed determinations at the indicated temperatures (C.) for various individuals of a population. Determinations made at various times over a period of several months.

temperatures, 4 ran faster at 35° and 3 ran faster at 30° C. We can only ascribe this to erratic behavior near the extreme end of the temperature scale.

One can use the Arrhenius equation to calculate the heat of activation of chemical systems. Substituting values from Figure 2 in the equation:

$$\frac{\text{Rate at } T_2}{\text{Rate at } T_1} = e^{\frac{\mu}{2}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)}$$

we obtain a μ value of about 12000 calories for the slope from 13–25°. This is closely similar to the value obtained for portions of the curves for diplopod (Crozier, 1924) and ant locomotion (Shapley, 1924; Barnes & Kohn, 1932) and various other processes which

Crozier & Stier (1925) suggest may be controlled by discharges from the central nervous system in arthropods. For a favorable review of Crozier's ideas see Barnes (1937); for an unfavorable review see the discussion following Hoagland's symposium paper (1936). Whatever validity one may assign to Crozier's ideas, ants differ from cockroaches in showing a much higher μ value for a portion of the curve (usually the lower temperature range).

Clearly, there is no direct correlation between the μ value of 12000 for running and the μ value of 20000 reported for the energy-releasing muscle apyrase (ATP-ase) enzyme system of the same species (Davison + Richards, 1954).

Barnes and Kohn (1932) found with ants that the change in speed with temperature is complicated by being partly related to frequency of leg movement and partly due to leg position and hence length of stride. Differences in stride as a function of walking speed have also been recorded for oriental cockroaches (Hughes, 1952) but that study was not comparable to the present one since it dealt only with submaximal velocities (and does not even state the temperature).[3] We did not study this point in detail but with measurements of footprints made on smoked paper (few dozen sets) we found that the width of stride remained constant irrespective of temperature but that the length of stride was sometimes the same and sometimes shorter at lower temperatures (up to 25% shorter). Individual differences seem to be involved; at least some individuals consistently maintained the same stride while others consistently shortened the stride at lower temperatures. Theoretically the situation is further complicated by some individuals dragging the body on the runway at lower temperatures. With so many known

[3] Hughes' paper is quite interesting to the general reader. It is based on analysis of successive frames of motion pictures. He discusses concepts of running and walking, points out that insects unlike mammals do not run in a dynamic balance such as has been termed a "braked fall" since insects can stop at any point in the walking pattern because the center of gravity is always within the support area provided by the legs, that no distinction can be made between walking and running in insects since both the velocity and change in stride are continuous over the range from zero to maximum speed, that six is the minimum number of legs which will permit the arthropod type of walking, that the pattern of leg movement shows more variation and plasticity than is generally thought, and that the only rules are (1) no pro- or mesothoracic leg is moved forward unless the next posterior leg is on the floor, and (2) opposite legs of the same segment always alternate

complications we do not care to attempt assessing the μ value obtained other than to remark that it is similar to the value recorded for certain portions of the curves for ants and that a straight line plot is not inconsistent with a complicated controlling mechanism.

Finally, we might mention than a check with thermocouples inserted into the muscles of the mesothorax showed that the temperature of the room was an adequate index of the temperature of the cockroach. Using a thermocouple sensitive to about 0.1° C. we found that a quiescent insect equilibrated to room temperature. At 20–35° C. some cockroaches taken at random were 1–2° lower than the air temperature, presumably due to hyperventilation. Single runs equal to that of a run down the race track did not detectably alter the intrathoracic temperature. Repeated runs totalling 100–200 cm. elevated the intrathoracic temperature less than 1° C. Incidentally, although not strictly relevant, intrathoracic temperature was raised only about 2.5° C. by several minutes of continuous flying and, presumably due to ventilation, returned to room temperature in 3 to 4 minutes.

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A NEW SPECIES OF ABAGROTIS (LEPIDOPTERA, NOCTUIDAE).

By John G. Franclemont, Ithaca, New York

The new species described here was first set aside by Benjamin in the Barnes Collection, and later a series was reared by Crumb and sent to the United States National Museum. Recently it became necessary to check over all the material of the *placida* and *nefascia* groups of *Abagrotis*, and at that time it was found that the species was not confined to the western part of the United States and Canada, but also occurred in the East.

Abagrotis crumbi n. sp.

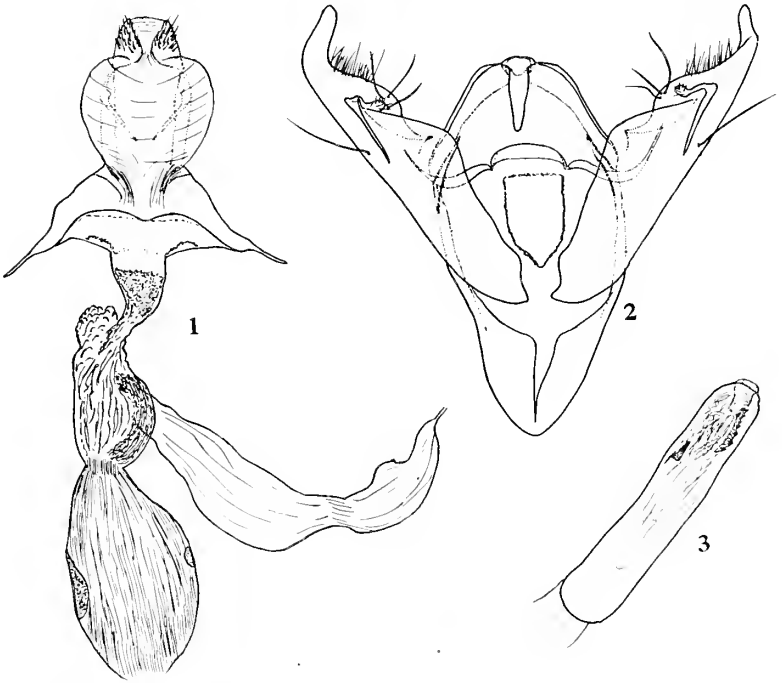
Superficially this species resembles small specimens of *variata* Grote, but it averages smaller and is somewhat narrower winged, with a resultant habitus like that of *placida* Grote and *forbesi* Benjamin, agreeing with the latter in its silken appearance.

Head pale purplish gray, contrasting with thorax; thorax and fore wings concolorous, variable individually, some shade of tan, chestnut-brown or olivaceous with a conspicuous silken sheen, more or less powdered with pale purplish gray scales, which fill the terminal space making it pale and strongly contrasting; basal line, when distinct, waved, geminate, the included space purplish gray; t. a. and t. p. lines marked by dark dots on the costa, geminate, filled with pale purplish gray; t. a. line waved; t. p. line excurved around cell, then incurved in the submedian interspace; orbicular round, usually slightly darker then the ground color, outlined by pale purplish gray; reniform similar, but of the usual shape; claviform, at most, only faintly indicated by an outline of pale purplish gray scales, usually obsolete; median shade often faintly visible, more frequently obsolescent or obsolete; subterminal line pale, irregular, inwardly defined by the darker subterminal space, and outwardly by the pale purplish gray terminal area; terminal line composed of irregular dark dots; fringe dark with a pale interline; hind wings fuscous brown, scarcely paler basally, fringe paler, with a fuscous interline and luteous base. Beneath: ground color whitish, heavily powdered and obscured by fuscous, appearing dark; fore wing with a strong, black oblique dash on the costa marking the otherwise faint common line, the costal and terminal areas paler than the disc; hind wing with a faint discal mark.

Expanse: 31–38 mm.

Male genitalia (Figures 2 and 3): The genitalia of this species

combine the characters of several others. The general appearance of the valves, tegumen and vinculum is almost identical with those of *duanca* Smith (see: Benjamin, Bull. Southern California Acad. Sci., vol. 20, p. 141, fig. 11); the uncus is similar to that of *variata;* the arms of the transtilla are narrow like those of *duanca* and *dodi* McDunnough, not broad as in *placida* and *alternata* Grote; the vesica is armed with a stout spine which sometimes possesses a slight sclerotization at its base, with a sclerotized band armed with small teeth, and with much fine spiculation which more or less as-



1. *Abagrotis crumbi* Franclemont, female genitalia, Tieton, Washington. Fig. 2. *Abagrotis crumbi,* Type, male genitalia, aedoeagus removed. Fig. 3. *Abagrotis crumbi,* Type, aedoeagus.

sumes a striated appearance as in *forbesi.*

Female genitalia (Figure 1): The genitalia are similar to *forbesi,* but the ductus bursae is distinctly less heavily sclerotized, and there are usually two signa on the bursa.

Type: Male; White Swan, Washington, June 5, 1933 (S. E. Crumb), in the Collection of the United States National Museum. USNM Type No. 54946.

Paratypes: 14 males and 13 females from White Swan, Ellensberg, Yakima, Tieton, and Cashmere, Washington. All bear June and July dates and were reared by S. E. Crumb. In the Collection of the United States National Museum.

Additional specimens are in the National Museum Collection from the following localities: Vernon, British Columbia; Truckee, California; Jemez Springs and Fort Wingate, New Mexico; Prescott, Arizona; Provo, Vineyard, and Eureka, Utah; Glenwood Springs, Oak Creek Canyon, and Lavetta, Colorado.

Abagrotis crumbi race **benjamini** n. subsp.

Similar to the typical race, but the markings are a little less distinct, and the color is generally duller. All the specimens are a rather uniform tannish brown with a contrasting purplish gray terminal area.

Male genitalia: Somewhat larger than the typical race.

Female genitalia: The ductus bursae more heavily sclerotized; general characteristics similar to those of *forbesi*.

Type: E. N. Y. [East New York, New York], July 17, 1900 (A. C. Weeks), in the Collection of the United States National Museum. USNM Type No. 54947.

Paratypes: 2 males and 3 females from East New York, New York (A. C. Weeks), and East River, Connecticut (Chas. R. Ely), in the Collection of the United States National Museum; 3 males, Martha's Vineyard, Massachusetts (F. M. Jones), in the Franclemont Collection.

Associated with these is a single specimen in the National Collection from the J. B. Smith Collection, but without locality or date of capture.

This description was drawn up while the writer was employed by the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C.

NOTICE

The Department of Engineering Physics of Cornell University will give a special course in "Techniques and Applications of the Electron Microscope" from June 13 to June 25, 1955. Inquiries should be addressed to Professor Benjamin M. Siegel, Rockefeller Hall, Cornell University, Ithaca, New York.

PHILANTHUS SANBORNII CRESSON AS A PREDATOR ON HONEYBEES

By Howard E. Evans, Ithaca, N. Y.

G. E. Bohart has recently described a remarkable instance of a *Philanthus flavifrons* Cresson killing honeybees at the entrance of a hive (1954, Proc. Ent. Soc. Wash., 56: 26). This is the first recorded observation of a *Philanthus* attacking honeybees in this country, although the European *P. triangulum* (Fabr.) is well known as a predator on honeybees, which it captures on flowers.

In the course of studies on solitary wasps at Little Gobi Desert, Pottawatomie Co., Kansas, during the past two summers, I have on several occasions seen *Philanthus sanbornii* Cresson provisioning its nest with honeybees. Three were actually captured with honeybees (author's note numbers 125, 324, and 415A) and several others were observed with them. Other bees are also used, though apparently less commonly; no. 330 was captured with the small halictid *Lasioglossum forbesii* (Robertson) and no. 434 with the larger green halictid *Agapostemon radiatus* (Say) [det. K. V. Krombein].

The bees are carried in flight by the wasp, being held beneath the body tightly by the legs. Occasionally the wasp lands on the earth one or more times enroute to the nest. The nest entrance is apparently never closed and the wasp flies more or less directly into the entrance with its prey. Several nests were marked and two were dug out, but unsuccessfully. One of these, a tortuous, nearly vertical tunnel, was followed for 23 inches without locating a cell. There was no definite "colony" of these wasps, the nests being widely separated and scattered over a strip of sand about 50 feet long. None of the nests were in open sand, but in grassy places, often at the base of a clump of grass. A small mound of earth surrounds the nest opening.

No observations were made on the capture and stinging of the bees, but it seems very probable that they were taken on flowers. *Philanthus sanbornii* is a rather large member of its genus, and is well able to handle a honeybee in flight and in its burrow. Probably it is quite unselective of its prey, but in this area was finding honeybees more readily available than wild bees. A nesting of *sanbornii* near an apiary might produce some interesting results.

ACANTHOSTICHUS (CTENOPYGA) TOWNSENDI (ASHM.), A SYNONYM OF ACANTHOSTICHUS TEXANUS FOREL (HYMENOPTERA: FORMICIDAE).

By Marion R. Smith,[1] Washington, D.C.

In 1904 Forel described the ant *Acanthostichus texanus* from a dealated female collected at Brownsville, Texas, by H. F. Wickham. Little is known about the circumstances of the collection. The record was unique, however, as this was the first time that an *Acanthostichus* had been found within the borders of the United States, all members of this Neotropical genus being previously known only from South America. Two years later Ashmead described the monotypic genus *Ctenopyga*, designating as type *townsendi*, which he based on two males and a dealated female collected by C. H. T. Townsend in La Puerta (state not given, but probably Chihuahua), Mexico. On October 24, 1942, William F. Buren collected two dealated females of *texanus* at Rio Grande City (Starr County), Texas. Since the type of *texanus*, which should have been in the Natural History Museum at Geneva, Switzerland, had been lost Buren determined his material from Forel's description. Later Buren gave one of the individuals to Dr. W. S. Creighton and the other to the United States National Museum. I have had the privilege of studying both and fully agree with Buren's determination of them as *texanus*.

Recently it occurred to me that *townsendi* might well be a synonym of *texanus*. I therefore compared the two females collected by Buren with the type female of *townsendi* and found that, except for some insignificant differences such as color and pilosity, they are identical. A partly dealated female collected by Creighton 10 miles west of Boca Chica (Cameron County), Texas, compared in a similar manner also proved to be *texanus*. I had previously compared a number of males in the collection of the United States National Museum from several localities in Texas with male types of *townsendi* and found them to be this species (for details see list below). Basing my judgement upon these data, I have no hesitancy in synonymizing *townsendi* with *texanus*.

Among specimens very kindly loaned me for study by Dr. Creighton is a single worker of *Acanthostichus* which he collected at the

[1] Entomology Research Branch, Agricultural Research Service. United States Department of Agriculture.

Forestry Cabin, Baboquivari Mountains, Arizona, 3,500 feet, on July 26, 1951. This might well be the worker of *texanus,* but I would be hesitant to describe it as such for at least two reasons: first, the worker is not associated with the known female or male; and second, it has a mandible with at least two distinct teeth, whereas the mandible of the female of *texanus* has no teeth.

Since the biology of *texanus* is unknown and the worker yet undescribed, an investigation of this species would seem to be a worthwhile project for some formicologist. Only one other North American *Acanthostichus* is known, and that is *skwarrae* Whlr., described from a single worker collected at Tamarindo, State of Vera Cruz, Mexico (1934, Harvard Univ., Bull. Mus. Compar. Zool. 77 (5): 161–162). Upon the basis of the worker alone, it is impossible to know whether or not this species belongs to the subgenus *Ctenopyga.*

Below are listed all important references pertaining to *texanus* as well as all locality records available to me.

Acanthostichus (*Ctenopyga*) *texanus* Forel

Acanthostichus texanus Forel, 1904, Ann. Soc. Ent. de Belg. 48: 168–169, *dealate female,* Brownsville, Texas, H. F. Wickham. (Type should be in the Museum of Natural History, Geneva, Switzerland, but according to Dr. Charles Ferriere it has apparently been lost.) Wheeler, 1908, Bull. Amer. Mus. Nat. Hist. 24: 400, *dealate female.*

Acanthostichus (*Ctenopyga*) *texanus* Forel, Emery, 1911, *in* Wytsman, Genera Insectorum, fasc. 118, pp. 13–14, *dealate female.* M. R. Smith, 1947, Amer. Midl. Nat. 37: 529, pl. 1, fig. 4, *dealate female.* Creighton, 1950, Harvard Univ., Bull. Mus. Comp. Zool. 104: 58–59, *dealate female.* M. R. Smith, 1951, *in* U. S. Dept. Agr. Mongr. 2, p. 782, *dealate female.*

Ctenopyga townsendi Ashmead, 1906, Proc. Ent. Soc. Wash. 8: 29–30, *dealate female, male*; fig. 4 (male), 4H (male hypopygium and pygidium of female), La Puerta (state unknown, but probably Chihuahua), Mexico, C. H. T. Townsend. (Types in the United States National Museum.) *New Synonymy.*

Acanthostichus (*Ctenopyga*) *townsendi* (Ashmead), Emery, 1911, *in* Wytsman, Genera Insectorum, fasc. 118, pp. 13–14, *dealate female, male.* M. R. Smith, 1942, Proc. Ent. Soc. Wash. 44: 62, *male.* M. R. Smith, 1943, Amer. Midl. Nat. 30: 283, 288–290, *male,* fig. 4, J (pygidium of male).

Texas

Brownsville (Cameron County), H. F. Wickham, a single *dealate female*. (Type locality for *Acanthostichus texanus* Forel.)

Brownsville, 8-12-53, collector?, in orchids from Mexico, 1 *male* (Lot 53-10081, Brownsville No. 74900).

Ten miles west of Boca Chica (Cameron County), 11-8-51, W. S. Creighton, partly *alate female*.

Rio Grande City (Starr County), 10-24-42, Wm. F. Buren, 2 *dealate females*.

Victoria (Victoria County), VI. 24, J. D. Mitchell, 1 *male*.

Hidalgo (Hidalgo County), 2-25-37, collector?, outside of bran sack from Mexico, 1 *male* (Lot 37-5199, Hidalgo No. 2081).

Mexico

La Puerta (state unknown, but possibly Chihuahua), 5-6-95, C. H. T. Townsend, 1 *dealate female*, 2 *males*. (Type locality for *Ctenopyga townsendi* Ashmead).

JOHN J. KELLNER

The Brooklyn Entomological Society records with profound sorrow the death of our Vice-President, Mr. John J. Kellner, who passed away on February 11, 1955 at the age of 61 years.

Mr. Kellner was born in New York City on September 5, 1893. His vocational interests were in the field of business and for many years he was an independent manufacturer. Due to poor health, he retired in 1951.

From early boyhood he was interested in the biological world and during his active life all of his leisure hours were devoted to the study of specific animal groups. His interest in butterflies and moths extended over many years and he shared the pleasures of studying these insects with many of the lepidopterists of our Society. He served as Vice-President of the Society from 1953 until his death. He was a gentle and kindly many who was thoughtful of others. We mourn his passing but we are grateful that it was our privilege to have him as a member for so many years.

NEW LOCALITY RECORDS FOR CIMEXOPSIS NYCTALIS LIST, THE CHIMNEY SWIFT BUG (HEMIPTERA: CIMICIDAE).

By Robert D. Lee, Loma Linda, California

Although it is a relatively common parasite, very little has been done with *Cimexopsis nyctalis,* the chimney swift bug, since it was described by List in 1925. His paper reports this species from Washington, D. C., and Nebraska City, Otoe County, Nebraska. This paper lists ten new state records, in all nineteen previously unreported records. They are as follows:

Data sent by Dr. D. F. Miller, The Ohio State University, collectors not stated:

Chardon, Geauga Co., Ohio; July, 1945.

Reynoldsburg, Licking Co., Ohio; Feb. 13, 1945.

Lynchburg, Highland Co., Ohio; July 10, 1942.

Ross Co., Ohio; May 2, 1952.

Data sent by Dr. C. E. Mickel, University of Minnesota:

Northfield, Rice Co., Minn.; April 29–May 17, 1942; Maude G. Stewart; 27 specimens; in a house near a chimney.

Data sent by Dr. L. J. Stannard, Illinois Natural History Survey, material determined by R. I. Sailer:

Springfield, Sangamon Co., Ill.; Oct. 15, 1941; J. H. Smith; 2 specimens.

Washington Co., Ark.; Jan. 1940; 1 specimen.

Champaign, Champaign Co., Ill.; July 24, 1942; M. M. Petrakis; 9 specimens; in a house.

Data sent by Dr. R. I. Sailer, Entomology Research Branch, U.S.D.A., specimens are in the U. S. National Museum:

Marshall, Clark Co., Ill.; 6-XII-40; D. F. Heidbrider; 7 specimens; from fireplace.

Clemson, Oconee Co., S. C.; 14-IX-13; 5 specimens; ex chimney swift.

Frederickstown, Fayette Co., Pa.; 1928; F. R. Smith; 3 specimens; ex chimney swift.

Wilkesville, Vinton Co., Ohio; 27-VI-39; Mrs. E. L. Newson; 2 specimens.

Tallahassee, Leon Co., Fla.; 9-IV-36; F. C. Bishopp; 1 specimen; chimney swift nest.

Staunton, Augusta Co., Va.; 11-III-43; A. M. Woodside; 4 specimens; ex chimney swift.

Muscatine, Muscatine Co., Iowa; 27-XII-40; 1 specimen.

Clinton, Kennebec Co., Maine; 24-VIII-44; 4 specimens.
Washington, D. C.; 10-VIII-44; Miss Bailey; 2 specimens; ex chimney.
West Point, King William Co., Va.; 31-VII-41; L. A. Hetrick; 5 specimens.
Hillsboro, Highland Co., Ohio; 11-VIII-41; Miller; 5 specimens.

Although collection records for *Cimexopsis nyctalis* are few, a casual glance at Figure I will reveal that it is quite possible that

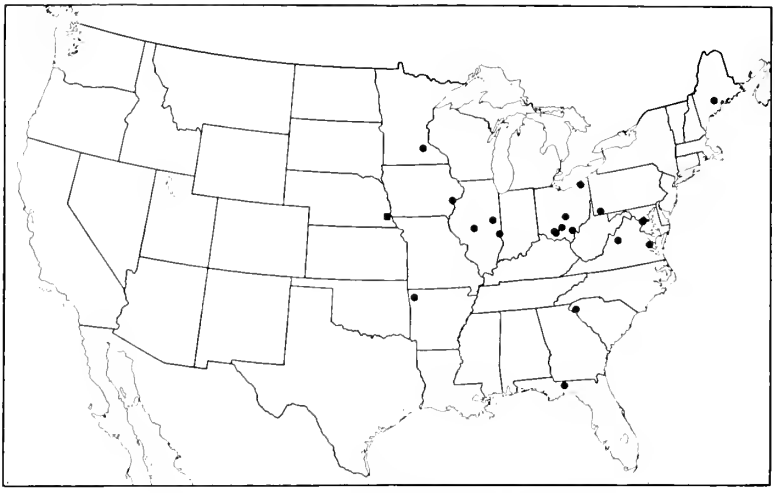


Fig. 1. Locality records of *Cimexopsis nyctalis*; those reported by List are indicated by small squares, those reported herein by small circles.

this species may yet be taken from all of the eastern and midwestern states inhabited by the chimney swift.

Without the help of Dr. Miller, Dr. Mickel and his assistant, Dr. E. F. Cook, Dr. Stannard, and Dr. Sailer, this paper would not have been possible. Grateful thanks to these men is hereby given.

Literature Cited

List, G. M. 1925. Three new genera and three new species of Cimicidae from North America. Proc. Biol. Soc. Washington, 38: 103–110.

NOTE ON THE LARVA OF EUPITHECIA RUSSELIATA SWETT (LEPIDOPTERA GEOMETRIDAE)

By J. McDunnough, Halifax, Nova Scotia

In the 1949 revision of the genus *Eupithecia* the author records the larval food plants as various conifers, based presumably on reports from the Canadian Forest Insect Survey. In 1952 Rindge (Amer. Mus. Novitates No. 1569) figures the terminal pupal segments, mentioning that the larva was found on *Kalmia*. Since then the larvae have been found quite frequently in the Halifax region on both *Kalmia* and *Rhodora* and it seems certain that these are the normal food plants: it is hardly probable that the larvae occur on conifers and such records must be considered as erroneous.

As the larvae differ very essentially from the normal form as typified in *E. satyrata* a detailed description is herewith appended, based on a larva feeding on Rhodora.

Body thin and elongate, light green dorsally, shagreened as usual. Head rather upright, very pale greenish. On the body segments there is no trace of the usual dorsal diamond patches. There are merely pale yellowish white, subdorsal lines and an indistinct subspiracular one along the fairly evident flange. On each of the two posterior segments a reddish median spot frequently occurs, situated near the posterior margin. The segmental incisions are pale yellow and the mid-abdominal segments are divided into approximately five subsegments of which the middle one is twice the width of the others. Spiracles small, whitish. Setae pale, moderately long, particularly on the thoracic segments. Length, when full grown 17–19 mm. Before pupation the larva turns pinkish and there are faint traces of incipient diamond patches on the posterior segments dorsally. The larva rests either extended on the edge of a leaf or more frequently along the midrib on the underside.

Several of the adults which emerged from the hibernating pupae were almost immaculate deep brown in the coloration of the primaries, corresponding to the form *russeliata brauncata* Swett which was treated doubtfully as a subspecies in the 1949 revision. As compared with Rindge's drawing of the terminal pupal segment (Fig. 7A) the pupae and pupal shells examined show on the whole a considerably broader and more rounded caudal edge than in this figure. It is probable that a good deal of variation exists in individual pupae, depending possibly to a certain extent on the sex of the insect.

THE STATUS OF PERIZOMA GRANDIS HULST (LEPIDOPTERA, GEOMETRIDAE).

By Douglas C. Ferguson, Halifax, Nova Scotia.

Recent collecting in the White Mountains, N. H. and Cape Breton Highlands National Park, N. S. turned up in series what at once appeared to be a second species of *Perizoma* Hbn. in addition to *basaliata* Wlk., the species usually prevalent in the north-east. Both occurred together in these localities. Comparison of the male genitalia was rather unsatisfactory and showed no tangible differences. Further investigation, however, revealed in the female genitalia rather striking differences that at once set the two things apart as distinct species. The larger one subsequently turned out to be the same as *grandis* Hulst of the Pacific coast region, which must therefore be removed from its association with *basaliata* and regarded as distinct.

Perizoma basaliata Wlk.

Larentia basaliata Walker, Cat. Lep. Het. Br. Mus., Pt. XXIV, p. 1185, 1862.

Type locality: United States (Doubleday collection).

Cidaria explagiata Walker, Cat. Lep. Het. Br. Mus., Pt. XXVI, p. 1728, 1862.

Type locality: Nova Scotia (Collected by Lt. Redman).

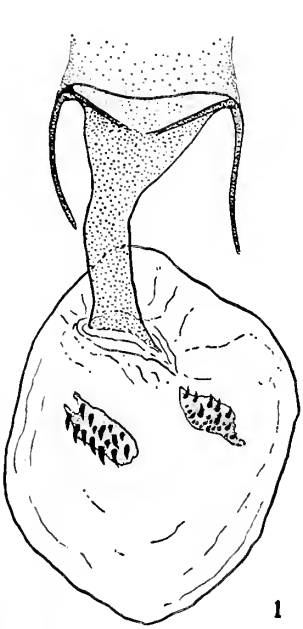
Basaliata is a small species, the average expanse being slightly less than 19 mm. The coloring is variable, but usually the blackish scaled median area contrasts sharply with the light brown shade that occupies the space between the basal and t.a. lines, and the inner half of the subterminal area next the t.p. line. In the outer third of the wing there is usually a blackish patch bounded outwardly by the fourth and fifth teeth of the s.t. line, and immediately below this a larger gray or whitish patch, often conspicuous, sometimes vague and suffused.

The main features of the female genitalia are the heavily chitinized ductus bursae and the armed signum. The rigidly chitinized ductus is curiously interrupted by a membranous connection near where it joins the bursa. The signum is in the form of a slender ring armed with spines, and partially encircles the bursa near the equator, causing a constriction on the left side. Figure 2 was drawn from a specimen taken at Dorchester, N. B.

Perizoma basaliata is essentially northern and eastern, occurring from Nova Scotia to Ontario and southward through the mountain-

ous areas of New England and New York to the Catskills in July and early August. Western records are doubtful and may refer to *grandis*.

According to Mr. D. S. Fletcher of the British Museum (Natural History), *basaliata* and *explagiata* of Walker undoubtedly refer to the same species, and a photograph of the type of *explagiata* which he kindly furnished confirms this.



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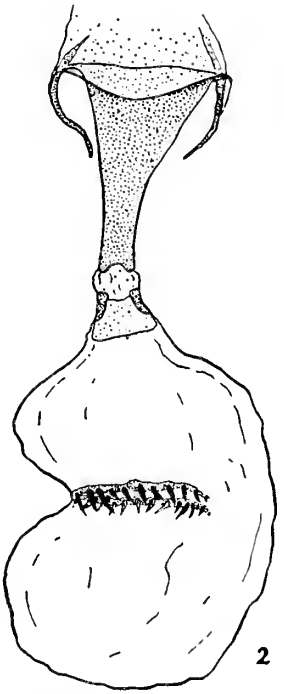

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Fig. 1. Female genitalia of *Perizoma grandis* Hulst, showing bursa, ductus bursae and ostium.

Fig. 2. Female genitalia of *Perizoma basaliata* Walker, showing the same parts.

Perizoma grandis Hulst

Eucymatoge grandis Hulst, Trans. Am. Ent. Soc., XXIII, 273, 1896.

Type locality: Washington.

Grandis is larger than *basaliata*, averaging about 23 mm. in both eastern and western examples. It is more uniformly colored than

basaliata, and the brownish areas before and after the median area are suffused with darker scaling and much less contrasting. The blackish patch in the subterminal area is present in *grandis,* but the whitish patch below it is more commonly obscured or entirely lacking, especially in eastern specimens. *Grandis* tends to be more constant than *basaliata* in both size and coloring, although in the eastern part of its range there is a form with primaries entirely suffused with reddish brown. I have seen no counterpart of this form in *basaliata.*

I do not know the form *saanichata* of Swett, but the original description reads very much as though it referred to a form corresponding to the more gayly colored variants of *basaliata* with light brown areas contrasting sharply with the blackish median band.

Eastern *grandis* are in general somewhat darker than western examples, but there is scarcely enough difference to warrant a racial name.

The female genitalia of *grandis* have the ductus bursae similarly chitinized but a little stouter. The peculiar membranous connection interrupting the otherwise rigid ductus in *basaliata* is entirely lacking in *grandis,* and the ductus abruptly joins the bursa part way down the ventral side, not apically as in *basaliata.* The signum is of entirely different form, consisting of two disconnected portions of irregular shape, one roughly ventral and the other dorsal, with spines protruding inward. Slides of females from Sonoma Co., California and Cape Breton Is., N.S. agree perfectly.

In the west *grandis* occurs through southern British Columbia, Washington, Oregon and southward in California at least to Sonoma County in June. Bowman records it from the vicinity of Edmonton, Alta. One might expect it throughout the mountainous regions of the north-west but few records are available. In the east we have it only from the zone of coniferous forest above 3000 feet in the White Mts., N.H. (Jefferson Notch, Half-way House) and an area of similar forest conditions in Cape Breton Highlands National Park, N.S. (French Mt., 1390 ft., North Mt., 1460 ft.), occurring in July and early August. It was very common at the Cape Breton localities.

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Vol. L JUNE, 1955 No. 3

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OF THE

BROOKLYN ENTOMOLOGICAL SOCIETY

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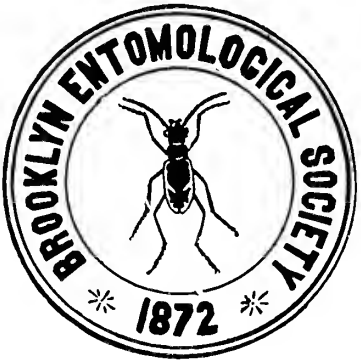

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BULLETIN

OF THE

BROOKLYN ENTOMOLOGICAL SOCIETY

VOL. L JUNE, 1955 No. 3

SOME UNDESCRIBED OR LITTLE KNOWN MALES OF TABANIDAE (DIPTERA).

By L. L. PECHUMAN, Lockport, New York

Male Tabanidae are rarely found in numbers and many species are known from the female only. Series of females may be collected while attacking humans or animals but the bloodsucking habit is not found in the male. Larval rearings have shown that both sexes of Tabanidae emerge as adults in approximately equal numbers so differences in habits must account at least in part for the scarcity of males in collections. There is some evidence that the males are shorter lived than the females so opportunities for collection of this sex are less than in the case of the females.

In Northeastern United States males are most frequently found on flowers, resting on vegetation or at damp spots on the ground. There appears to be considerable selection involved in flowers attractive to male Tabanidae. Such species as *Ceanothus americanus*, *Clethra alnifolia* and *Spiraea latifolia* seem to be favorites but *Spiraea tomentosa* does not appear to be at all attractive. Unusually good series of males have been collected as prey of certain species of wasps. In some *Tabanus* species, the males hover in openings in wooded areas and on mountain tops. Male Tabanidae are frequently taken at lights at night.

During the past few years some previously undescribed or inadequately known males of Tabanidae have accumulated in the writer's collection. Each of the following descriptions is based on an individual specimen which is labeled with a reference to this publication.

Chrysops amazon Daecke

Male, 10 mm. North Saugus, Massachusetts, 17 July 1906. The wing pattern associates this sex with the female. The characteristic

orange pleural pile and yellow beard of the female is absent, being replaced by dark hairs. The dorsum of the thorax is covered with dark hairs rather than gray as in the female and the pollen of the frontoclypeus including a narrow median stripe is grayish rather than yellowish. The entire insect is predominantly blackish, the only yellowish areas being the base of the middle and hind metatarsi and the first and second antennal segments and the base of the third. The abdomen is covered with blackish hairs with many gray hairs intermixed on the third and subsequent segments. On the venter the gray hairs are restricted to the posterior margins of the second and following segments. The wing pattern is much like that of the female with the hyaline triangle reaching the costal border and with the apical spot the same intensity as the crossband; the hyaline areas in the two basal cells are smaller than in the female and the anal cell and anal area is more heavily infuscated. The crossband broadly reaches the hind margin of the wing.

The male of *amazon* closely resembles the male of *C. celer* O.S. except for the presence of an apical spot and the more outwardly bowed distal margin of the crossband in *amazon*. Occasional specimens of the *carbonaria* group such as *celer, carbonaria* and *mitis* show some tinting at the wing tip which might be taken for an apical spot but this is normally paler than the crossband and indefinite in outline.

Superficially the male of *C. pechumani* is very close to the male of *amazon* but since they are widely separated geographically there should be no confusion. The main differences seem to be that in *amazon* the distal margin of the crossband is more outwardly bowed, the anal area is more heavily infuscated and the first two antennal segments are paler. The single male of *pechumani* examined by the writer shows some pale hairs on the pleurae and beard but practically none on the dorsum of the abdomen whereas the reverse is true of *amazon*.

Although Brennan (1935, p. 264) refers briefly to the male of *amazon*, he does not indicate that he saw this sex.

Chrysops parvula Daecke

Male, 7 mm. Lakehurst, New Jersey, 27 June 1954 (J. G. Franclemont). Except for the much heavier wing infuscation, this sex closely resembles the female. First two antennal segments yellow-brown, third dark brown. Entire facial area shining black except a dark yellow streak down the center of the frontoclypeus and a band of yellowish gray pollen above cheeks and a triangular

pollinose area projecting on frontoclypeus from below antennae. Palpi black. Dorsum of thorax as in female with only the slightest indication of stripes. Pleurae black with two horizontal gray pollinose stripes; the upper stripe which lies just below the wing base is not as distinct as the lower one. Legs mostly black, the fore coxae, fore femora, apical half of middle femora, extreme base of fore tibiae and almost all of middle tibiae and most of tarsi orange-yellow; hind tibiae with a brownish cast in some lights. Wing completely infuscated; there is a reduced intensity of the infuscation in the anal area beyond but not including the anal cell and a similar reduction indicates the hyaline triangle which has its apex at the bifurcation of the third longitudinal vein; the first and second submarginal cells, portions of which are included in the hyaline triangle in the female, are completely infuscated in the male; other areas which are hyaline in the female but as heavily infuscated as the crossband in the male include the second basal cell, fifth posterior cell and anal cell; there is a small pale spot at the wing margin just distad of the stigma. The abdomen, both dorsally and ventrally, is blackish brown, becoming slightly paler laterally on the first two segments; abdominal hairs are gray with a yellowish tint.

A second male from the same locality collected on 24 June 1954 has the pollinose area below the antennae prolonged as a narrow line on the frontoclypeus almost to the oral margin.

The male of *parvula* is separated from all species in the group related to *obsoleta* Wied. by the heavily infuscated anal and second basal cells, almost completely black frontoclypeus and cheeks, and much darker legs with the hind femora and tibiae almost completely dark. It is separated further from *obsoleta* and its variations by the absence of the pale stripe on each side of the thorax above the wing base.

Chrysops shermani Hine

Male, 8.5 mm. McLean Bogs Reserve, Tompkins County, New York, 2 July 1953 (T. J. Spilman). The male is remarkably like the female except for the usual sexual differences. First antennal segment yellow, second and third segments dark brown. Palpi orange with long black hair. Frontoclypeus deep yellow; frontoclypeal pits black. Thorax as in female but with center stripe broader. The wing shows the fragmented pattern characteristic of this species and differs from the female only in having the first basal cell even more completely infuscated and showing traces of infuscation in the basal portion of the second basal and anal cells. Legs as in the female; predominantly dark yellow with the apical half of fore

tibiae, fore tarsi, middle tarsi, extreme base and extreme apex of hind femora and hind tibiae respectively and most of hind tarsi, black. Abdominal pattern as in female although the median yellow triangle of the second tergite is smaller than in most females and the sublateral spots on the second tergite reach nearly to the anterior margin. Venter yellow with a narrow, sharply defined black median stripe running the length of the abdomen; narrower, sharply defined black sublateral stripes begin near the anterior border of the second sternite and run parallel to the median stripe. Apical segments of both dorsum and venter black with narrow yellow posterior borders.

Chrysops sordida Osten Sacken

Male, 9 mm. Top Mt. Joe, Essex County, New York, 12 June 1949 (H. Dietrich). Much darker than female but easily associated. Frontoclypeus shining black except for a pollinose yellow mid-facial stripe reaching almost to the oral margin and a small pollinose spot on each side below the frontoclypeal pits. The antennae and palpi are black. The thorax is black with scarcely a trace of median stripes. The apical spot of the wing is paler than the crossband and broadly joined to it for the width of the first submarginal cell; apical spot gradually fades out in the second submarginal cell but entire cell is tinted. The outer margin of the crossband is straight and reaches the hind margin of the wing in the third posterior cell. The infuscation at the apex of the fourth and fifth posterior cells is somewhat paler than the rest of the crossband. The first basal cell has a small hyaline area near its apex but the second basal cell is completely infuscated. The anal cell is considerably more infuscated than in the female. The legs are black. Abdomen black with inconspicuous yellowish gray markings; the first segment is completely black; second segment with a narrow reddish spot at extreme lateral margin; second and following segments with very narrow pale posterior margins which expand into small median triangles. Venter black, from second segment on with narrow pale posterior margins on each segment.

Chrysops berta Pechuman

Male, 7 mm. Nova Teutonia, Brazil, 13 December 1940 (Fritz Plaumann). Antennae black with black hair on the first two segments; first segment somewhat enlarged. Frontoclypeus with a median gray pollinose stripe which extends almost to the oral margin. Facial calli yellow within the frontoclypeal suture and black outside it. Lower portion of cheek with a small denuded black area;

balance of facial area gray pollinose. Palpi black. Thorax black with black hairs and a few paler hairs intermixed; there is a pale stripe immediately above base of wing; pleurae black with some pale hairs. Legs black; middle tibiae with a yellowish tinge on the basal third and middle and hind metatarsi somewhat yellowish. Wings much as in the female but anal cell and rest of anal area infuscated; hyaline area of fifth posterior cell reduced in size and hyaline area of second basal cell reduced to a spot subequal to that in the first basal cell. Halteres yellowish brown. Abdomen mostly black; first tergite with two very small gray sublateral spots resting on the posterior border; second and following tergites with narrow pale posterior borders which on the second and third segments expand to form a very small median triangle and a small oval spot on each side of the triangle; on the extreme lateral margin of the second tergite is a narrow yellowish spot which extends from the posterior border nearly to the anterior border of the segment. Tergites mostly with dark hairs except along the lateral margins where they are yellowish. Venter with a black median stripe and black lateral margins on each sternite; the posterior margins of the sternites are narrowly yellowish with pale hairs and sublateral yellowish spots on the second, third and fourth sternites form a pale stripe.

A study of this male from the type locality of *C. berta* indicates a close relationship and possible synonomy with *Chrysops trisignata* Kröber (1926, p. 336) which was described from a male and the female of which remains unknown or unrecognized. However, the peculiar extension of the crossband of the wing figured by Kröber distinguishes the two forms. There is a possibility that Kröber's species is based on an aberrant specimen.

Chrysops gracilis Kröber

Male, 7 mm. Gran Guardia, Territory of Formosa, Argentina, October, 1952 (J. Foerster). First antennal segment black and very slightly enlarged, second segment dark brown, third segment yellowish brown with black annuli; first two segments with black hairs. Frontoclypeus with a gray pollinose stripe; genae yellowish gray pollinose; facial calli dark brown, not enlarged. Vertical tubercle very large and three reddish ocelli are prominent. Eyes do not quite meet. Palpi dark brown. Thorax black, with mostly black hairs; some patches of pale hairs on pleurae. Legs black; fore and hind tibiae with a reddish cast and hind metatarsi yellowish. (The middle pair of legs is missing in this specimen). Wings as in female except for increased infuscation in the basal cells, re-

ducing the hyaline areas to two small adjoining spots, the one in the second basal cell not reaching the posterior border of the cell. Halteres dark brown. Abdomen mostly black; pale median triangles are vaguely indicated on the second and third tergites; the second and third tergites have a small sublateral yellowish spot on each side which does not touch either margin but is closer to the anterior margin and is narrowly separated from a poorly defined yellowish area along the lateral margin of the segment; third and following tergites with narrow yellowish posterior borders. Venter with a black median area and a sublateral yellowish area on the second and third sternites; remainder of sternites black except for narrow yellow posterior margins on the second and following sternites.

Asuncion, Paraguay, the type locality of *C. gracilis,* is only a short distance from Gran Guardia, Argentina where the above male was collected.

Chrysops nigricorpa Lutz

Male, 8 mm. Villarica, Paraguay, December, 1936 (F. Schade). Easily associated with female. First antennal segment yellow and differing from that of the female in being somewhat enlarged; second segment yellowish brown and third segment brownish black; first and second segments with long black hair. Entire facial area bright yellow with no pollen except for a minute spot near the frontoclypeal pit. Facial calli swollen and protuberant, somewhat more so than in the female. Palpi brownish black. Thorax black with two grayish stripes which do not quite reach to scutellum; scutellum concolorous with rest of thorax; dorsum of thorax with long dark and pale yellowish hairs, the pale hairs predominating. Legs brownish black, the basal third of the middle tibiae and the middle and hind metatarsi with a yellowish cast. Wings as in the female but with more extensive infuscation; the anal area including the anal cell is infuscated, the hyaline area in the fifth posterior cell is smaller than in the female and the hyaline areas in the first and second basal cells are reduced to small spots near the distal end of the cells. The halteres are dark yellowish brown. Abdomen uniformly brownish black with many black hairs and a few pale hairs.

A second male from Guaira, Paraguay, December, 1950, is like the above except most of the black areas lack the brownish tinge of the Villarica specimen.

Chrysops patricia Pechuman

A male from Gran Guardia, Territory of Formosa, Argentina, October, 1952 (J. Foerster) is apparently very close to the male of

Chrysops uruguayensis Kröber, not Lutz, described by Kröber (1926, p. 358) and a redescription is hardly necessary. As noted by Kröber, the male is considerably darker than the female.

The status of *C. uruguayensis* of Kröber has been discussed by the writer (1953, pp. 115–118).

Chrysops flavocincta Ricardo

Male, 6.5 mm. Nilgiri Hills, 3,500 ft., Guadalur, India, April, 1949 (P. S. Nathan). Readily associated with the female but with pale markings showing more yellow than in most females. Frontoclypeus and genae shining black, somewhat swollen and separated from the eyes by an extremely narrow band of yellow pollen; a triangle of yellow pollen projects on the frontoclypeus from just below the antennae. Vertical tubercle very prominent. First two antennal segments and basal fourth of third segment yellow; apical three fourths of third segment blackish. The very small second palpal segment is dark brown. Areas of large and small facets of eyes rather distinctly differentiated. Thorax blackish with no apparent stripes and with a scattering of long yellow hairs; pleurae with patches of dense golden pubescence as in female. Legs blackish brown with fore and middle femora and hind metatarsi pale brown. Wings as in the female; only a trace of infuscation is present at the extreme base of basal cells; outer margin of crossband concave, reaching the posterior margin of the wing only in the fourth posterior cell and in an extremely limited adjoining portion of the fifth posterior cell; apical spot exists only as a narrow faint shadow along the costal border. Abdomen black with yellow areas; first and second tergites as in female but paler areas are more yellow and central dark area of second tergite reaches almost to the anterior margin; third and fourth tergites with a parallel sided median yellow stripe narrowly separated from a vaguely indicated sublateral yellowish area; on the fifth tergite the median yellow area and sublateral area are merged and the entire segment is dark yellowish except at the sides. First, second and most of third sternite yellow; balance of sternites black.

Most workers do not mention the extremely narrow pale apical spot of the female of *C. flavocincta* nor do they do mention the indistinct row of median yellowish spots on the abdomen. These spots are more developed in the male than in the female.

The male of *C. flavocincta*, like the female, should not easily be confused with any other species. There is a superficial resemblance to the male of *C. pellucida* Fabr. but *pellucida* has a distinct apical spot of the same intensity as the crossband and the cross-

band reaches the posterior margin of the wing both in the fourth posterior cell and along the vein separating the fifth posterior and anal cells.

Conoposclaga albitarsis (Macquart)

Male, 7.5 mm. Gran Guardia, Territory of Formosa, Argentina, October, 1952 (J. Foerster). A predominantly black form easily associated with the female. Antennae dark yellow, apical portion of the third segment brown; first antennal segment about equal in length to the combined length of the second and third segments. Frontal triangle, subcallus, frontoclypeus and cheeks shining black; subcallus and cheeks somewhat swollen; cheeks with considerable black hair. Palpi shining black, considerably enlarged, with black hair. Eyes densely pilose with pile much longer than in female; small facets occupying about lower one fifth of eye but line separating large and small facets not distinct. Thorax black with black hairs and sparse reddish gold scales as in female. Wing pattern as in female; outer margin of crossband not quite reaching posterior margin of wing. Halteres dark brown. Legs black; tarsi white; all tibiae swollen to about same degree as in female. Abdomen black with considerable black hair on first two tergites; from third tergite on with considerable golden hair; second tergite with a dull yellow lateral spot which crosses the tergite and extends slightly over the adjoining portions of the first and third tergites. Venter black with black hair.

The male of the only other species presently placed in *Conoposclaga*, *C. aberrans* (Lutz) is unknown. The male of *C. albitarsis*, although showing some relationship to the male of *Lepisclaga crassipes* (Fabr.), is quite distinct differing in the much longer first antennal segment, black subcallus, less swollen tibiae, different wing pattern, lack of scales on the abdomen and hairy eyes.

Since Macquart's description in 1850, *C. albitarsis* has been placed in the genus *Lepisclaga*. However, there can be little question that it belongs in *Conoposclaga* which has recently been proposed by Barretto (1948–49, p. 87) with *Lepisclaga aberrans* as the genotype. Some of the characters used by Barretto to separate *Conoposclaga* from *Lepisclaga* include hairy eyes, wide frons, ridge at vertex, long first antennal segment, somewhat elevated scutellum and absence of abdominal scales. A series of females of *albitarsis* studied by the writer agree in all these characters although in some specimens a few scales are present on the abdomen.

Scaptiodes nigerrima Enderlein

Male, 10.5 mm. Ancud, Chiloe, Chile, 23 January 1952 (Luis E.

Peña). Almost completely black, only the white empodia and pulvilli contrasting with the rest of the insect; other paler areas are gray pollinose subcallus, greenish brown eyes and dark brown halteres. Wing mebrane clear with a dusky tint which is darker in the costal cell. Subepaulet without coarse hairs. First two antennal segments, cheeks, palpi, coxae, thorax and abdomen with long black hairs. Antennae as in female except basal portion of third segment is somewhat more slender. First palpal segment somewhat swollen; second palpal segment not quite as wide as first segment, about four times as long as its greatest width tapering to a rather acute apex. Subcallus and cheeks only moderately swollen but more so than in female, so frontoclypeus has a sunken appearance. Eyes thickly haired, large facets occupying about upper two thirds but line between large and small facets indistinct.

Chrysozona rara (Johnson)

Male, 8.5 mm. Arlington, Virginia, 20 June 1950 (K. V. Krombein). First antennal segment subcylindrical, about two and a half times as long as greatest thickness, shining black with traces of gray pollen on inner surfaces; second antennal segment very small, shining black; basal portion of third antennal segment slightly over twice as long as greatest width, yellowish brown; annuli black. Pile of eyes short but dense; small facets occupying about lower fifth of eye and line of demarcation between small and large facets rather distinct. Hairs at vertex black. Subcallus gray pollinose with a large black area which is velvety in the center and shining on the sides. Cheeks pale gray with many small black spots above. There is a large black spot just below the antennae and the cheeks have many black and a few pale hairs. Second palpal segment pale yellowish gray, slightly more than twice as long as greatest thickness and with many pale and a few black hairs; apex blunt. Thorax black with black hairs; three narrow white lines run length of thorax; pleurae with some white hairs. Wings as in female. Knob of halteres dark brown, stem white. Legs colored and marked as in female. Abdominal tergites and sternites blackish brown with pale posterior margins beginning with the second segment; lateral area of second tergite with a reddish cast; tergites with black hairs, sternites mostly with yellowish gray hairs.

Tabanus (*Hybomitra*) *affinis aurilimbus* Stone

Male, 17 mm. Rutland, Mass., August, 1950 (W. T. M. Forbes). First, second and basal portion of third antennal segment yellow; basal portion of third segment with some brownish mar-

ginal shading between dorsal angle and annuli; annuli brown. Subcallus and cheeks gray pollinose, the latter with a faint yellowish tinge; hair of cheeks pale. Second palpal segment yellow, slightly over twice as long as greatest thickness, with long yellow hairs and a few shorter dark hairs. Small eye facets in lower portion of eye gradually merging with larger upper facets with no definite line of demarcation between them. Thorax as in female but pale hair of dorsum much longer; some dark hairs mixed with pale hairs. All coxae black; femora black with fore femora slightly and middle and hind femora extensively yellow toward apex; all femora with long yellow hair; all tibiae yellow, fore tibiae darker than the others; outer hind tibial fringe blackish with a strong bronze cast; inner hind tibial fringe almost completely yellow; fore tarsi black, middle and hind tarsi yellow. Halteres pale brownish yellow shading to cream color at apex of knob. Abdomen much as in female but median black markings much reduced; black spot on third tergite very small, not touching any margin of segment; spots on second to fourth tergites tend to be elongate rectangles rather than oval in outline; fifth and following tergites black with narrow pale posterior margins; tergites predominantly black haired but with many yellow hairs sublaterally and on posterior margins. Venter yellow with yellow hairs; fifth and following sternites black with narrow pale posterior margins.

After a study of considerable material of both sexes, it is the writer's belief that the holotype female of *Tabanus aurilimbus* Stone is a rather extreme variant of a form closely related to *Tabanus affinis* Kirby. The holotype of *aurilimbus* has a yellow hind tibial fringe and yellowish palpal hairs but these have been found to be somewhat unusual characters present to a varying degree and in various combinations in the series studied. Specimens collected at the same time may show individuals with a yellow hind tibial fringe, completely black fringe and several intermediate stages where the fringe is made up of differing amounts of black and yellow hairs. A similar situation may be seen in reference to the palpal hairs. It also may be noted that these characters are variable in *affinis* although the presence of a yellow hind tibial fringe is a rarity in this species.

The writer in his description of the male above has selected a specimen which comes closer to matching the holotype in tinctorial characters than any other available male. Many other males have been studied and most of these show a little more black on the abdomen, the outer hind tibial fringe is usually black and the inner fringe often so, the legs are often darker and there are more black

hairs on the palpi. In general, the population of *aurilimbus* is composed of individuals showing more melanistic characters than the holotype and the male described above.

The taxonomic status of *aurilimbus* seems to be expressed best by placing it as a subspecies of *affinis* which it largely replaces in the southeastern portion of its range in New England, New York, Pennsylvania and New Jersey. In New York and New England, typical *affinis* seems to be restricted almost entirely to the mountainous areas along with other Tabanidae with northern affinities whereas *aurilimbus* is found at lower elevations and nearer the coast.

The following key may be used to distinguish the majority of specimens of these two forms.

1. Males 2
   Females 3
2. Base of third antennal segment distinctly excised; second palpal segment yellowish white, about 1½ times as long as greatest thickness ..... *affinis* Kirby
   Base of third antennal segment slender and shallowly excised; second palpal segment yellow, about 2 times as long as greatest thickness; median black area of abdomen usually much reduced ..... *affinis aurilimbus* Stone
3. Basal callus quadrangular, rarely joined to median callus; basal portion of third antennal segment rather deeply excised; palpi yellowish white, about three times as long as greatest width *affinis* Kirby
   Basal callus rounded above, often joined to median callus; basal portion of third antennal segment rather slender and not deeply excised; palpi yellow, 3½ to 4 times as long as greatest width *affinis aurilimbus* Stone

Tabanus imitans excessus Stone

Male, 19 mm. (Abdominal segments beyond the fourth are telescoped and estimated length with these in normal extended position is 22 mm.). Savannah R. Refuge, Jasper County, S. C., 28 May 1946 (Harvey I. Scudder). When compared with a series of males of typical *imitans, excessus* seems to differ only in the absence of the long projecting process of the third antennal segment.

Only those specimens of *imitans* or *imitans excessus* which lack a row of median abdominal spots would key to *imitans* in Stone's key to *Tabanus* males (1938). Most specimens seen by the writer would go to couplet 31 which contains *cheliopterus* Rondani and

recedens Walker. Typical *imitans* would be separated at once by the long process on the third antennal segment. From *recedens, excessus* would be separated by the wider third antennal segment, smaller and proportionally broader median abdominal spots and larger more intensely infuscated spots on the wing. From *cheliopterus, excessus* may be separated by the relatively small median abdominal spots and absence of pale posterior bands on the abdominal tergites.

Tabanus gilanus Townsend

Male, 14 mm. Greer, Arizona, 3 July 1953 (A. & H. Dietrich). First and second antennal segments reddish with black hair; third antennal segment rather narrow, reddish at extreme base with balance of segment including annuli black; annulate portion shorter than basal portion. Eyes pilose with pilosity shorter over area of small facets which occupy about lower one fourth of eye and are rather sharply set off from the larger upper facets. Second palpal segment pale yellowish with long black and white hairs, slightly over twice as long as greatest thickness and somewhat tapering. Subcallus with very thin yellowish gray pollen which scarcely covers integument. Cheeks with yellowish pollen above which shades to gray below; upper portion of cheeks with black hairs and lower portion with gray hairs. Thorax, legs and abdomen essentially as in female; thoracic hairs are longer than in female and very few of the recumbent golden hairs found in unrubbed females are present. Hind tibial fringe black with a few white hairs.

Other males collected at the same time as the above specimen vary from 12 to 15 mm. in length and in some the cheeks show little yellow pollen and are almost entirely black haired.

The present interpretation of *T. gilanus* and its close relative *T. stonei* Philip (*T. intensivus* of authors not Townsend) differs somewhat from that of Stone (1938). This is discussed by Philip (1941) who at that time did not have males of *gilanus* available for comparison with *stonei*. One male of *stonei* from Greer, Arizona and one from Logan, Utah differ from *gilanus* in being considerably more hirsute, most of the hairs being white, in having a white tibial fringe, much heavier pollen on the subcallus, and paler, shorter, more globose palpi with almost no black hairs. It is to be hoped that most of these characters will hold when longer series are available for study.

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Uinta Mountain Leafhoppers: While crossing over the high Uinta Mountains, from Vernal to Manila, Utah, on July 17, 1952, Dr. G. E. Bohart and I picked up a nice series of the leafhopper *Verdanus evansi* (Ashm.) at Elk Park. Additional specimens were taken at Kobel Springs, and specimens the day before at Douglas Pass, in Colorado. *Deltocephalus dorsti* Oman also was taken at Kobel Springs, and *Errastunus sobrinus* S.-De. L. at Elk Park, in Utah. Leafhoppers of several species were very numerous in some of the areas where collections were made in the high meadow and canyon areas on that trip. (Det. by Dr. D. A. Young.)—George F. Knowlton, Logan, Utah.

SYNONYMICAL NOTES ON NORTH AMERICAN SPHECOID WASPS. IV.[1] SOME SYNONYMY IN OXYBELUS AND DESCRIPTION OF A NEW SUBSPECIES (HYMENOPTERA).

By Karl V. Krombein,[2] Washington, D.C.

Synonymy in most of the following species of *Oxybelus* was established as a result of a critical study of type material of North American species in the collection of the United States National Museum. This study was initiated when R. M. Bohart, of the University of California at Davis, requested specific determinations for some species from California. The opportunity is also taken at this time to describe a new subspecies of *sericeus* Robt., for which a name is needed in connection with some biological observations.

Oxybelus cornutus Robertson

Oxybelus cornutus Robertson, 1889. Trans. Amer. Ent. Soc. 16: 80. Male.

Oxybelus quadricolor Cockerell and Baker, 1896. Psyche 7 (sup.): 21. Female. NEW SYNONYMY.

Oxybelus polygoni Rohwer, 1909. Trans. Amer. Ent. Soc. 35: 116. Female. NEW SYNONYMY.

Oxybelus cornutus var. *quadricolor* Cockerell and Baker, Rohwer, 1909. Trans. Amer. Ent. Soc. 35: 117. Female.

There are in the U. S. National Museum collection the female type of *quadricolor* from Santa Fe, New Mexico, and the female paratype from Fort Collins, Colorado, the unique female type of *polygoni* from Boulder, Colorado, and a female from Cope, Colorado, determined as *cornutus* var. *quadricolor* by Rohwer. These specimens agree in such important details as having the mesonotum red anteriorly, a large impunctate tubercle on the middle of the vertex, a rather large impunctate swelling along inner anterior margin of posterior ocellus, the pronotal carina interrupted at anterolateral angle, and the shape of the squamae which taper to an acute, curved point. The mucro in the type of *polygoni* is more robust than in the other specimens. The type of *quadricolor* was damaged

[1] Part III of this series appeared in Bull. Brooklyn Ent. Soc. 45: 35–40, 1950.

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by museum pests at some time in the past, and the head, thoracic sternum and all of the abdomen except first two tergites are missing. What is left agrees with the paratype of *quadricolor* in all essential respects except that the mucro is extremely short. It appears that the mucro in this species is subject to more variation than is normal for species of *Oxybelus,* and that its exact shape cannot be depended upon for differentiation of this species.

The male is similar to the female in the ocellar and vertexal tubercles, pronotal carina, and squamae. The chief differences between the two sexes, other than those of a sexual nature, are the shape of the mucro, which is more or less parallel-sided with rounded apex in the male and tapering to an acute point in the female, and in the male the red is usually lacking on the mesonotum.

Oxybelus lactus Say

Oxybelus lactus Say, 1837. Boston Jour. Nat. Hist. 1: 375. Male.
Oxybelus Packardii Robertson, 1889. Trans. Amer. Ent. Soc. 16: 80. Female, male. NEW SYNONYMY.
Oxybelus Packardii var. *texanus* Robertson, 1889. Trans. Amer. Ent. Soc. 16: 81. Female, male. NEW SYNONYMY.
Oxybelus heterolepis Cockerell and Baker, 1896. Psyche 7 (sup.): 22. Male. NEW SYNONYMY.
Oxybelus heterolepis var. *defectus* Cockerell and Baker, 1896. Psyche 7 (sup.): 23. Male. NEW SYNONYMY.
Oxybelus unicus Mickel, 1918 (1917). Nebr. Univ. Studies 17: 323. NEW SYNONYMY.

This widely distributed species is quite variable with respect to the color and extent of the pale markings, the color varying from white to yellow, and the extent varying as indicated in Robertson's descriptions of *packardii,* the variety *texanus,* and *lactus.* The types of *heterolepis* and the variety *defectus* are in the U. S. National Museum—both fall within the normal limits of variation. There is also in the Museum collection a topotypic paratype of *unicus* from Mitchell, Nebraska, and topotypic material of *packardii* and *packardii* var. *texanus,* all of which fall as synonyms of *lactus.*

Oxybelus robertsonii Baker

Oxybelus robertsonii Baker, 1896. Ent. News 7: 156. Male.
Oxybelus varicoloratus Baker, 1896. Ent. News 7: 157. Female. NEW SYNONYMY.
Oxybelus hirsutus Baker, 1896. Ent. News 7: 157. Female. NEW SYNONYMY.

The types of the three names listed above are in the U. S. National Museum. Those of *varicoloratus* and *hirsutus* (head lacking) from Fort Collins, Colorado, are separated by only a few minor color differences which hardly merit nomenclatorial recognition. These females are certainly the opposite sex of *robertsonii* males (type from vicinity of Fort Collins). The two sexes agree in the shape of the squamae and mucro, the presence of moderately dense silvery pubescence on dorsum of scutum and propodeum, development of pronotal carina, postscutellum not carinate in middle but with broad, shallow groove, and carina almost evanescent laterally on posterior surface of propodeum. The name *hirsutus* was inadvertently omitted in the Synoptic Catalog of North American Hymenoptera.

Oxybelus fossor Rohwer and Cockerell

Oxybelus fossor Rohwer and Cockerell, 1908. Ent. News 19: 179. Female.

Oxybelus umbrosus Mickel, 1916. Trans. Amer. Ent. Soc. 42: 432. Male.

This synonymy was established by Pate (Pan-Pacific Ent. 19: 125, 1943), but was overlooked in the Synoptic Catalog of North American Hymenoptera.

Oxybelus intermedius Baker

Oxybelus intermedius Baker, 1896. Ent. News 7: 160. Female.

Oxybelus coloradensis Baker, 1896. Ent. News 7: 160. Male. NEW SYNONYMY.

Notoglossa incisura Mickel, 1916. Trans. Amer. Ent. Soc. 42: 430. Male. NEW SYNONYMY.

The types of *intermedius* and *coloradensis*, both from Fort Collins, Colorado, are in the U. S. National Museum, and are obviously opposite sexes of the same species. They agree in such characters as the general sculpture, shape of squamae and mucro, microtrichiae present only anteriorly in basal cell, presence of a small swelling along inner anterior margin of posterior ocellus, and the well-developed, rounded distal lobe on hind femur. There are also two topotypic paratypes of *incisura* from Harrison, Nebraska, in the Museum collection which differ in no significant details from the type of *coloradensis*.

Oxybelus emarginatus Say

Oxybelus emarginatus Say, 1837. Boston Jour. Nat. Hist. 1: 375. Male.

Oxybelus parvus Cresson, 1865. Proc. Ent. Soc. Phila. 4: 476. Female.

Notoglossa pacifica Rohwer, 1909. Trans. Amer. Ent. Soc. 35: 119. Male. NEW SYNONYMY.

The unique type of *pacifica* from Pullman, Washington, is in the U. S. National Museum. It falls easily within the normal limits of variation of the common and widely distributed *emarginatus*.

Oxybelus sericeus **crocatus** n. subsp.

This subspecies is described at this time so that some biological observations can be published which were made by H. E. Evans of Cornell University and two of his students. At present it is known only from the type series from Pascagoula on the Gulf Coast of Mississippi. The color differences which separate it from typical *sericeus* are of the character which distinguish the Florida races of many other aculeates. Many of these Florida races occur also along the Gulf Coast and in Georgia, so it seems very probable that *sericeus crocatus* should be found also in Florida and perhaps as far west as New Orleans.

It may be distinguished from typical *sericeus* by the replacement by orange of the normal pale yellow markings on thorax, legs and abdomen. It is separated from *fulvipes* Robt. and *floridanus* Robt., the only two species from Florida which are at all similar in general coloration and sculpture, by the following combination of characters: male with apical margin of clypeus quinquedentate, apical tergites without posterolateral teeth, and last two tergites lacking lateral carinae; female with the clypeus densely punctate except for very narrow apical rim; both sexes with very dense silvery vestiture on clypeus and face, punctation of thorax and abdomen more delicate, pronotal carina interrupted laterally, and basal cell of forewing with microtrichiae evenly distributed.

Type. Male; Pascagoula, Jackson County, Mississippi; August 4, 1953 (H. E. Evans, C. M. Yoshimoto, and C. S. Lin) [U. S. National Museum, Type No. 62537].

Male. Length 6.9 mm. Punctation and vestiture as in typical *sericeus*. Mandible yellow except at extreme base and the apical fourth. Other pale maculations orange instead of pale yellow as follows: small spot laterally on pronotum, tubercle, a pair of large ovoid spots on first tergite, a pair of narrow elongate streaks along apical margin of second tergite, tip of fore femur, short stripe on outer surface of mid femur on apical half, fore tibia on outer surface, anterior edge of outer surface of mid tibia, basal fourth of posterior

tibia on outer surface, and fore tarsus. Last three abdominal segments and flagellum orange as in typical *sericeus*.

Allotype. Female; same data as type [USNM].

Female. Length 6.9 mm. Similar to the male except the following also orange: a pair of oblique ovoid spots on scutellum, inner edge of squama, third and fourth tergites with very narrow lateral stripe along apices, mid and hind tibiae entirely on outer surface. The last two abdominal segments are entirely orange.

Paratypes. Six males, 3 females; same data as type. Two males and one female bear an additional label, "Biol. Note No. 580." Paratypes have been placed in the U. S. National Museum and Cornell University, and in the personal collections of H. E. Evans and the author.

Male paratypes vary in length from 4.9 to 7.9 mm. They are quite similar to the type except that three of them have narrow lateral lines on the apical margins of the third and fourth tergites. The female paratypes vary in length from 6.4 to 7.4 mm., and are otherwise very similar to the allotype.

Dr. Evans writes that these specimens were taken on a small beach of white sand along the Gulf, with adjacent salt marsh and mud banks. Numerous individuals were flying around close to the sand and landing on it, and several pairs were flying in copula. One female was taken with prey, an otitid fly, *Chactopsis fulvifrons* (Macq.) [det. R. H. Foote]. The fly is carried beneath the wasp during flight.

PUBLICATIONS RECEIVED

The Lepidoptera of Nova Scotia, Part I, Macrolepidoptera, by D. C. Ferguson. 215 pp., 17 plates and 1 map. 6×9 ins., paper bound. 1954. Nova Scotian Institute of Science. (Copies are available at $2.00 each from the author at the Museum of Science, Halifax, Nova Scotia).

The Evolution and Taxonomy of the Sarcophaginae, by Selwyn S. Roback. 181 pp., 34 plates. 7×10 ins., paper or cloth bound. 1954. The University of Illinois Press, Urbana, Ill. (Price, paper bound—$4.00, cloth bound—$5.00)

Applied Entomology, by H. T. Fernald & Harold H. Shepard. 385 pp., 269 illus. 6×9 ins., cloth bound. Fifth Edition, 1955. McGraw-Hill Book Company, Inc., New York, N. Y. (Price, $7.00)

Pomp and Pestilence, by Ronald Hare. 224 pp. 5×8 ins., cloth bound. 1955. Philosophical Library, Inc., New York, N. Y. (Price, $5.75)

BOOK NOTES

Insects of Micronesia, Introduction, by J. Linsley Gressitt. viii + 257 pp., 21 maps, 49 figs. 7 × 10 ins., paper bound. 1954. Bernice P. Bishop Museum, Honolulu, Hawaii. (Price, $3.50)

This first volume of a proposed 20 volumes series on the Insects of Micronesia has been appropriately described in the foreword by the Director of the Bishop Museum as "—more than a technical preface; it presents a comprehensive survey of the natural history of Micronesia that will be of interest to a wide audience." The truth of that statement becomes increasingly apparent as one delves deeper into this well prepared volume. In fact, it appears to this reviewer that Dr. Gressitt has given us what will probably be for some time the standard reference work to biological information concerning Micronesia.

For those who seek a thorough understanding of the entomology of Micronesia, volume I of this series will be indispensible. It contains brief accounts of the activities of man in Micronesia, and an historical account of entomology in the islands. Following these brief prefatory sections, the environment under consideration is discussed in some detail—its geology, soils, climate, flora, fauna and ecology. There is also a section that contains descriptions of the islands, one on economic entomology, one on the field work that forms the basis for the projected reports, a bibliography of papers dealing with entomology of the region, and a gazetteer. At the risk of neglecting equally important points, special mention will be made of the sections on the fauna, ecology and economic entomology.

In discussing the fauna of Micronesia, Gressitt first calls attention to the importance of isolation in the development of specialized faunas on oceanic islands, and effectively analyzes the comparative isolation of various islands and groups of islands by brief discussions supported by tabular data. In spite of the fact that Micronesia neighbors on various zoographic regions, the insect fauna lacks diversity. Many groups of insects, including categories up to orders, are absent from the islands. The available evidence indicates that the insects established in the islands prior to visitations by European man originated from limited sources. Consideration of the importance of isolation leads naturally to the discussion of means of spread. This is followed by a provisional statement concerning the insect fauna of Micronesia, and by accounts of the faunas of the island groups, both the terrestrial vertebrate fauna and the terrestrial invertebrate fauna.

The insect ecology of Micronesia is discussed in two general cate-

gories, atoll insect ecology and high island insect ecology. The strand, the inner beach, the open woodland and the canopy woodland are the principle habitats considered in the atolls, whereas the high islands include also lowland rainforest communities, aquatic communities, and high cloud forest associations. In addition, the human community is discussed for both types of islands.

Economic entomology in the area is discussed in three categories—insects that attack crops, beneficial insects, and insects of medical and veterinary importance. Organization of the plant feeding insects on the basis of the crops they attack makes for easy reference, and this portion of the volume is admirably complemented by the sections on the flora, fauna and ecology of the islands. Economic workers will surely find this a most valuable summary of our present knowledge of the insect pests of crops in the area.

All in all, this introductory volume is a fitting beginning for a most ambitious and worthwhile project. It sets a standard of excellence that should be a challenge to the "more than 115 authors" who will prepare the succeeding volumes. If those various accounts are comparable in quality to the example set, Micronesia will have been transformed from one of the least known to one of the best known areas of the world, entomologically speaking, within the brief span of about two decades. Dr. Gressitt and the Bishop Museum, as well as the several collaborating agencies that have contributed to this project, are to be congratulated on the appearance of volume I of the series.—P. W. Oman, Beltsville, Md.

NOTICE

The American Museum of Natural History has announced the establishment of The Southwestern Research Station. It is located on the eastern slope of the Chiricahua Mountains, near Portal, Cochise County, in southeastern Arizona. The property is within the limits of the Coronado National Forest at an elevation of 5,400 feet.

The station was established for the purpose of making available research facilities for scientists and students in all branches of science, who have problems that can be investigated through the utilization of the faunal, floral and geological features of the area. It will be open during the entire year.

It is operated by the American Museum of Natural History, Central Park West at 79th Street, New York 24, New York and under the direction of Dr. Mont A. Cazier, Chairman and Curator of the Department of Insects and Spiders, to whom all inquiries should be addressed.

AN ETHOLOGICAL STUDY OF ANOPLIUS (POMPILINUS) FRATERNUS (BANKS) (HYMENOPTERA, POMPILIDAE).

By Howard E. Evans,[1] Karl V. Krombein,[2] and Carl M. Yoshimoto[1]

The pompilid wasp *Anoplius* (*Pompilinus*) *fraternus* (Banks) was described originally in 1941, and until 1951 was known only from the type series of two females. It is still poorly represented in most collections. In a revision of the genus in 1951 Evans (Trans. Amer. Ent. Soc. 76: 322) redescribed the species from 85 specimens from various localities from Florida and Texas north to Long Island and to Nebraska. It was noted that nearly all the records were from sea beaches or inland salt flats. The species occurs occasionally on sandy beaches, often where there is seaweed or debris, but more frequently on muddy salt flats around salt marshes or salt lakes. Within its habitat it is often extremely abundant at the proper season. Its restriction to a habitat which is unusual for a pompilid undoubtedly accounts for its scarcity in collections.

During the springs of 1953 and 1954 we spent a few days on the salt flats at Cape Sable, Everglades National Park, Florida. The observations reported here were made near the southern terminus of the gravel road running through the Park, a place called Flamingo on many maps. The actual dates were March 31, 1953, and March 24, 25, and 27, 1954. The observations made in 1953 were reported briefly by Krombein and Evans in 1954 (Proc. Ent. Soc. Washington 56: 231). At this locality we encountered a very large population of *fraternus* which, judging from the uniformly fresh appearance of specimens and the abundance of males, must have emerged not more than a week or two prior to our arrival. Specimens were taken on debris at the ocean edge and, in much greater numbers, on bare spots and in the vegetation surrounding them on the salt flats behind the beach. The soil on the flats is heavy, black, and has a high salt content. The top crust tends to be hard and dry, but down to a depth of about 20–30 cm. it is somewhat moist, and below this depth it is saturated with water. In this habitat only two other species of Pompilidae were taken, and these in very small numbers. In fact, aside from *fraternus*, a large colony of *Bembix cinerea* Hand-

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lirsch, and considerable numbers of two species of Mutillidae, aculeate wasps were notably uncommon in this area. *Anoplius fraternus* and *Bembix cinerea* seem adapted for life in this type of habitat. The lack of competition, numerous nesting sites, and abundance of prey (spiders and horseflies, respectively) apparently enable these two species to build up high populations on the salt flats.

In the following summary of our notes on *fraternus* reference is made to the observers by the use of initials, and to the numbers of the field notes and associated specimens, which are on file at the writers' respective institutions. Determinations of the spiders were made by H. K. Wallace of the University of Florida, to whom we wish to express our thanks.

Activity of males. Large numbers of males were in flight over bare areas and in the surrounding vegetation during the morning hours and lesser numbers during the afternoon. On March 27, 1954, there was considerable cloudiness during part of the day, and during this period little activity was noted. Otherwise sunny weather prevailed, and males were abundant, flying erratically close to the ground, occasionally landing on the ground, and now and then darting after females which were searching for prey or nesting. A few males were found by one of us (KVK) to be attracted to a solution of honey and water which was sprayed on low vegetation. Neither sex was seen visiting flowers; in fact, there are no records known to us of this species ever visiting flowers for nectar.

Hunting and prey transport by females. It was a common sight to see females walking rapidly over the earth with their wings flicking rapidly in the usual manner of pompilids. It is probable that much of the hunting is done in low vegetation and the spiders carried out onto bare places where the female seeks a place to start a nest. At any rate, none was seen attacking spiders, while no less than 27 were found transporting their paralyzed spiders across the bare areas. Twenty-four of these were taken and identified, with the results indicated in the table, while the other three were used for rearing purposes. Sixteen of the twenty-four were a single species of spider, *Lycosa watsoni* Gertsch, all immature. Three others were *L. carrana* Bryant, adult and immature. These species are typical coastal spiders, occurring principally in salt marshes. The four other species used are apparently more wide-ranging. All are ground-dwelling, free-living spiders.

The spiders used varied considerably in size, the smallest measured being 4.6 mm. long (carried by a wasp 7.1 mm. long) and the largest 11.7 mm. long (carried by a wasp 9.1 mm. long). In every case observed, regardless of the relative size of wasp and prey, the

method of transportation was the same. The wasp walked backward, grasping the spider with her mandibles by the base of the hind legs, and holding it rather high in the air, so that smaller spiders were clear of the ground and larger spiders tended to drag their legs on the ground. This is the common method of transportation in the Pompilidae, occurring in many species, for example in *Anoplius apiculatus autumnalis* (Banks) (Evans, Lin and Yoshimoto, Jour. New York Ent. Soc. 61: 61–78, 1953). The latter species, however, when carrying a small spider, will often turn around and proceed forward, holding the spider high off the ground, or may

Table 1. List of Spiders used as Prey by *Anoplius fraternus*

Species	Sex or Stage	Number of Records	Note Numbers
LYCOSIDAE			
Lycosa watsoni Gertsch	Immature	16	KVK32554A,B,C,-E,F; 32754A.HEE-301; 302A; 720A1, A2,B1,B2.CMY-664A,B,C,D
Lycosa carrana Bryant	Immature	2	KVK32554D; 327-54B.HEE302B
	Adult ♂	1	
Sosippus floridanus Simon	Immature	2	CMY400, HEE-720A3
Pardosa longispinnata Tull.	Adult ♀	1	HEE720B3
SALTICIDAE			
Habronattus sp.	Adult ♀	1	HEE720A4
Pellenes sp.	Adult ♀	1	HEE720A5

actually fly short distances using the same grasp on the spider. In contrast to this, *fraternus* walked backward over the ground in all the 26 examples observed.

Selection of nesting site. After carrying their prey into a suitable area for nesting, the wasps normally deposit their spiders on the ground and undertake a search for holes and crevices. For example, one wasp (CMY, no. 400) carried her spider about 3 meters across a bare space, deposited it on the ground, and explored an area of about 1.5 meters diameter by walking rapidly in a zigzag

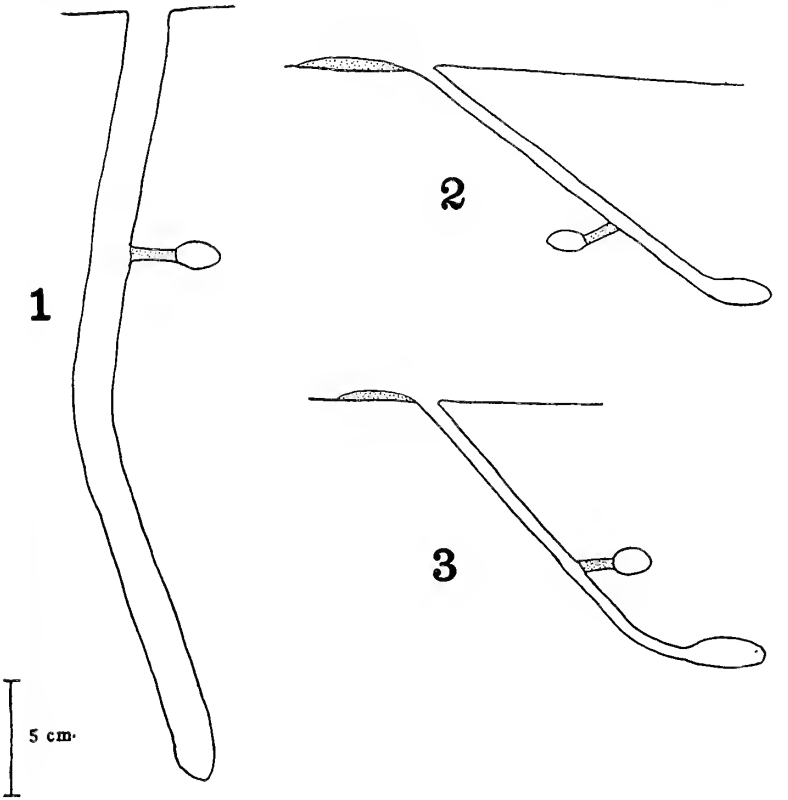
fashion with the antennae in constant motion and the wings flickering rapidly. She encountered some difficulty in finding her spider again, and located it only after about 10 minutes search. After finding it, she picked it up in the usual manner and proceeded another 3–4 meters, when she again deposited it in the midst of a colony of *Bembix cinerea*. After examining two *Bembix* nests in succession for a few moments each, she returned to her prey, again experiencing some difficulty in finding it. She picked up the spider and carried it further, deposited it again, and then stung it two or three times in quick succession. Next, she left it on the earth while she explored further, this time entering a crab-hole which apparently was suitable for nesting. She picked up the spider in the usual manner and carried it directly into the crab-hole. The wasp was first observed at 1126 and the spider was carried into the crab-hole at 1231.

Females of *fraternus* examined depressions and holes of many kinds in their search for suitable nesting places. We did not observe any wasps starting their nests on flat, unbroken earth. One female dug her nest at the lower edge of a heel print in soft soil (KVK, no. 32554 F). Another was at the bottom of a crack in the mud (CMY, no. 660). One specimen (HEE, no. 301) nested on the side of a small vertical burrow, either that of a beetle or a small crab, and another (CMY, no. 400) on the side of a crab-hole about 2 cm. in diameter. Many individuals were seen entering nests of *B. cinerea*, a species which leaves the entrance to its burrow open all through the day. Two specimens (CMY, nos. 668 and 803) nested several centimeters down off the side of *Bembix* burrows. This naturally involved some conflict between the rightful owners of the nest and the trespassers. No. 668 carried her spider into a *Bembix* nest at 1050, and at 1150 was seen carrying small clumps of earth to close the entrance of the *Bembix* burrow. The *Bembix* returned at this time and proceeded to dig this earth away, but the *fraternus* persisted in her efforts, and after several attempts was finally driven away by the *Bembix*. The latter often spend considerable time away from their burrows during the day, and *fraternus* takes advantage of this and apparently often completes its nesting without disturbance. The *Bembix* nest is not harmed in any way by the activities of *fraternus*.

The practice of starting a nest from the side of a depression of some sort is common in the subgenus *Pompilinus*, to which *fraternus* belongs. The members of this subgenus have a poorly developed tarsal comb and are not efficient diggers. In this instance there was a relatively hard crust on the mud, and apparently the wasps sought

places where entry could be easily made into the softer soil below.

Nesting activities. These activities could be observed only in the two nests previously mentioned which were started close to the surface of the soil. One of these (KVK, no. 32554F) began her nest at the lower edge of a heel print in soft mud at 1502 on March 25, 1954. Her paralyzed spider, an immature *Lycosa watsoni* Gertsch, was lying on its side on the mud about 40 cm. from the burrow en-



Profiles of nests of *Anoplius* (*Pompilinus*) *fraternus* (Banks). Fig. 1—Nest located on the side of a vertical crab hole. Figs. 2 & 3—Nests built from the sides of burrows of *Bembix cinerea* Handlirsch; in each case the lower cell is that of the *Bembix*.

trance. The burrow had a diameter of about 6 mm., and entered the earth at a 45° angle in a southerly direction. The soft mud was pushed out of the burrow into a circular pile about 4 cm. in diameter north of the burrow; small pellets were pushed out of the bur-

row with the posterior legs at intervals of ½ to 1 minute. At 1527 the wasp came out head first, took about a minute to find her spider, then grasped it in the usual manner and walked backward toward the burow. She deposited it half-way, then took it up again and carried it to the entrance, where it was again deposited. She went in head first, turned around inside the burrow, came to the surface, grasped the spider by the spinnerets and pulled it into the nest abdomen-first at 1529. At 1532 she had not reappeared and the nest was excavated; however there was no egg on the spider. The total length of the burrow and cell was 7.5 cm.

Another wasp (CMY, no. 660) located a favorable place to dig at the bottom of a crack in the mud, about 5 cm. deep, at 1345 on March 24, 1954. About 10 minutes were spent digging the nest, during which time the paralyzed spider was lying on the surface of the mud a short distance away. The wasp made extensive use of the mandibles in digging. She carried the spider in the usual manner into the crack at 1359 and left it beside the entrance while she re-entered the nest for further digging. After about a minute she reappeared, grasped the spider by the spinnerets, and pulled it into the hole. After two minutes, at 1402, she came to the entrance, and used her mandibles to loosen the earth from the walls of the burrow. When she had nearly completed filling the burrow it was noted that she was packing the earth in the burrow with the tip of the abdomen, by moving it up and down slowly while describing more or less of a circle. The wasp completed filling in the nest at 1423, when she was captured and the burrow excavated. The total length of the burrow and cell was only about 4 cm., of which only the outer part of the burrow, about 1.5 cm. long, was filled with a plug of closely packed soil. Since the crack itself was 5 cm. deep, the cell was actually 9 cm. below the surface of the ground. The cell was higher than wide, and the spider was placed in it in a vertical position with the abdomen down. The egg of the wasp was laid diagonally latero-ventrally near the base of the abdomen.

In the case of those nests constructed well down in crab-holes or *Bembix* holes, the details of digging and filling could not be observed. In at least one instance (CMY, no. 400) the wasp carried the spider into a crab-hole backward by the base of the hind legs and presumably deposited it within the hole while the actual nest was dug from the side. This wasp entered the crab-hole at 1231 on March 31, 1953. When the nest was dug out at 1330, the wasp was just finishing the closing of her burrow. The crab-hole had a diameter of about 2 cm. and was a somewhat crooked burrow terminating about 35 cm. down in mud which was saturated with water. The

nest of the wasp was about 10 cm. down the side of this hole. It was about 4 cm. long, with the cell separated from the crab-hole by an earthen plug about 2 cm. long. The cell was longer than high, and the spider lay on its side, with its abdomen away from the earthen plug. The egg of the wasp was laid vertically latero-ventrally about halfway back on the abdomen. The profile of this nest is shown in figure 1.

The two nests prepared off the sides of active burrows of *Bembix cinerea* were of particular interest. One of these wasps (CMY, no. 668) carried her spider directly into a *Bembix* nest at 1050 on March 27, 1954, and was not seen again until 1150, when she appeared to be closing the entrance to the *Bembix* nest. Eventually she was driven off by the returning *Bembix*. When this nest was dug out, the *Bembix* burrow was found to be 16 cm. long, oblique, with the cell 8 cm. beneath the surface. The *fraternus* nest was 12.5 cm. down, off the side of the burrow; there was a plug of earth about 1.5 cm. long separating the more or less spherical cell from the *Bembix* burrow (fig. 2). In the other example (CMY, no. 803), again, about one hour elapsed from the time the *Anoplius* entered the *Bembix* burrow until she emerged. In this instance the *Anoplius* nest was 9 cm. down the burrow and the cell about 9 cm. from the surface ventrally; its construction was about the same as the preceding (fig. 3).

In the six nests of *Anoplius* which were dug out, the depth of the cell varied from 7.5 to 10 cm., a rather narrow range. Since the amount of moisture in the soil increased markedly with increased depth, the position of the cell was probably determined by the amount of soil moisture present. The shape of the cell seemed to vary somewhat, and the spider lay either vertically or horizontally in it, but in every case the abdomen was innermost. The egg was always laid latero-ventrally on the abdomen of the spider, either perpendicular or diagonal to the long axis of the spider. The cell was closed in each case by a closely packed plug of earth 1.5–2 cm. long.

Development. In each case where the paralyzed spider was kept alive, it recovered within a few hours and ran about freely. Probably in nature the spider recovers but is unable to escape from the cell. In three cases larvae were reared to maturity in salve tins. Hatching of the egg occurred in about 2 days; the larval stage required either 4 or 5 days. Two of the larvae were preserved as they began to spin; a third one (CMY, no. 660) was allowed to pupate on March 31, and an adult male emerged from this pupa on May 1. The species is undoubtedly multivoltine.

Summary. In most details of behavior *Anoplius* (*Pompilinus*) *fraternus* closely resembles other species of its subgenus. It is relatively unselective as to prey, taking whatever errant spiders are most prevalent in its habitat. In this case 16 of 24 spiders were immature *Lycosa watsoni*, and the other 8 spiders belonged to 3 other species of Lycosidae and 2 species of Salticidae. The wasp carries the spider over the ground, walking backward, employing the grasp common to most *Anoplius* and many other Pompilidae. The wasp starts her nest from some pre-existing break in the surface of the ground, as do most other *Pompilinus*, and the burrow is rather short, the depth of the cell beneath the surface varying from 7.5 to 10 cm. The spider recovers from paralysis within a few hours. The egg stage lasts about 2 days, the larval stage about 5, and about a month is spent in the cocoon.

Like a few other species of *Anoplius*, e. g., *A.* (*A.*) *ithaca* (Banks) and *A.* (*Arachnophroctonus*) *apiculatus* (Smith), *fraternus* is not known to visit flowers for nectar. Most of the other unusual features of its biology are related to the habitat which the species occupies. It tolerates a high degree of salinity in the soil, and nests in what is best described as "mud" rather than sand. In the area studied, crab-holes, cracks in the mud, and burrows of *Bembix cinerea* were preferred places to nest. The abundance of *cinerea* and the fact that it does not close its burrow during the daylight hours make its burrows particularly suitable for *fraternus*, which apparently is often able to complete its nesting in the *Bembix* burrows without being disturbed by the rightful owners.

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Vol. L OCTOBER, 1955 No. 4

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BULLETIN

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BROOKLYN ENTOMOLOGICAL SOCIETY

VOL. L OCTOBER, 1955 No. 4

ANOPLURA FROM SOME KOREAN SMALL MAMMAL HOSTS.

By JOHN E. SCANLON[1]

In an earlier paper the writer (1954) discussed records of sucking lice from a large number of small mammals collected in the four main islands of Japan. The present work deals with the sucking lice of the small mammals of central Korea.

The hosts included in this report consist of rodents and insectivores collected during 1952 and 1953 by members of the Field Unit of the Commission on Epidemic Hemorrhagic Fever, United States Army. Anoplura from these hosts were furnished to the writer through the cooperation of Lt. Col. Robert Traub, Army Medical Graduate School, Washington D. C. The specimens are now in the collection of that institution unless otherwise indicated.

The hosts were identified by Mr. William Lawrence, now at the University of Michigan at Ann Harbor. Table I lists the species of hosts and their lice. Locality records have been omitted primarily because of the relatively small geographic area under consideration; generally just north of the 38th parallel, some 40 miles north-east of Seoul, and in the Korean National Forest near that city. Futhermore, locality records of Anoplura tend chiefly to reflect the distribution and ecology of their hosts, a subject which has been prepared by Lawrence for presentation eleswhere.

In addition to those persons mentioned elsewhere in this report the writer wishes to express his appreciation to Miss Tomako Shimada for the excellent quality of the slides prepared by her incident to this study.

[1] First Lieutenant, Medical Service Corps, United States Army. Department of Entomology, Cornell University, Ithaca, New York.

Enderleinellus tamiasis Fahrenholz

Enderleinellus tamiasis Fahrenholz, 1916, Archiv für Naturgeschichte, Abteilung A, 81: 11: 27, text figure 22.

Type Host: *Tamias striatus*, Berlin Zoological Garden.

Comments and Records: The history of this species is an excellent illustration of the danger inherent in describing species of ectoparasites based upon specimens taken from captive animals or

Table I

Host Parasite List

Host	Number represented	Anoplura
Insectivora		
Crocidura lasiura) *Crocidura suaveolens* (	54	*Polyplax reclinata*
Rodentia		
Apodemus agrarius	1117[1]	*Hoplopleura affinis* *Polyplax serrata*
Apodemus sylvaticus	6	*Polyplax serrata*
Clethrionomys rufocanus	20	*Hoplopleura acanthopus* *Polyplax alaskensis*
Cricetulus triton	11	*Hoplopleura cricetuli*
Micromys minutus	15	*Hoplopleura longula* *Polyplax gracilis*
Microtus fortis	27	*Hoplopleura acanthopus*
Mus musculus	16	*Polyplax serrata*
Rattus norvegicus	1	*Hoplopleura acanthopus* *Polyplax spinulosa*
Tamias sibiricus	6	*Enderleinellus tamiasis*

[1] The immense preponderance of this species reflects both its unusual abundance in the area surveyed and a heavy bias toward collection of this species because of its presumed importance as a disease reservior and its relative ease of capture.

museum skins, where the danger of contamination or straggling is so great. The type host designated by Fahrenholz is a chipmunk native to eastern North America, quite common through most of its range. Many specimens of the host have been taken in the years since Fahrenholz's description of *E. tamiasis* but no member of the genus *Enderleinellus* has ever been found on them. Ferris

(1932 and 1951) and Hopkins (1948) expressed doubt that *Tamias striatus* was the true host. This suspicion is confirmed here, for male and female specimens of *E. tamiasis* were taken from six specimens of *Tamias sibiricus* captured in the Central National Forest of Korea in 1952. It is therefore held that *Tamias sibiricus* is the true host of *E. tamiasis*, and that the specimens examined by Fahrenholz were stragglers, or, more unlikely, that the host animal was misidentified by the curators of the Berlin Zoological Garden.

The writer since examining the Korean specimens has had an opportunity to study a number of *Tamias striatus*, both freshly caught and museum skins. The only lice recovered were *Hoplopleura erratica* (Osborn); strengthening the conclusion stated above.

The Korean specimens agree very well with a male and female from the type lot of *E. tamiasis* which were loaned to the writer through the courtesy of the authorities of the Berlin Museum. These appear to have been the same two specimens examined by Ferris (1932) and upon which his illustrations were based. Because of the poor quality of the slide preparation Ferris was unable to prepare drawings of the male genitalia, or to describe these structures in detail. Inasmuch as these structures are of considerable importance in the taxonomy of the genus an illustration has been prepared based on the Korean specimens (figure 1).

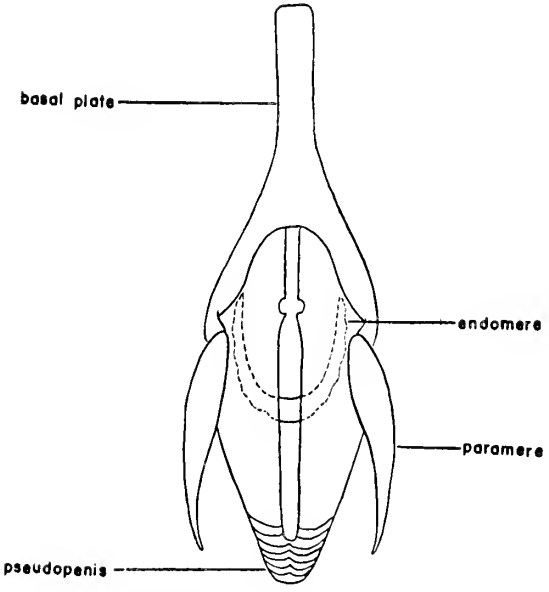

Fig. 1. Male genitalia of *E. tamiasis*.

The species is readily identified by the very long dorsal seta on the paratergite of abdominal segment four as noted by Professor Ferris in his key (1951), in other respects it resembles *E. malaysianus* Ferris.

Hoplopleura acanthopus (Burmeister)

Pediculus acanthopus Burmeister, 1839, Genera Insectorum, Rhynchota, Number 5, Plate 1, figure 2.
Type Host: *Microtus arvalis*, Europe.
Comments and Records: Previously reported from rodents of the genera *Microtus, Mus* and *Clethrionomys* in Europe, Asia and North America, this species is very widely distributed. In the present collection it was very common on *Microtus fortis* and *Clethrionomys rufocanus* and taken once from *Rattus norvegicus* together with *Polyplax spinulosa*. This latter host record is unusual but not unprecedented inasmuch as *H. acanthopus* has also been reported from the Norway rat in the southern United States (Littig, 1953). Lice from the three Korean hosts listed above and additional specimens from Japan and North America were compared during this study, but no significant differences were found.

Hoplopleura affinis (Burmeister)

Pediculus affinis Burmeister, 1839, Genera Insectorum, Rhynchota, Number 10.
Type Host: *Apodemus agrarius* and *A. sylvaticus*, Europe.
Comments and Records: In addition to records from the type hosts in Europe and Asia this species has been reported from *A. speciosus* (Scanlon, 1954) and from a number of species of South American rodents (Hopkins, 1951). In the present collection it was found in large numbers on *A. agrarius*, being second only to *Polyplax serata* in abundance. The two species occurred in multiple infestations of a single host in several cases.

Hoplopleura cricetuli Ferris

Hoplopleura cricetuli Ferris, 1951, The Sucking Lice, Memoirs of the Pacific Coast Entomological Society, Volume 1: 134.
Type Host: *Cricetulus incanus*.
Comments and Records: The type specimens of *H. cricetuli* were taken from a skin in the U. S. National Museum and were long misidentified as *H. affinis*. These two species are very close and Professor Ferris has recently (1953) published figures giving the characteristics of *H. cricetuli* and listing an additional record of specimens collected at Wei-hsien, China from *Cricetulus trition*. Profes-

sor Ferris was good enough to compare specimens from the present collection with the type of the species and confirmed the indentification. The host in Korea is *Cricetulus triton*. *C. incanus* is a synonym of this species.

Hoplopleura longula (Neumann)

Haematopinus (*Polyplax*) *longula* Neumann, 1909, Archives de Parasitologie, 13: 514, figures 15 and 17.
Type Host: *Micromys minutus*, Colchester, Essex, England.
Comments and Records: Previous records of this louse are from the type host in Europe and Japan. The Korean specimens, also from *Micromys minutus*, and those from Japan have two very minute setae on the paratergites of abdominal segments four through six. In this respect they do not agree with the characters given by Ferris in his key (1951). These setae are, however, noted in the original description and shown in the accompanying figure of the abdomen.

Polyplax alaskensis Ewing

Polyplax alaskensis Ewing, 1927, Proceedings of the Entomological Society of Washington, 29: 118.
Type Host: *Microtus* sp., Alaska.
Comments and Records: From records now available it appears that this species is uncommon but widely distributed on microtine rodents in northern latitudes. The type host was collected in Alaska and Ferris has recorded the species as *P. borealis* from *Clethrionomys rufocanus* collected at Finmark, Norway. The Korean specimens were also found on *Clethrionomys rufocanus*. Korean specimens were compared with Ewing's types by Mr. C. F. W. Muesebeck.

Polyplax gracilis Fahrenholz

Polyplax gracilis Fahrenholz, 1910, Zoologischer Anzeiger, 35 (23): 715.
Type Host: *Micromys minutus*, Europe.
Comments and Records: Fahrenholz in his original description and subsequent references to this species gave no details concerning its collection other than the type host; and it may safely be assumed that this specimen was collected in Europe. Fahrenholz's record was repeated several times by other workers but apparently no further collections were made until that reported by the writer for Japan (1954) from the type host. In Korea the species was again found on *M. minutus*; twice in multiple infestations, together with *Hoplopleura longula*.

Fahrenholz (1912) and Jancke (1932) have described and figured the species at some length. It is not included in Ferris's key (1953) and specimens of *P. gracilis* will run to the species grouping *serrata, alaskensis, spinulosa* and *abscisa* when using this key. It may be distinguished from *P. serrata* by its lack of the long seta on the paratergite of abdominal segment four, so characteristic of that species. It differs from *P. spinulosa* in lacking lateral extensions on the pseudopenis in the male and from *P. alaskensis* and *P. abscisa* by the shape of the hind-head and sternal shield, as figured by Fahrenholz (1912). The most obvious gross difference from all of these species is the elongated appearance of *P. gracilis* from which it takes its name. Fahrenholz characterizes the species as "Eine art von sehr schlanken Form."

Polyplax reclinata (Nitzsch)

Pediculus reclinatus Nitzsch, 1864, Zeitschrift für den gesamten Naturwisenschaften, 25: 23.
Type Host: *Sorex araneus*, Europe.
Comments and Records: The entire question of the lice of Asiatic insectivores was recently reviewed by Ferris (1951), who concluded that further study, particularly examination of specimens from the type host of *P. reclinata*, will be necessary before the status of lice from the various species of shrews can be settled. The writer has examined a long series of lice from various species of shrews from Japan, Korea, Okinawa, Asam and Formosa and believes that for the present all of these lice should be placed in *Polyplax reclinata*. The Korean specimens are from *Crocidura lasiura* and *C. suaveolens*.

Polyplax serrata (Burmeister)

Pediculus serratus Burmeister, 1839, Genera Insectroum, Rhynchota, Number 6.
Type Host: *Mus musculus*, Europe.
Comments and Records: This species has been reported frequently from the type host and from members of the genus *Apodemus* in Europe, Asia and North America. The Korean specimens were from *Apodemus agrarius, A. sylvaticus* and *Mus musculus*. The specimens from the various hosts showed no difference sufficient for separation into sub-specific categories and all agreed well with lice of the same species from *Apodemus* sp. collected in Japan and Germany.

Polyplax spinulosa (Burmeister)

Pediculus spinulosus Burmeister, 1839, Genera Insectorum,

Rhynchota, Number 8.
Type Host: *Rattus norvegicus*, Europe.
Comments and Records: The collection of this species from the type host in Korea indicates once again that *P. spinulosa* will almost surely be found wherever domestic rats are examined. It is a common species wherever *R. norvegicus* is found.

Summary

Records of lice from a series of Korean rodents and insectivores are discussed. *Enderleinellus tamiasis* Fahrenholz 1916 and *Polyplax gracilis* Fahrenholz 1910, were collected for the first time since their original descriptions, and the male genitalia of *E. tamiasis* are illustrated. With the exception of the later species all of the lice were members of the genera *Hoplopleura* and *Polyplax*.

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FLIGHT RECORDS OF SOME HYMENOPTEROUS PARASITES ACROSS DELAWARE BAY[1].

By Donald MacCreary and L. A. Stearns[2], Newark, Delaware

Only on rare occassions is opportunity presented to acquire information on continuous over-water flight of insects. In 1936, a study of mosquito migration across Delaware Bay was made by means of New Jersey-type mosquito traps installed on four of the five lighthouses that mark the ship channel in the approximate center line of the Bay. This was reported upon by MacCreary and Stearns (1937)[3]; and, subsequently, data on leafhopper migration incident to this study were published by Stearns and MacCreary (1938)[4].

The present paper is concerned with hymenopterous parasites collected by the trap on Ship John Shoal lighthouse, which is almost midway between the Delaware and New Jersey shores, the distances being 3.2 and 3.3 miles, respectively. Most of our knowledge on the movement of these parasites is based on distances traveled in fields or orchards and not on sustained flights, such as are necessary over bodies of water. While the data on flight range included herein are not of recent origin, they are fully as valuable now as when obtained and it seems desirable, therefore, to make this information available.

The Ship John Shoal lighthouse has an open deck, and the trap was placed thereon and secured to the deck plates by means of weights. It was approximately 20 feet above mean low water.

The light was visible for a distance of nearly 15 miles at a point 15 feet above sea level. The white sector, rated at 20,000 candle power, was beamed toward Delaware; and the red sector, at 6,000

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[1] Published as Miscellaneous Paper No. 221 with the approval of the Director of the Delaware Agricultural Experiment Station. Publication 269 and Scientific Article 188 of the Department of Entomology, February 22, 1955.

[2] Research Professor and Professor and Head of Department, Entomology, respectively.

[3] MacCreary, Donald and L. A. Stearns. Mosquito Migration Across Delaware Bay. Proc. 24th Ann. Mtg. N. J. Mosquito Extermination Assoc., March, 1937, 188–197.

[4] Stearns, L. A. and Donald MacCreary. Leafhopper Migration Across Delaware Bay. Jour. Econ. Ent. Vol. 31, No. 2, April, 1938, 226–229.

candle power, toward New Jersey. The light was set for a cycle of four seconds on and two seconds off.

It had been planned to operate the trap each night from dusk to dawn during the months, May to September, inclusive. However, a severe northeast storm in mid-September swept the trap overboard; consequently, it operated only 134 of the intended 153 nights. Wind direction records, both evening and morning, made by lighthouse personnel indicated that on a majority of nights the wind was from the Delaware side of the Bay. These are in agreement with those of the Weather Bureau for 1936, which show that, as usual, the prevailing wind for this area is from the southwest during the period mentioned above.

The 16 parasites collected, with the dates and numbers in each

Table 1. Hymenopterous parasites collected at Ship John Shoal Lighthouse by New Jersey-type mosquito trap, May–September, 1936.

Species[5]	Date and Number Collected
Meteorus vulgaris (Cresson)	July 11, (2) and August 24, (2)
Macrocentrus crambi (Ashmead)	May 8, (2)
Macrocentrus delicatus Cresson	July 29, (2) and August 24, (2)
Apanteles carpatus (Say)	August 14, (2)
Rogas aciculatus (Cresson)	May 24, (2)
Rogas terminalis (Cresson)	May 8, (6); July 17, (2); and July 21, (2)
Rogas n. sp.	May 12, (1)
Netelia sayi (Cushman)	May 8, (2)
Gelis sp.	May 15, (1)
Melanichneumon soror (Cresson)	May 8, (1)
Diradops bethunei (Cresson)	August 23, (2)
Lathrolestes sp.	May 8, (3)
Cremastus epagoges Cushman	May 8, (2)
Cremastus sp.	July 30, (1)
Xyalaspis sp.	August 20, (1)
Pseudisobrachium sp.	August 22, (2)

[5] Determined by specialists at the U. S. National Museum, Washington, D. C.

case, are summarized in table 1. While six can be listed by genera only, nevertheless it seems advisable to include them.

Several species are important parasites of crop, household, and woodland pests in the Delaware-New Jersey area. For example[6], *Meteorus vulgaris* has been recorded from the fall armyworm, alfalfa caterpillar, cabbage webworm and the clover, dingy and variegated cutworms. *Macrocentrus delicatus* is active in controlling the codling moth, European corn borer, and oriental fruit moth. *Apanteles carpatus* attacks the casemaking and the webbing clothes moths. *Rogas terminalis* is one of the natural enemies of both the armyworm and the fall armyworm; *Netelia sayi*, of the corn earworm or tomato fruitworm; *Melanichneumon soror*, of the yellow woollybear and fall webworm; and *Diradops bethunei*, of the variable oak leaf caterpillar. *Cremastus epagoges* is a common form, recovered frequently from such locally destructive insects as the codling moth, oriental fruit moth, and Nantucket pine moth.

It will be observed that the genus *Apanteles*, a large group, is represented by but a single species, while *Rogas*, a relatively small one, contributed three. No conclusions are warranted from the data presented herein. They are being published simply to record the fact that the species listed are able to make over-water flights exceeding three miles. Futhermore, it must be emphasized that these parasites were attracted by a strong light and that the trap, which captured them, operated only from dusk to dawn.

[6] Reference—Muesebeck, C. F. W., *et al.* Hymenoptera of America North of Mexico, Synoptic Catalog. U. S. D. A. Agri. Monograph No. 2, April, 1951, 1–1420.

NEW AND LITTLE KNOWN POLYCENTROPUS (TRICHOPTERA).

By R. L. Blickle and W. J. Morse,[1] Durham, New Hampshire.

The following is a redescription and figuring of *Polycentropus clinei* (Milne), a description of a new species of *Polycentropus*, and locality records for *P. picicornis* Stephens, a species previously known to occur only in the Palearctic region.

Polycentropus clinei (Milne) 1936

Adult male: length from front of head to tip of wings 8.5–9.0 mm. Ninth sternite produced apically into a long blunt process; apex of process covered with a fringe of broad hairs. Genitalia, Fig. 1. In Fig. 1A; cerci short, ovate; the dorsal angles produced into long sclerotized structures which are divided apically into a long pointed process and inner rounded process; the ventro-mesal angles are extended into sclerotized, crescent-shaped parts which project below the aedeagus; the caudal margin of the ventro-mesal projections are covered with denticles. Claspers short, narrow at base, expanded and emarginate at apex; a small projection on the inner, apico-dorsal margin. Tenth tergite membranous, apex rounded. Fig. 1B; claspers with two apical projections, inner larger than outer; apex of main portion of claspers rounded. Fig. 1C; tenth tergite with apical part cleft for about one third its length, apices rounded; outer dorsal arms of cerci pointed, long, curved towards meson; inner arms short, rounded directed towards meson. Aedeagus with a tubular base, the large membranous apex directed ventrad; several pairs of curved, pointed sclerotized rods present in the apical part of the aedeagus; baso-lateral rods pointed and curving ventrad, apical pair curved dorsad. Locality records: Lee, N. H., July 14, 1948; July 8, 1951; July 24, 1953. Jaffrey, N. H., July 24, 1954.

Dr. C. Betten of Asheville, N. C. and Dr. H. H. Ross of the Illinois Natural History Survey kindly furnished determined specimens of this species.

Polycentropus weedi n. sp.

Adult male: length from front of head to tip of wings 6.5–8.0 mm. Ninth sternite with a short apical process; apex of process covered with broad hairs. Genitalia as in Fig. 2. In Fig. 2A; cerci

[1] Scientific Contribution #178, New Hampshire Agricultural Experiment Station.

short, ovate; the dorsal angles produced into long sclerotized structures, which are divided into an outer pointed process and an inner rounded process; ventro-mesal angles of cerci are sclerotized and crescent shaped, posterior margins of these angles covered with denticles. Spines may or may not occur on the dorso-mesal angle of the cerci; these spines vary in length and shape, Fig. 2S. Claspers short, ovate; apex expanded and emarginate; a small projection on the inner, apico-dorsal margin. Apex of tenth tergite membranous and pointed. Fig. 2B; claspers broad at base, tapering to an acute apex. Fig. 2C; tenth tergite cleft at apex, the divided parts pointed; outer dorsal arms of cerci long, pointed; inner arms short, rounded and directed mesad. Aedeagus with large mebranous apex which is directed ventrad; base tubular; no visible sclerotized rods present.

P. weedi is closely related to *P. clinei* (Milne). It differs by having a short process on the ninth sternite; there being no visible sclerotized rods in the apical part of the aedeagus; the tenth tergite appearing more pointed in lateral view; and by the claspers appearing pointed in ventral view. Most specimens of *P. weedi,* at hand, have spines at the dorso-mesal angle of the cerci, these were not present in the specimens of *P. clinei.* The average length of *P. weedi* is 7.0 mm., that of *P. clinei* is nearly 9.0 mm.

Holotype male: Lee, N. H. July 12, 1948, light trap.

Paratypes: Lee, N. H. July 12, 1938 (5 males); July 12, 1951 (2 males); July 20, 1952 (1 male); June 15, 1953 (1 male); July 6, 1954 (1 male). Bow, N. H. Aug. 5, 1951 (1 male).

The holotype will be placed in the Illinois Natural History Survey Museum. Paratypes will be placed in the above museum and in the Collection of the University of New Hampshire.

Polycentropus picicornis Stephens 1836.

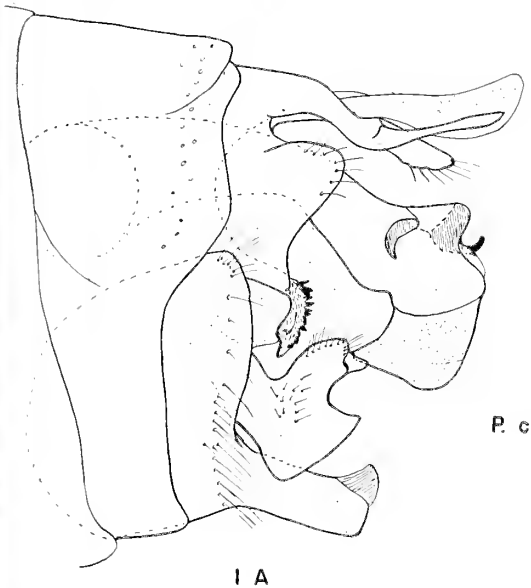
Various locality records have been established in the Nearctic region for this Palearctic species. Records other than those from New Hampshire were furnished by Dr. H. H. Ross, Illinois Natural History Survey.

Locality records: Lee, N. H. June 22, 1948; June 25, 1952; June 15, 1953; July 6, 1954. Plymouth, N. H., June 24, 1948; June 18

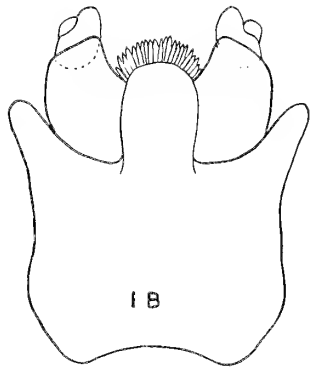
Explanation of Plate II

Polycentropus, male genitalia. A, lateral view. B, ventral view. C, dorsal view. S, spines on cercus.

BULL. B. E. S. VOL. L PLATE II



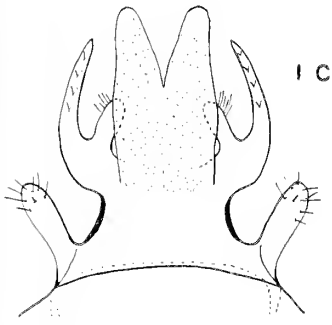
1 A



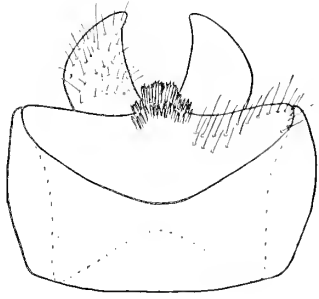
1 B

P. clinei

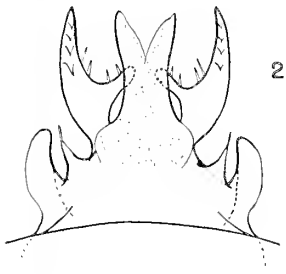
2 S



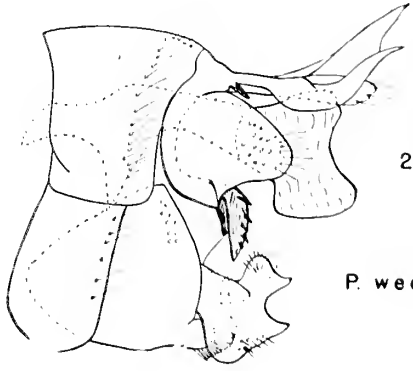
1 C



2 B



2 C



2A

P. weedi

and 23, 1953. Jaffrey, N. H. July 24, 1954. Red Deer Lake, Manitoba, July 26, 1945 (W. M. Sproules) 1 male. Indian Head, Saskatchewan, July 12, 1947 (M. Cummings) 1 female. Great Slave Lake (Gros Cap), N.W.T., July 26–August 4, 1947 (Rawson) 1 female.

REMARKS CONCERNING THE TYPES OF FIVE SPECIES OF ANTS DESCRIBED BY ROGER OR FOREL (HYMENOPTERA, FORMICIDAE).

By Marion R. Smith [1], Washington, D. C.

Recently I have had occasion to investigate the locations of the types and the identities of the following ants described by J. Roger and A. Forel, four of which were described as North American species. Types of two of the three species described by Roger are still in the Zoological Museum of the University of Berlin, where they have been examined for me by H. Bischoff. Types of the two species described by Forel should be in the Museum d'Histoire Naturelle, Geneva, Switzerland, but unfortunately that of *Acanthostichus texanus* has apparently been lost. An examination or report of the two was furnished me by Charles Ferriere.

Discothyrea testacea Roger, 1863. Berlin Ent. Ztschr. 7: 177, *worker, dealate female.* Type locality, "North America." (Genotype).

Discothyrea workers from Savannah, Georgia, collected by H. T. Vanderford, and from near Holly Springs, Wake County, North Carolina, collected by Merle W. Wing, were compared with Roger's type of *testacea* by Dr. Bischoff, and he believes they represent the same species. He further believes that the type locality of the species is probably one of the Carolinas and that the types were probably collected by Christian Zimmerman. The history, taxonomy, and biology of this species are fully dealt with in a paper to be published by Wing and me in the Journal of the New York Entomological Society.

Colobopsis impressa Roger, 1863. Berlin Ent. Ztschr. 7: 160, *worker.*

Type locality, "United States of North America."

The type of *impressa*, according to Dr. Bischoff, has apparently been lost. As the species was briefly described from a worker (not a soldier) and no specific locality was indicated, it seems wise to disregard Roger's name in future treatments of *Colobopsis*.

[1] Entomology Research Branch, Agricultural Research Service, United States Department of Agriculture.

Plagiolepis flavidula Roger, 1863. Berlin Ent. Ztschr. 7: 162, *worker*. Type locality, "Cuba."

Dr. Bischoff found Roger's type of *Plagiolepis flavidula* to be a *Brachymyrmex*, but he was not able to determine the species. This information, while new, is not very surprising as no *Plagiolepis* is known to be native to the New World, although it is of course possible that Roger might have applied a valid name to an introduced species. So far as I am aware the name *flavidula* is not a homonym; therefore it should now stand as *Brachymyrmex flavidula* (Roger), new combination. It is possible, though, that some of the species described later in *Brachymyrmex* may prove to be a synonym of *flavidula*.

Acanthostichus texanus Forel, 1904. Soc. Ent. Belg. Ann. 48: 168, *dealate female*. Type locality, "Brownsville, Texas."

Although the holotype of *texanus* has apparently been lost, the description of the species is complete enough so that W. S. Creighton, Wm. F. Buren, and I have had no difficulty in placing female individuals from several localities in Texas not too distant from the type locality. In a paper to be published in the Bulletin of the Brooklyn Entomological Society I am synonymizing *Ctenopyga townsendi* Ashmead (1906. Ent. Soc. Wash. Proc. 8: 29, *male* and *alate female*. Type locality, La Puerta (probably Chihuahua). Mexico) with *A. texanus*.

Tetramorium (*Cephalomorium*) *bahai* Forel, 1922. Rev. Suisse de Zool. 30: 91, *worker*. Type locality, "Faisons, North Carolina, United States."

North American myrmecologists have never been able to place the ant described by Forel as *Tetramorium* (*Cephalomorium*) *bahai* from Faisons, North Carolina. As no *Tetramorium* is known to be native to North America, it is assumed that either Forel was incorrect in his generic placement of the ant or he had described an introduced *Tetramorium*, or else his locality labels were incorrect. When Santschi (1925. Soc. Ent. Belg. Bul. et Ann. 65: 228) stated that he had examined Forel's type and found the ant to be a *Pheidole* (*Hendecapheidole*), it was only natural to assume that Santschi was correct in his generic and subgeneric placement. I was therefore greatly surprised when Charles Ferriere examined the type and found that, although it was a *Pheidole*, it could not possibly be a *Hendecapheidole* since it had 12 instead of 11 antennal segments. As Dr. Ferriere could not send me the holotype for examination and he did not have the time to determine it specifically, we do not yet know what the species is. Perhaps this can be settled at a future date when some North American myrmecologist is visiting the museum in Geneva.

STUDIES IN PANAMA CULICOIDES (DIPTERA, HELEIDAE) IV. DESCRIPTION OF THREE NEW SPECIES

By Willis W. Wirth[1] and Franklin S. Blanton,[2]
Washington, D. C.

This paper is based on material collected by the junior author in Panama by means of light traps. The methods and terminology are explained briefly in Part I of this series (1953, Jour. Wash. Acad. Sci. 43: 69–77). The types of the three new species here described and most of the other material studied, are deposited in the U. S. National Museum, Washington, D. C.

Culicoides carsiomelas n. sp.

(Figure 1)

Female. Length about 0.9 mm., wing 0.95 by 0.44 mm.

Head, including antennae and palpi, dark brown; eyes narrowly separated, bare. Antenna with flagellar segments in proportion of 18: 16: 16: 16: 16: 16: 16: 16: 22: 22: 26: 24: 35, antennal ratio thus 1.0; distal sensory tufts on segments III, VII-X. Palpal segments in proportion of 5: 15: 25: 8: 8, third segment (fig. 1b) broadly swollen with very deep, large sensory pit.

Mesonotum without prominent pattern, the sides and entire anterior margin back to sensory pits dark brown; median area from sensory pits to prescutellar depression and wing bases brownish yellow. Scutellum yellowish, brown in middle on anterior margin. Postscutellum and pleuron brownish black. Legs brown, fore- and mid femora with subapical, all tibiae with sub-basal and hind tibia with apical, narrow pale rings; apical comb of hind tibia with four spines, the ventral one longest.

Wing (fig. 1a) with first radial cell slitlike, second radial cell complete, twice as long as broad; costa extending to 0.65 of wing length; macrotrichia sparse but covering distal half of wing and anal cell to near its base. Wing appearing mostly pale with limited dark areas; anterior wing margin with two broad yellow areas, the first at wing base extending entirely across anal cell, the second centered on r-m crossvein, which however, is itself entirely black-

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[2] Lieutenant Colonel, MSC, Department of Entomology, Army Medical Service Graduate School, Washington, D. C.

ened; two other very dark broad anterior spots, the first midway between crossvein and wing base, the second extending over second radial cell and distal half of first; cell R_5 with a small, round, pale spot on anterior margin just past end of costa, a separate, U-shaped, pale spot lying behind this spot and enclosing within its arms a small black spot behind end of second radial cell; apex of cell R_5 with a large, distally notched, round pale spot nearly filling cell, but more or less broadly attaining anterior wing margin and broadly separated from distal wing margin; cell M_1 with two elongate narrow pale spots nearly filling cell but the second broadly separated from wing margin; cell M_2 with pale streak extending from wing base to level of mediocubital fork, an oval pale spot lying close to vein M_2 behind the basal pale spot in cell M_1 and a round pale spot near apex of cell but broadly separated from wing margin; cell M_4 with a large round pale spot slightly anterior to middle of cell; a single large pale spot in apex of anal cell; apices of veins M_1, M_2, M_{3+4} and Cu_1 with small pale spots at wing margin. Halter knob infuscated, stem pale yellowish.

Abdomen dull blackish, cerci yellow. Spermathecae (fig. 1c) two, large, slightly unequal, one subspherical, the other pyriform with base of duct sclerotized a short distance.

Male genitalia (fig. 1d, e). Ninth sternum narrow, the ventral membrane bare; ninth tergum broad and not markedly tapering distally, the apicolateral processes short and narrowly pointed. Basistyle simple, ventral root foot-shaped, dorsal root long and slender; dististyle slender with narrow, curved apex. Aedeagus with basal arch reaching to three-fourths of total length, the basal arms rather stout, the distal apex truncated. Parameres each with base and stem curved, arcuate; apex of stem portion with a well-developed pouch, apical portion abruptly bent laterad, ventrad, and then mesad, bearing about four fine lateral barbs on the slender, pointed distal portion.

Holotype female, Mojinga Swamp, Canal Zone, 17 December 1951, F. S. Blanton, in light trap (Type No. 62806, U.S.N.M.). Allotype, same data except 29 October 1951; Paratypes: 6 females, same data but 28 August, 4, 14, November and 19 December 1951, July, August 1952; 1 female, San Lorenzo, Canal Zone, 15 August 1952; 2 females, El Real, Darién Prov., 8 August 1952; 8 females, Almirante, Bocas del Toro Prov., December 1952, January 1953.

C. carsiomelas is very closely related to *acotylus* Lutz, but in *acotylus* the distal pale spot in cell R_5 is well separated from the anterior wing margin, there is a separate small pale spot at the base of cell R_5 just ahead of vein M_1, the pale spot behind the base of

vein M_2 is absent, there are two distal pale spots in the anal cell, the scutellum is entirely dark brown and the sensory pit is lacking on the third palpal segment.

Culicoides fairchildi n. sp.

(Figure 2)

Female. Length about 0.85 mm., wing 0.85 by 0.38 mm.

Head dark brown; eyes narrowly separated, bare. Antenna with flagellar segments in proportion of 18: 16: 16: 16: 16: 16: 16: 16:-25: 25: 25: 25: 48, antennal ratio thus 1.1; distal sensory tufts on segments III, VII and X. Palpal segments (fig. 2b) in proportion of 10: 10: 20: 10: 10, third segment swollen, with very broad, shallow, sensory pit on distal third.

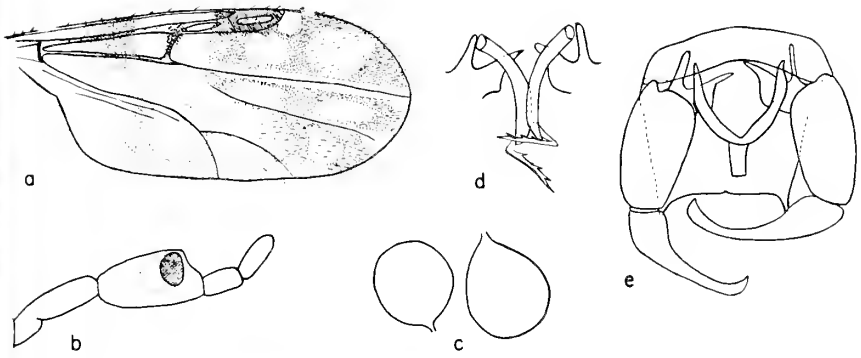
Mesonotum dark brown on anterior half with prominent pattern of yellowish patches consisting of an admedian pair of large elongate spots, just laterad of which is another pair of very small round spots; humeri, a small area around each sensory pit, and entire posterior half of mesonotum yellowish; scutellum dark brown in center and yellowish on sides; postscutellum dark brown; pleuron yellow on upper half and dark brown below. Legs dark brown; knee spots blackish; fore and mid femora yellow on distal halves, fore and mid tibiae yellow on basal halves, hind tibia with narrow basal and apical pale rings; four distal tarsal segments pale.

Wing (fig. 2a) with radial cells both complete, short; costa extending to 0.6 of wing length; macrotrichia sparse in apex of cells R_5, M_1 and M_2. Yellowish spots along anterior margin of wing at wing base and over r-m crossvein, the latter spot scarcely attaining anterior media caudad; very dark areas between these two spots and over second radial cell and most of first. Cell R_5 with an irregular pale spot just past end of costa extending basad behind vein R_{4+5}; a subapical round pale spot in middle of cell R_5; elongate pale spots, sometimes faint, straddling veins M_1 and M_2 at about their midlengths; one distal oval pale spot not reaching wing margin in cell M_1 past the spot straddling M_1; cell M_2 with a large round pale spot just anterior to the junction of mediocubital fork and a distal pale spot broadly reaching margin of wing; cell M_4 with a large distal round spot at wing margin; anal cell with two distal pale spots, entire base of cell pale. Halter pale yellow.

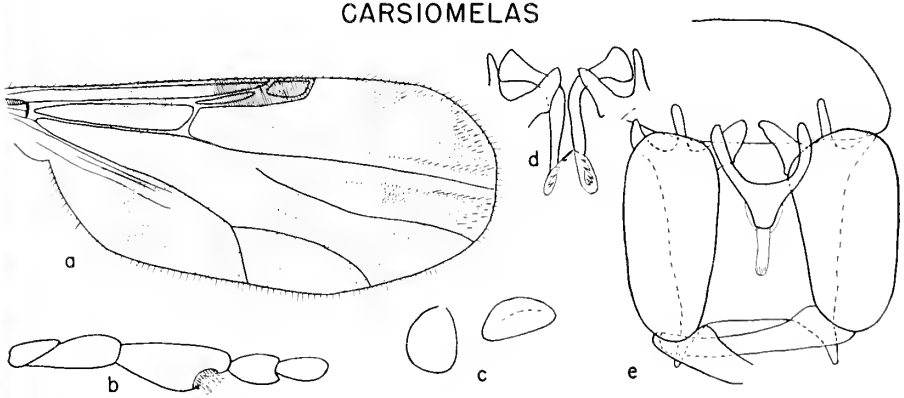
EXPLANATION OF PLATE III

Fig. 1. *Culicoides carsiomelas;* Fig. 2. *Culicoides fairchildi;* Fig. 3. *Culicoides pusilloides:* a, female wing; b, female palpus; c, spermatheca; d, male parameres; e, male genitalia, parameres omitted.

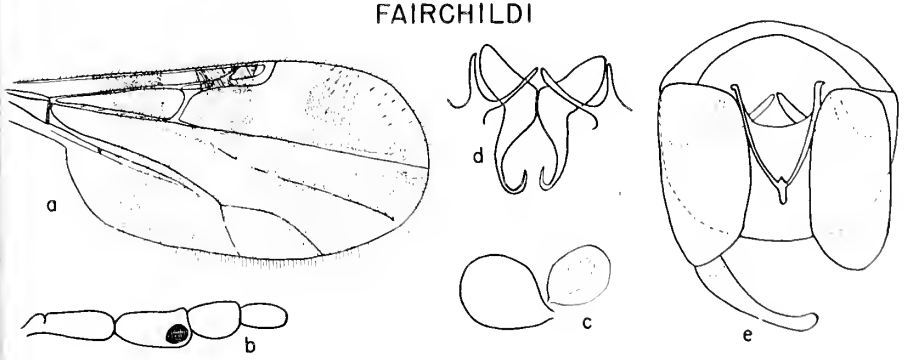
BULL. B. E. S. VOL. L PLATE III



CARSIOMELAS



FAIRCHILDI



PUSILLOIDES

Abdomen black, velvety on sides, grayish pruinose above. Spermathecae two, subequal, pyriform, without sclerotized necks.

Male genitalia (fig. 2d, e): Ninth sternum with posterior margin not excavated, the posterior membrane bare; ninth tergum slightly tapering to slender, well-developed, apicolateral processes. Basistyle with ventral root rather slender, with a small posterior spur, dorsad root slender; dististyle long and slender, slightly curved, with slender, rounded, slightly bent apex. Aedeagus with broad basal arch, arms meeting at approximately half the total length of aedeagus; distal portion slender with bluntly rounded apex. Paramere with base knobbed, stem fairly straight and tapering, apical portion abruptly bent, the base of fringe moderately expanded with approximately five basal and two apical barbs.

Holotype female, allotype, Madden Dam, Canal Zone, 28 April 1952, F. S. Blanton, in light trap (Type No. 62801, U.S.N.M.). Paratypes: Canal Zone—6 females, Madden Dam, 28 April, 21 September, 9 October, 1952; 1 male, 3 females, Mojinga Swamp, 1 November 1951, January 1953; 3 females, San Lorenzo, 15 August 1952; Darien Prov.—6 females, El Real, 19 July, 8 August 1953; 1 female. Colon Prov.—Cativa, 27 August 1952; Bocas del Toro Prov.—8 females, Almirante, October, November, December 1952.

We take great pleasure in naming this species in honor of Dr. Graham Bell Fairchild of the Gorgas Memorial Laboratory, in recognition of his extensive contributions to the knowledge of Neotropical Diptera.

C. fairchildi belongs in the *haematopotus* group of the subgenus *Oecacta* Poey. The wing markings, with pale spots straddling veins M_1 and M_2, would put this species in the *copiosus* group, but the male genitalia of the latter group are of an entirely different type. The male genitalia of *fairchildi* are very similar to those of *carpenteri* Wirth and Blanton, *galindoi* Wirth and Blanton and *pifanoi* Ortiz. In all of the latter species, however, the pale spots straddling veins M_1 and M_2 are absent or are not discrete, and the distal pale spot in cell R_5 meets the wing margin broadly.

Culicoides pusilloides n. sp.
(Figure 3)

Female. Length about 0.75 mm., wing 0.75 by 0.35 mm.

Head dark brown, antennal flagellum and palpus yellowish. Eyes broadly contiguous above, bare. Antenna with flagellar segments in proportion of 12:10:10:10:10:10:10:13:15:16:18:-18:26, antennal ratio thus 1.1; distal sensory tufts on segments

III, XII-XV. Palpal segments (fig. 3b) in proportion of 5:12:-15:8:7, third segment slightly swollen with a small, deep sensory pit.

Mesonotum blackish; anterior margin and two broad sublateral vittae extending the entire length of mesonotum, intense black; a broad median band and sides of mesonotum behind level of humeral pits densely bluish gray pruinose. Scutellum, postscutellum and pleura black. Legs brown; fore and mid femora with broad apical pale rings; fore tibia with narrow, and mid tibia with broad basal pale rings; hind tibia and most of tarsi yellowish. Hind tibia with six spines on apical comb, the ventral one much longer than the others.

Wing with costa extending 0.56 way to wing tip; radial cells complete and short; wing nearly bare, only a few macrotrichia along wing margin in cells R_5 and M_1. Wing with four incomplete transverse bands of large, diffuse pale spots as in figure 3a. Base of wing yellow, this pale area continuing as a pale streak to distal fourth of cell M_2 and including all of anal cell except one dark spot over middle of anal vein. Second pale area reaching from costal margin over r-m crossvein, extending into pale area in base of cell M_2. Third pale area including distal half of second radial cell, broadly crossing vein M_1 and continuing across cells M_1 and M_2 to wing margin in cell M_4, with a narrow extension to wing margin in cell M_1. Fourth pale area including the broad apex of cell R_5 to wing margin. Dark areas of wings thus less extensive than the pale areas, the dark band in cell R_5 less than half as broad as the pale areas on each side; vein M_1 dark-margined on distal half; vein M_2 with a strong subapical dark spot, the extreme apex pale; veins M_{3+4} and Cu_1 dark-bordered and base of cell M_4 dark. Halter pale yellowish.

Abdomen pale brown, darker toward apex. Spermathecae two, subspherical, very unequal, their diameters in the proportion of 11 to 18, the entrances to the ducts not sclerotized.

Male. Similar to the female with the usual sexual differences; abdomen pale yellowish. Genitalia (fig. 3d, e) with ninth sternum narrow, ribbonlike, the ventral membrane not spiculate; ninth tergum broader than long, slightly convex caudally, without apicolateral processes or median notch or lobes. Basistyle about twice as long as broad, not tapering, ventral root long and slender, dorsal root about half as long as ventral one, pointed; dististyle curved, the apex slightly expanded, with a distinct point on mesal apex. Aedeagus 1.4 times as long as basal breadth, with basal arch reaching about 0.4 of total length, distal apex nipplelike. Parameres with

bases very stout; stems bulbous; apices very slender and recurved, without fine hairs.

Holotype female, allotype, Almirante, Bocas del Toro Province, Panama, November 1952, F. S. Blanton, in light trap (Type No. 62808, U.S.N.M.). Paratypes: 9 males, 58 females, same data as type; 7 males, 23 females, same data except October 1952; 1 male, 8 females, January 1953; Canal Zone—1 male, 3 females, Mojinga Swamp, 24 October 1951, 7 May 1952; 1 female, Loma Boracho, 23 February 1951; 3 males, Camaron, Ft. Kobbe, 23 June 1952; 1 female, Pedregal, Panama Prov., 3 December 1952.

This species belongs to the *obsoletus* group of species, which in the Neotropical Region is also represented by *pusillus* Lutz. The latter species differs from *pusilloides* in having the second radial cell entirely dark, or the yellow area distal to it only slightly encroaching on the end of vein R_{4+5}; the wing pattern very faint and obscure; the legs entirely pale except for the dark knee spots; eyes narrowly contiguous, the antennal ratio 1.2; antenna with sensoria on segments III, XIII-XV; palpal segments not so stout, the pit on the third segment faint or absent; hind tibial comb with five spines; spermathecae oval and subequal; male genitalia with ninth tergite bilobate and mesally cleft and the parameres with slender bases. The Holarctic species *obsoletus* (Meigen) and *chiopterus* (Meigen) and the Palaearctic *scoticus* Downes and Kettle and *pseudochiopterus* Downes and Kettle all are larger species (wing 1.15–1.58 mm. long) and are easily separated from *pusillus* and *pusilloides* and from each other by characters of the male genitalia (figured by Downes and Kettle, 1952, Proc. Roy. Ent. Soc. London (B) 21: 61–78).

A NEW SPECIES OF VELOIDEA FROM VENEZUELA (HEMIPTERA: VELIIDAE).

By Carl J. Drake[1] and Janis A. Roze[2]

The present paper characterizes an undescribed species of the genus *Veloidea* Gould from Venezuela and also describes the male form of *Oiovelia cunucunumana* Drake and Capriles from Paraguay. In addition to the new species described herein, the genus *Veloidea* is represented by *V. gigantea* Gould (genotype) from Colombia and by *V. vivata* (Buchanan-White) (= *Velia vivida* Buchanan-

[1] Iowa State College, Ames, Iowa.
[2] University of Venezuela, Caracas, Venez.

White = *Rhagovelia reposita* Drake and Harris) from Guatemala and British Honduras.

Genus *Oiovelia* Drake and Capriles

Oiovelia Drake and Capriles, Great Basin Nat. 12 (1–4):51. 1952.

Generic notes: Hemelytra with four closed cells (two long basal cells extending to middle of hemelytra, and two shorter ones just beyond the middle) and a median preapical cell with distal end entirely open. Wings clear, almost as long as hemelytra. Rostrum four-jointed, the two basal joints very short, the third long. Legs moderately long, moderately stout, unarmed in both sexes (femora, tibiae, coxae and trochanters without spines, teeth or bristly long hairs); all tarsi 3-, 3-, 3-segmented; last tarsal segment in all three pairs of legs divided apically so as to form a rather wide and very deep cleft, the inner lobe of which is about half as long as outer one; claws two in number, long, sickle-like, attached at the bottom of cleft, also provided with a long modified hair attached at the bottom of cleft between the claws. An examination of a number of tarsal segments shows that the median hair between the tarsal claws is a modified hair and not a typical claw.

Oiovelia cunucunumana Drake and Capriles

Oiovelia cunucunumana Drake and Capriles, Great Basin Nat. 12 (1–4): 52–53, 1 fig. 1952.

The type series of this species consisted of three alate females, collected north of Mount Duida, Territorio Amazonas, Venez. Since then, specimens have been studied as follows:—1 specimen, taken in a small stream, near Caracas, Venez., numerous males and females, netted in the Paraguay River, southern Paraguay. Oct., 1951. The Paraguayan series of specimens include an apterous male and an apterous female. The pronotum of the female is larger, differently shaped behind, very coarsely punctate and distinctly unicarinate, whereas the pronotum of the male is more broadly rounded behind, without median carina and much more finely punctate. The legs and antennae in both sexes and the male parameres agree very closely with these structures in the macropterous form. On account of the marked pronotal differences between the sexes, it seems advisable not to describe the wingless forms until more specimens are available for study.

Macropterous male: Color and marking as described in female, some specimens in both sexes not as dark as others with paler legs.

Antennal measurements—I, 45; II, 35; III, 19, IV, 26. Anterior tibiae within slightly flattened apically, provided with an extremely long slender comb, three-fifths as long as segment, with apex of comb curving across the apex of segment; femora scarcely longer tibiae (68:66); tarsal measurements—I, 6; II, 5; III, 21. Middle legs with femora shorter than tibiae (78:86); tarsi—I, 5; II, 9; III, 28. Hind femora shorter than tibiae (96:115); tarsi—I, 8; II, 15; III, 30. Rostral measurements—I, 9; II, 9; III, 30. *Allotype* (male), Paraguay River, southern Paraguay, Oct., 1951, in Drake Collection.

Veloidea venezolana, n. sp.

Apterous form: Very large, pale stramineous, with sides of thorax and a stripe on each side of abdomen dark brown to dark fuscous; anterior part of abdomen (including pleura but not collar) grayish white; apex of head, vertex next to eyes, both sides of abdominal tergites and side of entire body more or less coated with whitish pruinose. Dorsal surface of body nude, without pubescence or hairs. Length, 7.25 mm.; width, 2.30 mm.

Head slightly convex above, finely sparsely pubescent between eyes, with distinct median longitudinal line, with vertex scarcely twice as wide as an eye, width across eyes 1.28 mm.; eyes moderately large, dark fuscous; rostrum testaceous with fourth segment blackish, reaching slightly beyond prosternum. Antennae long, slender, shortly pubescent, pale testaceous, measurements—I, 204; II, 150; III, 112; IV, 64. Pronotum strongly broadly produced posteriorly, covering most of mesonotum, slightly convex across humeral angles, slowly broadly rounded behind, extremely coarsely punctate, with median longitudinal carina more raised anteriorly and becoming obsolete behind, the median length greater than width across humeral angles (170:130); collar very narrow, testaceous, set-off by an encircling row of small pits; calli covered by frosted grayish white. Wing pads not visible. Median carina not frosted.

Abdomen with tergites slowly narrowed posteriorly, the last tergite nearly one-half longer than the preceding; connexiva suberect, with exterior margin slowly rounded, with sutures between segments (also joints of tergites) narrowly embrowned, each terminating behind in a long, slender, spine-like projection, which is not quite as long as the last tergite. Abdomen beneath sparsely pubescent, without median spine, processes or carina; last ventrite shallowly impressed behind, a little longer than preceding segment, with posterior margin broadly roundly shallowly excavated at mid-

dle. Male genital segments testaceous, clothed with pale pubescence; first genital segment above subquadrate, scarcely as long as posteriorly-directed processes of connexiva, beneath roundly produced at middle behind; parameres long, with ends reaching above genital segment, slightly sinuate, with apices a little curved posteriorly; basal suranal plate bifurcate on each side, with inner prong short and upright, the outer prong longer, curving obliquely outward-upward.

Legs long, slender (save hind femora), pubescent, without long stiff hairs or bristly spines, all tarsi 3-segmented; last tarsal segment of all three pairs of legs deeply cut-out apically on the inner side, provided with four, thin, blade-like claws attached at base of excavation. Anterior legs clothed with short pubescence; femora slender, beneath with short hairs interspersed with longer hairs, also armed on median line with a row of closely-set, slender, brown spinulae; tibiae slender, rather densely clothed with short hairs, a little flattened within apically, without armature or apical comb, shorter than femora (225:245); tarsal segments I and II very short, beadlike, III long. Middle legs very long, longest, slender, sparsely pubescent, unarmed, with femora and tibiae subequal in length (350:360); tarsal measurements—I, 10; II, 110; III, 100. Hind legs long, sparsely pubescent; trochanters beneath with numberous, very short, blunt teeth; femora enormously swollen, suddenly narrowed or constructed on apical fifth (especially beneath), about two-fifths as wide as long, with entire ventral surface armed with a large number of short, blunt, black-tipped teeth not arranged in regular rows and also with a row of six or seven much larger, black-tipped spines on median line of swollen part, shorter than tibiae (320:344); tibiae feebly bowed, armed beneath with three long rows of short, closely-set teeth, the median row with larger teeth; tarsal measurements—I, 8; II, 110; III, 100. In all measurements 80 units are equivalent to one millimeter.

Type (male), Quinagvina, Venez., Oct. 8, 1915, J. A. Roze, in Drake Collection.

Differs from *V. gigantea* Gould by its smaller size, stramineous color, antennal measurements (especially by shorter apical segment), very coarsely punctate and smooth pronotum, vestiture of legs and antennae. *V. vivata* B.-White is a much darker species with hairy legs and dorsum, and with very different male parameres.

DESMOPACHRIA PORTMANNI (CLARK) IN THE UNITED STATES (COLEOPTERA: DYTISCIDAE)[1].

By Frank N. Young, Bloomington, Indiana

Through the kindness of Hugh B. Leech of the California Academy of Sciences, I have recently been able to examine specimens of *Desmopachria portmanni* which were compared with Clark's type by J. Balfour-Browne of the British Museum. This species has apparently not been previously recorded from the United States, but specimens from Arizona and Texas have probably been masquerading in various collections as *mexicanus* Sharp. It will not fit either choice of the first couplet of my key to the U. S. and Canadian species (*Bull. Brooklyn Ent. Soc.*, 46 (4): 109–110, 1951); but can be recognized by the lack of basal plicae on the pronotum, the larger size (2.3 to 2.6 mm.), and the sutural striae which vary from well-defined to almost absent.

D. portmanni is placed in his Group II by Zimmerman (*Archiv für Naturgesch.*, Abt. A., Heft 12 (1917): 130, 1919), but the sutural stria is often very vague if not lacking. Sharp in his original description of *dispar* (*Biol. Cent. Amer., Coleoptera* I (Part 2): 17, 1882) also remarks of that species: ". . . there is an indistinct sutural impression which can scarcely be called a stria." There is, however, in *portmanni* a vaguely impressed discal series of punctures, apparently above an internal groove on each elytron, but this series is about ¼ the width of the elytron distad to the suture at its base and slants obliquely backward so that it diverges strongly to the elytral apex.

One of the interesting features of *portmanni*, and apparently of some other species of *Desmopachria*, is the occurrence of two distinct types of prosternal processes. In the males the tip of the process seems to be hollowed out so that it is bifurcate with a pit-like depression in the middle. In the females the process is more nearly normal, the tip merely being slightly depressed. Sharp (*loc. cit.*) mentions a similar condition in *D. laevis, variegata*, and *dispar*, but not in *portmanni* of which he had apparently seen only the unique type in the Fry collection (British Museum). He surmised that individuals with the furcate process were the females, but the converse is true in all specimens examined (both males and females dissected).

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[1] Contribution No. 595 from the Zoological Laboratories of Indiana University.

Brief Redescription of D. portmanni: Similar in general size and shape to *D. mexicanus* Sharp, but with sutural stria varying in development, pronotum without impressed lateral plicae, and clypeus with a distinct upturned margin which is indented at the middle. *Punctation* approximately as follows: Head finely, not densely punctate; pronotum with fairly coarse dense punctures along base and front margin but disk finely and sparsely punctate; elytra with fairly coarse, dense punctures along suture becoming finer and sparser toward the sides; coxal plates finely and sparsely punctate. *Color:* Head and pronotum usually shining reddish brown, the latter sometimes with sides yellow or yellowish brown; elytra yellow to yellowish brown with an indefinite discal infuscation and a moderately broad dark brown sutural stripe; venter dark brown to black. (One specimen seen is almost uniformly reddish brown above, but this seems to be due to poor preservation). Length variable, about 2.3 to 2.6 mm.

Specimens Examined: Arizona: Santa Rita Mts. (5 to 8000 ft.), July, F. H. Snow (2-leech Coll.); Madera Canyon, Santa Rita Mts., April 21, 1953, A. and H. Dietrich (1-Cornell Coll.); Huachuca Mts. (near Mexican border), May 7, 1953, A. and H. Dietrich (2-Cornell Coll.); Bear Canyon, Huachuca Mts., May 7–8, 1953, A. and H. Dietrich (16-Cornell Coll.); Mt. Lemmon, Bear Canyon, Huachuca Mts., April 18, 1953, A. and H. Dietrich (1-Cornell Coll.); Ft. Grant, Pinaleno Mts., July 15, 1917 (1-Cornell Coll.); Globe, Oct. 13, 1948, F. H. Parker (1-Leech Coll.) Texas: Limpia Canyon, Davis Mts. (500–5500 ft.), July 7, 1917 (1-Cornell Coll.); Cherry Canyon, Davis Mts., June 19, 29, and July 8, 1916, F. M. Gaige (9-Univ. Michigan Mus. Zool. and 1-Fall Coll. in Mus. of Comparative Zoology)[2]; Fort Davis, August 10, 1914, M. M. Sampson (1-UMMZ); Jeff Davis Co., Aug. 27, 1916 (1-Leech Coll.); "Texas," (1-Fall Coll., MCZ).[2]

[2] According to a label in his collection, H. C. Fall compared specimens with *mexicanus* in the Horn Collection and found them distinct, but he noted that they were identical with specimens labelled *mexicanus* in the U. S. National Museum.

Weda parvula (V.D.), Pentatomidae: Three specimens of this interesting and apparently rare stink bug were collected in a marshy area along Highway 40, a few miles north-east of Myton, Duchesne County, Utah on July 8, 1955. They were taken in insect-net sweepings along the side of the oiled highway, on a "bend" in the road. Sedges predominated, with some grass. I had to reach out to sweep over the boggy area. No specimens were taken in sweeps of meadowy areas nearby. John D. Lattin identified the material and called my attention to the fact that only twelve specimens of this species were available from Colorado and one from Brigham, Utah, at the time Barber and Sailer revised this section of the Pentatomidae (Graphosomatinae: Podopini) in 1953.—G. F. Knowlton, Logan, Utah.

PUBLICATIONS RECEIVED

Microbiology, An Introduction, Ernest A. Gray. 175 pp. 5 × 7 ins., cloth bound. 1955. Philosophical Library, Inc., New York, N. Y. (Price, $3.75)

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OBSERVATIONS ON THE BIONOMICS OF SOME CULICOIDES OF CHEBOYGAN COUNTY, MICHIGAN, (DIPTERA, HELEIDAE).[1]

By ROGER W. WILLIAMS,[2] New York, N. Y.[3]

Light trap, recovery cage, and biting studies were conducted on the haemotophagous fly genus *Culicoides* in the vicinity of the University of Michigan Biological Station on Douglas Lake in Cheboygan County, Michigan, between June 23 and August 11, 1954. No similar study had previously been made in the state of Michigan. Foote and Pratt (1954) indicate that three species of *Culicoides* had been reported from this state, these being *C. crepuscularis* Malloch and *C. stellifer* (Coq.) from South Haven, and *C. haematopotus* Malloch from East Lansing.

Light Trap Studies: A single New Jersey type light trap, equipped with an automatic timing device for switching it on and off, was in operation nearly every night between June 30–31 and August 10–11. The location of this trap was restricted by the location of electrical outlets and for the most part operated in a semi-wooded area approximately 18 meters west of the station boat house, 23 m. south of the lake shore and 16.8 m. north of the road, which was on a level some 6 or 7 m. above. *C. biguttatus* (Coq.),

[1] Contribution from the University of Michigan Biological Station.

[2] I wish to express my thanks to Dr. W. W. Wirth, of the U. S. National Museum, for checking by identification of those species discussed, to Dr. A. J. Sharp, Professor of Botany, Uni. of Tenn., for many of the floral identifications and to Dr. George Lauff, Dept. of Zoology, Uni. of Michigan, for the determination of the pH of the soil samples.

[3] School of Public Health and Administrative Medicine, Columbia University.

C. crepuscularis Malloch, *C. guttipennis* (Coq.), *C. obsoletus* (Meig.), *C. piliferus* Root and Hoffman, *C. stillifer* (Coq.), and *C. venustus* Hoffman were taken in this trap. Table I indicates the total number of each species collected and their distribution in time by days. From this table it can be seen that during the time of this study the peak population of *C. obsoletus* and *C. piliferus* occurred during the first half of the trapping period, through July 19–20 (the 4 nights when the trap was in operation only a portion of the time are disregarded), and *C. biguttatus* was most abundant during a 3 week period near the middle, while *C. stellifer* occurred more commonly during the later half of the study period.

Table II presents the distribution in time by hours on 7 different nights for the more abundant species. It would appear from biting studies, which are discussed later, that here, as elsewhere, the activity of *C. obsoletus* is greatest in the early evening, before it is dark enough for a light trap to attract them, and that the activity of this species is controlled to a great extent by light intensity. Hill (1947) has shown that in England *C. obsoletus* reaches the height of its activity about an hour before sunset and Williams (1951) found it active during cloudy days (10 a.m. to 4 p.m.) in wooded areas in Alaska where the light intensity approximated that of sunset, or just before. Williams (1955) showed that the greatest activity for all species collected in light traps, during August, September, and October, in Baker County, Georgia, occurred between the hours of 9 p.m. and midnight irrespective of the time of sunset. It may be worthy of note that here *C. biguttatus,* which was not taken in the Georgia study during the months mentioned, was more active after midnight than before, particularly on 3 or the 7 nights, however, it should also be noted that on these 3 nights the other species, although trapped in very small numbers, were also more numerous during the early morning hours. From Table II it can be seen that this activity is apparently not correlated with temperature. The moon was full on the night of July 15–16. In view of the fact that the preponderance of adults were captured after midnight, at least through the night of July 26–27, it would appear that probably moon light intensity did not play an important role in determining this nocturnal activity.

Recovery Cage Studies: Four cages, each two feet on a side, for recovering adults as they emerged from their breeding areas, were utilized. The construction was similar to that described by Dove, Hall and Hull (1932). Theoretically all insects emerging within the confines of these cages were caught. A Beckman pH meter

Table I. Light Trap Collections of *Culicoides* at the University of Michigan Biological Station, Douglas Lake, Michigan—Summer, 1954

Date	Low Temp. (C°)	*C. obsoletus*	*C. biguttatus*	*C. piliferus*	*C. stellifer*	*C. guttipennis*	*C. crepuscularis*	*C. venustus*	Total
6/30–31	—	1							1
7/ 1– 2	11.7	1							1
7/ 2– 3	8.9	2	1	2					5
7/ 3– 4	11.7	85	7			1			93
7/ 4– 5	10.6	12	4	1					17
7/ 5– 6	10.6	20	3	2					25
7/ 6– 7	8.3			1					1
7/ 7– 8	6.7			1					1
7/ 8– 9	8.9	1	2	1					4
7/ 9–10	13.9	55	10	3	1				69
7/10–11	12.8	41	11	12		1			65
7/11–12	16.1	62	12	3			1		78
7/12–13	17.2	92	33	12		7			144
7/13–14	18.3	126	50	24		3		1	204
[1]7/14–15	10.0	1	2						3
7/15–16	9.4	7	11	2					20
7/16–17	11.1	1	32	1					34
[2]7/17–18	18.3	1	1	1					3
[3]7/18–19	14.4		3	1		1			5
7/19–20	17.2	26	28	4					58
7/20–21	15.6		10						10
7/21–22	13.9	1	1	1					3
[4]7/22–23	12.2		9				1		10
7/23–24	13.9	10	58	4	1		1		74
7/24–25	14.4	1	17	1	3				22
7/25–26	14.4	1	14	2	1				18
7/26–27	17.2	2	63	2	1				68
7/28–29	17.2	18	40	2	4				64
7/29–30	16.7	16	14	6		1			37
7/30–31	12.8		1						1
8/ 2– 3	10.6		1						1
8/ 3– 4	13.9		5	1					6
8/ 4– 5	12.8		5						5
8/ 5– 6	14.4		1						1
8/ 6– 7	16.1		5		2				7
8/ 8– 9	14.4	1	1		1				3
8/ 9–10	13.9	1	2						3
8/10–11	11.7	—	—	—	—	—	—	—	0
Total		585	457	90	14	14	3	1	1164

[1] Trap operated from 3 a.m. to 4: 30 a.m.
[2] Trap operated from 4 a.m. to 6: 45 a.m.
[3] Trap operated from 12 a.m. to 1 a.m.
[4] Trap operated from 9 p.m. to 12 p.m.

Table II. The Nocturnal Distribution of Several Species of *Culicoides* in Cheboygan County, Michigan—July, 1954

Date	Time	*C. obsoletus*	*C. biguttatus*	*C. piliferus*	*C. guttipennis*	*C. stillifer*	Total No. Trapped	Temp. 6 p.m.–6 a.m.	
								High C°	Low C°
7/10–11	8 p.m. to 12 midnight	37	8	6	1	0	52	21.1	12.8
	12 midnight to 4 a.m.	4	3	6	0	0	13		
7/12–13	8 to 9 p.m.	0	0	0	0	0	0	26.1	17.2
	9 to 10 p.m.	11	3	6	0	0	20		
	10 to 11 p.m.	27	2	1	2	0	32		
	11 to 12 p.m.	26	10	0	2	0	38		
	12 to 4 a.m.	28	18	5	3	0	54		
7/13–14	9 p.m. to 12 midnight	93	21	19	2	0	135	25.6	18.3
	12 midnight to 4 a.m.	33	29	5	1	0	68		
7/16–17	8 to 9 p.m.	0	0	0	0	0	0	23.3	11.1
	9 to 10 p.m.	0	0	0	0	0	0		
	10 to 11 p.m.	0	0	0	0	0	0		
	11 to 12 p.m.	0	1	0	0	0	1		
	12 to 4 a.m.	1	31	1	0	0	33		
7/23–24	8 to 9 p.m.	0	0	0	0	0	0	22.8	13.9
	9 to 10 p.m.	0	0	3	0	0	3		
	10 to 11 p.m.	0	3	0	0	0	3		
	11 to 12 p.m.	2	8	0	0	0	10		
	12 to 4 a.m.	8	47	1	0	1	57		
7/26–27	8 to 9 p.m.	0	0	0	0	0	0	27.2	17.2
	9 to 10 p.m.	0	0	0	0	0	0		
	10 to 11 p.m.	0	1	1	0	0	2		
	11 to 12 p.m.	1	4	0	0	0	5		
	12 to 4 a.m.	1	58	1	0	1	61		
7/29–30	8 p.m. to 12 midnight	4	5	4	1	3	17	24.4	16.7
	12 midnight to 4 a.m.	12	9	2	0	1	24		

was used to determine the pH of the several types of soil from which *Culicoides* were trapped. A number of readings from each habitat were taken, both directly from the soil and from distilled water preparations of the soil. The microflora (that covered by the recovery cages) of each type of habitat was determined and the soil temperatures of each recorded. This data is presented in Table III.

The Gorge (High Spring Area or headwaters of Carp Creek): Burt Lake lies to the south of Douglas Lake and is roughly 35 m. lower in elevation. As a result subterranean waters flow from Douglas Lake and several streams emerge from the banks of a wooded gorge, unite and form Carp Creek which flows into Burt Lake. Recovery cages were placed in the muck and flowing water of a stream margin in this gorge. *C. piliferus* was recovered. This is one of the few times in my biological studies of this genus that I have recovered adults from areas covered by flowing water, outside of tidal zones.

Reese's Bog: Carp Creek, the underground drainage from Douglas Lake, flows through a bog which lies at the north end of Burt Lake, which is known as Reese's Bog. It is composed largely of what is termed Rifle peat consisting of brown rather coarse moderately decayed woody peat, which ranges from 1 to 2 feet in thickness over a yellowish-brown mixed woody and fibrous peat. A layer of moss and undecomposed forest litter, 2 or 3 inches thick, covers the immediate surface in this thickly wooded area. It is very high in organic matter and contains very little admixed mineral matter. The water table fluctuates but may be from surface level to 18 inches below. Cedar, balsam fir, spruce, and tamarack abound in this area with some secondary growth in places of poplar, aspen, paper birch and alder. From the moss layer at the edge of a stream in this dense woods *C. piliferus* was again recovered.

Nigger Creek Drainage System: The upper area of a small stream, known as Nigger Creek, which flows into Mullet Lake, is called Riggsville Bog. At the north-east end of this drainage system is a small unnamed *Carex* bog surrounded by willows, which apparently drains underground into the Riggsville Bog-Nigger Creek drainage system. A finger of this drainage system also includes Smith's Bog.

Recovery cages were placed in the area of Riggsville Bog which lies to the east of the "road." The gross vegetation did not consist of the typical bog trees but was composed of deciduous varieties. Since there was no standing water in this area the recovery cages were placed in shaded, moist mud which contained many decaying

Table III. Ecological Observations on the Breeding Habitats of *Culicoides* Species Trapped in Recovery Cages, Cheboygan County, Michigan—Summer, 1954

Habitat	Trapping Dates	Living Vegetation Covered by Cage	*p*H	Temperature	Remarks	Species Recovered
"The Gorge" or High Spring Area (Headwaters of Carp Creek)	6/25 to 7/ 5	None	7.67 to 8.00	11.5°C. to 12°C.	Cages placed in muck and decaying leaves in slowly flowing water, shaded.	*C. piliferus*
Reese's Bog	6/25 to 7/ 5	*Thuidium delicatulum* (Fern moss) *Conocephalum conicum* (Liverwort) *Mnium affine* (A common moss)	6.89 to 7.11	12°C.	Cages placed on bank of stream, shaded.	*C. piliferus*
Riggsville Bog	7/ 5 to 7/12	None	5.88 to 6.25	13.5°C. to 16°C.	Cages in muck formed by decaying leaves; no standing water, shaded.	*C. biguttatus*
Unnamed Bog draining into Riggsville drainage	7/12 to 7/23	Thick growth of *Carax* sp. (Sedge)	5.50 to 6.06	21°C. to 22°C.	Cages in standing water, in open.	*C. sphagnumensis*[1] *C.* sp. (undescribed)
Smith's Bog	7/23 to 8/10	*Typha latifolia* (Cat tail) Sedge other than *Carax* *Dulichium arundinaceum*	4.60 to 5.50	20°C. to 21.5°C.	Cages in standing water, in open.	*C. crepuscularis*
Bryant's Bog	7/ 5 to 8/10	*Sphagnum* sp. (A moss)	3.85 to 4.22	19°C. to 24°C.	Cages set in bog mat at edge of pond in open.	*C. sphagnumensis* *C. furensoides*[1]

[1] New species described in a separate paper, Williams (1955).

leaves and other organic matter. No vegetation grew in these areas. *C. biguttatus* was recovered. About 200 yards to the north, over a slight ridge, was a small unnamed bog of about an acre in size. *Carex* sp. grew profusely throughout the water area which was surrounded by *Salix*. On July 12 the cages were placed at the edge of the water, partly in and partly out. On the 14th they lay well above the water line, as the water appeared to be rapidly draining through the ground, and as a result were moved and placed in about 10 cm. of water. On the 17th the pond was completely dry and the first *Culicoides* specimens were recovered. Five *C. sphagnumensis* Williams and a single male specimen of an undescribed species were taken.

The mat around the open water of Smith's Bog is composed largely of *Carex* peat and organic mud. Recovery cages were placed in various locations during an 11 day period and only a single specimen was taken, this being *C. crepuscularis*. The cage which trapped it had been placed over the following plants: *Typha latifolia* (which had been cut so that the edges of the cage could be embedded in the mat), a sedge other than *Carex*, and *Dulichium arundinaceum*. *Chamaedaphne calyculata* grew profusely in the area although the cage did not happen to be set over any of it.

Bryant's Bog: Near Bryant's resort, on the south shore of Douglas Lake, is a circular bog which has a small somewhat crescent shaped pond near its center. A ring of *Sphagnum* maintains this pond at an elevation of about .9 m. above Douglas Lake. A cage placed in this moss at the pond's edge collected 257 females and 253 males of *C. sphagnumensis* over a 36 day period. It is of interest to note how equally the sexes emerged over this time interval. At no time during the trapping period was the discrepancy between the number of the two sexes trapped greater than 15. Two males and 2 females of *C. furcnsoides* Williams were also taken in the same trap on July 22, 1954.

Biting Studies: I collected adults from myself on 12 different evenings between the hours of 7:30 and 8:30 p.m. during the first 3 weeks of investigation. Only once was any other species other than *C. obsoletus* taken. On the evening of June 28 a single specimen of *C. biguttatus* was recovered from my arm. The greatest number of *C. obsoletus*, 200, were taken on the evening of July 3, 1954 at the area where the light trap was located. The activity of this species here coincides with the findings of Hill (1947) in England.

Summary

Only 3 species of *Culicoides* had previously been reported from the state of Michigan, all from the southern half of the lower peninsula. During the course of this investigation 10 species were trapped in the Douglas Lake region of Cheboygan County at the northern tip of the lower peninsula. Some activity data was obtained on 7 of these species (Table I, II) and observations were made on certain breeding habitats of 6 of them (Table III).

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NOTICE

A special sale of all overstock reprints of articles which have appeared in the new series of **Entomologica Americana** since 1926 is now in progress. A price list may be obtained from George S. Tulloch, 22 East Garfield Street, Merrick, N. Y.

STUDIES IN PANAMA CULICOIDES (DIPTERA, HELEIDAE) V. DESCRIPTIONS OF THREE NEW SPECIES OF THE SUBGENUS OECACTA POEY

By Willis W. Wirth[1] and Franklin S. Blanton,[2]
Washington, D. C.

This paper is based on material collected by the junior author in Panama by means of light traps. The methods and terminology are explained briefly in Part I of this series (1953, Jour. Wash. Acad. Sci. 43: 69–77). The types of the three new species here described, and most of the material studied, are deposited in the U. S. National Museum, Washington, D. C.

Culicoides aethionotus n. sp.
(Figure 1)

Female. Length about 1 mm., wing 0.9 by 0.45 mm.

Head dark brown; eyes practically contiguous, bare. Antenna with flagellar segments in proportion of 18: 15: 15: 15: 15: 15: 15: 15: 20: 20: 22: 22: 32, antennal ratio thus 0.94; distal sensory tufts on segments III-X. Palpal segments (fig. 1b) in proportion of 10: 20: 22: 10: 10, third segment short and swollen, with broad, shallow, sensory pit on distal third.

Mesontum dull, blackish brown on humeri, broadly on each side of sensory pits and narrowly along sides to wing bases; disc uniformly dark grayish to coppery pruinose. Scutellum uniformly pruinose brown. Postscutellum and pleuron blackish. Legs dark brown, fore and mid femora with subapical, and all tibiae with sub-basal narrow pale rings.

Wing (fig. 1a) with radial cells complete, short; costa extending to 0.6 of wing length; macrotrichia sparse, on distal third of wing in cells R_5, M_1 and M_2. Pale spots whitish and extensive, in a framework of narrow, connected, dark linear markings, principally along the veins; stigmal spot over second radial cell and distal third of first, black. Base of wing pale; large pale area over r-m crossvein; cell R_5 pale, dark along posterior margin with sub-basal and apical dark lobes and a narrow transverse dark line across middle

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to wing margin; two elongate pale spots in cell M_1, the second reaching wing margin; cell M_2 with distal marginal pale spot and a pale streak from base of wing to level of pale spot in cell M_4, the latter filling all of cell or all except narrow dark borders along the veins; anal cell pale at base and along wing margin, with a more distinct large pale spot behind mediocubital fork. Halter pale.

Abdomen dull brownish black; spermathecae (fig. 1c) two, large and heavily sclerotized, subequal and slightly ovoid, the ducts unsclerotized.

Male genitalia (fig. 1d, e): Ninth sternum with broad, shallow, posterior excavation, the ventral membrane not spiculate; ninth tergum rounded caudad, with apicolateral processes absent or indicated only by enlarged setal tubercles. Basistyle short and tapering, mesal margin densely setose; ventral and dorsal roots short, slender, subequal in length and joined together by a dark sclerotization; dististyle longer than basistyle, slender, curved, apex rather pointed. Aedeagus with heavily sclerotized, slender, nearly straight basal arms, joined by a broad, ventrally concaved band at two thirds of total length of aedeagus: distal median portion very broad and cap- or mushroom-shaped. Paramere with slender base and stem, the stem gradually narrowed and slightly curved to a slender, simple apex.

Holotype female, allotype, Patino Point, Darién Province, Panama, July 1952, F. S. Blanton, in light trap (Type no. 62809, U.S.N.M.). Paratypes: Darién Prov.—2 males, 30 females, same data as type; 5 females, Garachine, February 1953; 13 females, Cocle Prov.—Puerto Farallon, 8 November 1952; Rio Hato, 24 September 1951, 15 January 1952; Panama Prov.—1 female, San Carlos, 17 September 1952; 2 females, Pedregal, 13 December 1952; 6 females, Bayano, 8 April 1952. Canal Zone—64 females, Mojinga Swamp, January 1952, 1953, November, December 1951; 1 female, Mindi Dairy, 3 December 1951; 5 females, Loma Boracho, 29 November 1952. Perlas Islands—4 females, Rey Island, 22 January 1953.

The wing markings of *aethionotus* closely resemble those of *galindoi* Wirth and Blanton and *wokei* Fox, particularly in having the distal pale spots in cells R_5, M_1 and M_2 broadly meeting the wing margin, but both the related species have a mesonotal pattern, in the former consisting of large yellow and brown patches and in the latter of brown punctiform dots. The male genitalia of *aethionotus*, on which taxonomic relations in large part depend, are quite unlike those of any species known to us.

Culicoides dicrourus n. sp.
(Figure 2)

Female. Length 1.2 mm., wing 1.25 by 0.5 mm.

Head dark brown; eyes narrowly separated, bare. Antenna with flagellar segments in proportion of 30 : 25 : 25 : 25 : 25 : 25 : 25 : 25 : 35 : 35 : 40 : 45 : 60, antennal ratio thus 1.05; segments with apical portions dark brown-banded; distal sensory tufts on segments III, (VI), VII-X. Palpal segments in proportion 10 : 20 : 32 : 10 : 12, third segment (fig. 2b) swollen, with broad, shallow sensory pit.

Mesonotum elongated, dark brown, with prominent pattern of large, yellowish gray, pruinose patches consisting principally of a pair of elongate submedian areas before middle and a larger pair in prescutellar depression, an irregular border of the area around humeral pits and two or three lateral spots on each side of mesonotum. Scutellum dark in middle. Postscutellum and pleuron dark brown, upper half of pleuron yellowish. Legs dark brown, all femora with subapical, tibiae with sub-basal, and hind tibia with apical, broad yellowish bands; four distal segments of tarsi pale.

Wing (fig. 2a) with radial cells complete, normal; macrotrichia sparse over distal half of wing and in anal cell. Large yellow spots on anterior wing margin at base of wing and over r-m crossvein, the latter spot extending to the anterior media; three broad anterior, very dark areas, the one over second radial cell and distal half of first radial cell extended as a small, round, dark spot behind second radial cell. Cell R_5 with a round light spot at end of costa often narrowly connected behind the round dark spot to an elongate pale spot behind radial cells; cell R_5 near wing tip with a large, oblique, hourglass-shaped, light spot broadly attaining wing margin. Cell M_1 with two elongate light spots, the distal one often attaining wing margin; cell M_2 with a large pale area anterior to mediocubital fork and continued narrowly halfway to wing tip, often entirely pale to wing base, and a separate, triangular, light spot at wing margin; apices of veins M_1 and M_2 with short pale spots; cell M_4 with a large rounded light spot reaching wing margin; anal cell with base pale and two distal pale spots. Halter pale.

Abdomen dark brown; spermathecae (fig. 2c) subequal, pyriform, with sclerotized necks.

Male genitalia (fig. 2d, e): Ninth sternum with very shallow mesal excavation, the ventral membrane bare; ninth tergum long and tapered, apicolateral processes long and closely approximated. Basistyle stout, ventral root broad with posterior hook, dorsal root

more slender; dististyle long and slender, apex slightly curved. Aedeagus with short, broad, mosque-shaped basal arch, the basal arms rather stout, median portion long and slender with a deeply bifid (two-pronged) apex. Paramere with base knobbed, stem stout and nearly straight with a subapical ventral pouch, distal portion greatly narrowed to a curved and flattened, distally pointed blade with about five lateral barbs.

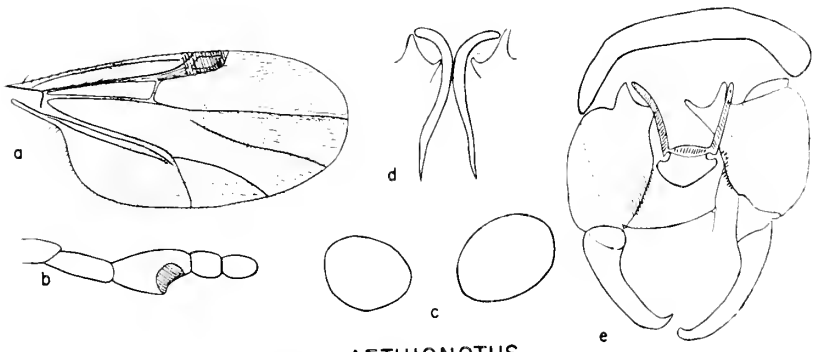
Holotype female, allotype, Loma Boracho, Canal Zone, 29 October 1951, F. S. Blanton, in light trap (Type no. 62810, U.S.N.M.). Paratypes: Canal Zone—4 males, 34 females, same data as type, except dates 23, 29 October 1951, 17 April 1952, July 1952; 5 males, 34 females, Mojinga Swamp, 15, 21 August, 24 October, 14 November, 5 December 1951, 2, 23 January 1952, January 1953; 1 male, 2 females, Madden Dam, 21 September 1951, 9 October 1952; 1 female, Mindi Dairy, 3 December 1951; 5 males, 7 females, Atlantic Side, 17 October 1952; 3 females, Tabernilla, (A. Busck). Panama Prov.—7 females, Tocumen, 25 March 1952; 1 female, Arraijan, 21 May 1951; 1 female, Pacora, 4 June 1951; 2 males, 7 females, La Jolla, 5 October 1951. Bocas del Toro Prov.—10 males, 44 females, Almirante, October, November 1952, January, March 1953. Darién Prov.—2 females, Jaque, July, 1952; 11 females, El Real, 8 August 1952; 1 male, 2 females, Garachine, February 1953.

C. dicrourus is most closely related to *discrepans* Ortiz and Mirsa. The latter is known only from a single female from Venezuela and differs as follows: Size larger, wing 1.9 mm. long. Wing with the pale spot at the end of the costa entire, not broken into two more or less separate spots and the lower portion not bending around U-shaped proximad toward vein R_{4+5} and not cutting off a separate black spot behind end of second radial cell; there are three separate discal spots in cell M_2 instead of one long pale area, and the pale area at wing base continues to the hind margin of the wing at the anal angle. Antennal sensoria only on segments III, VIII, IX and X. Palpal segments IV and V combined 0.88 as long as III (0.7 in *dicrourus*); the sensory pit on third segment deeper with a narrower opening.

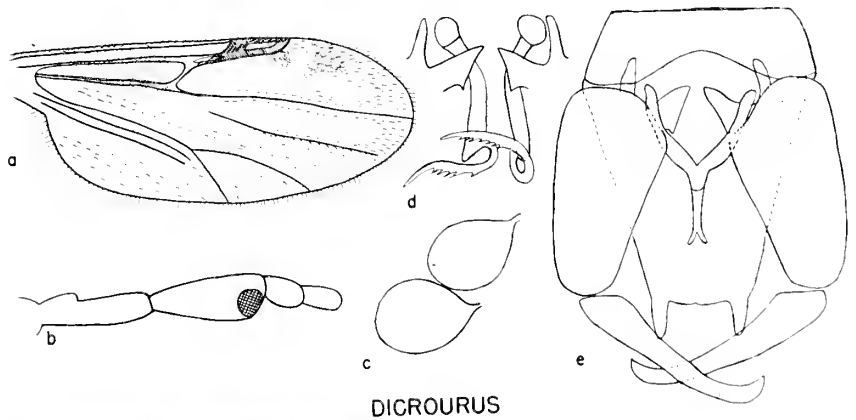
Explanation of Plate IV

Fig. 1, *Culicoides aethionotus;* Fig. 2, *Culicoides dicrourus;* Fig. 3, *Culicoides lyrinotatus:* a, female wing; b, female palpus; c, female spermathecae; d, male parameres; e, male genitalia, parameres omitted.

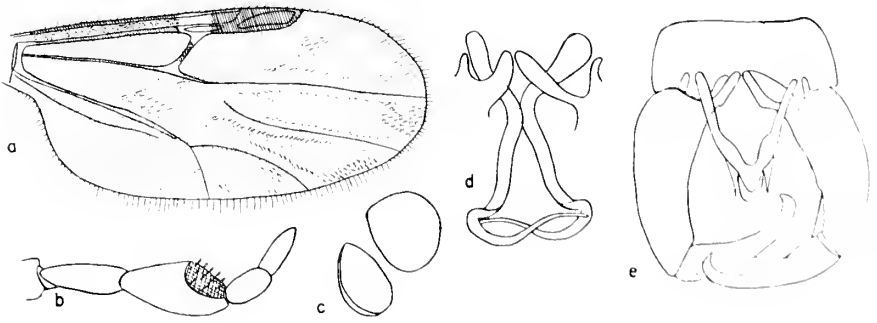
BULL. B. E. S. VOL. L PLATE IV



AETHIONOTUS



DICROURUS



LYRINOTATUS

C. avilaensis Ortiz and Mirsa is also closely related, but in that Venezuelan species the pale wing spots are even more reduced than in *discrepans*.

Culicoides lyrinotatus n. sp.
(Figure 3)

Female. Length about 1 mm., wing 1.14 by 0.50 mm.

Head brown; eyes very narrowly separated, bare. Antenna brown, bases of first eight flagellar segments pale yellowish; flagellar segments in proportion of 20:20:20:20:20:20:20:20:25:28:32:35:50, antennal ratio thus 1.06; distal sensory tufts on segments III, VIII and IX. Palpal segments (fig. 3b) in proportion of 8:20:20:10:10, third segment swollen with a very broad, shallow, sensory pit.

Mesonotum dark brown, with prominent pattern of small yellowish-white spots arranged as follows: on humeri; two pairs of elongate submedian spots, one at suture, the other in the prescutellar depression; five pairs of very small spots in a pair of lyre-shaped, curving lines the anteriormost pair covering sensory pit, the second pair behind and slightly laterad, third and fourth pairs on lateral margins on each side of suture and the fifth pair above the wing bases. Scutellum broadly black in the middle, yellowing on sides, extreme ends narrowly black. Postscutellum and pleuron dark brown. Legs dark brown, femora with narrow subapical, tibiae with narrow sub-basal, and hind tibia with narrow apical, pale rings.

Wing (fig. 3a) with radial cells both complete, the second one quite elongate, more than twice as long as broad. Costa extending to 0.67 of wing length; macrotrichia numerous on distal half of wing and also on apex of anal cell. Yellowish spots on anterior margin of wing at wing base and over base of first radial cell; a small yellowish spot over the junction of the anterior media and the r-m crossvein, the crossvein deeply infuscated; two very dark areas on wing, one between the two first-mentioned pale spots and the second covering second radial cell and most of first radial cell; cell R_5 with three small round spots in a triangle at end of costa and a small spot near base of cell forming a triangle with the two spots at ends of r-m crossvein; apices of veins M_1, M_2, and M_{3+4} and Cu_1 each with a small pale spot at wing margin; cell M_1 with two oval pale spots, the second one far from wing margin; cell M_2 with a small pale spot near base, two oval spots in line, one ahead of the other, at level of mediocubital fork and one near apex of cell well removed from wing margin; cell M_4 with a small

pale spot in middle; anal cell with one pale spot near hind margin at base and two pale spots near apex. Halter knob infuscated.

Abdomen brownish black, the cerci yellowish. Spermathecae (fig. 3c) two, pyriform, large, subequal, not heavily sclerotized.

Male genitalia (fig. 3d, e): Ninth sternum three times as broad as long, with shallow posterior excavation, the ventral membrane bare; ninth tergum moderately tapering, the apicolateral processes short and bluntly triangular. Basistyle 2.5 times as long as broad; ventral root long and broadly foot-shaped with slender ankle, the posterior heel scarcely evident; dorsal root not as long, slender, with knobbed apex; dististyle about 0.7 times as long as basistyle, slender and slightly curved, with abruptly bent, pointed apex. Aedeagus with a heavily sclerotized, rather narrow, basal arch extending to 0.8 of total length of aedeagus, the basal arms straight at bases, moderately expanded toward distal part of arch; distal portion a short, rounded, faintly sclerotized blade. Paramere with stout basal knob, stem strongly bent at base, sinuate in mid-portion, thence abruptly bent Z-shaped ventrolaterad, the apical portion of paramere thence gently curved and gradually narrowed to a slender tip with a fringe of four or five minute barbs.

Holotype female, allotype, Almirante, Bocas del Toro Province, Panama, November 1952, F. S. Blanton, in light trap (Type no. 62811, U.S.N.M.). Paratypes: 2 males, 10 females, same data as type except dates November and December 1952.

The wing markings of *C. lyrinotatus* are very similar to those of *ginesi* Ortiz, *propriipennis* Macfie and *hertigi* Wirth and Blanton, none of which, however, has the dark r-m crossvein. *C. propriipennis* and *hertigi* have the halter knobs pale and the spots in cell R_5 arranged differently, while in *ginesi* the mesonotum is marked with many dark punctiform dots and the wings have only one pale spot in the apex of the anal cell.

PUBLICATIONS RECEIVED

Classics of Biology, by August Pi Suner. Authorized English translation by Charles M. Stern. 337 pp. 6 × 9 ins., cloth bound. 1955. Philosophical Library, Inc., New York, N. Y. (Price, $7.50)

The World of Bees, by Gilbert Nixon. 214 pp., 16 figs. 5 × 7 ins., cloth bound. 1955. Philosophical Library, Inc., New York N. Y. (Price $4.75)

NEW NEARCTIC SARCOPHAGIDAE AND TACHINIDAE (DIPTERA).[1]

By H. J. Reinhard,
College Station, Texas

The following descriptions are offered at this time to make names available for use in other reports on materials borrowed for study and received for identification.

Amobia aberrans n. sp.

Male.—Parafrontal with a double row of weak bristles extending to antenna, gray pollinose, wider than frontalia on entire length; vertical bristles two pairs; ocellars hairlike; parafacial bare, subsilvery; vibrissae hardly differentiated, well above oral margin; facialia with minute setae ascending almost to middle; front at vertex 0.25 of head width and equibroad to antenna; latter black, hardly reaching to mid face, subbulbous third segment but slightly longer than second; arista black, bare, thickened on proximal fourth thence slender to tip; proboscis short; palpus brownish black; eye bare, large, extending below vibrissal level; cheek narrow in profile, hardly one-tenth eye height; occiput gray pollinose, sparsely clothed with short black hairs.

Thorax gray pollinose, notum marked with three broad black vittae which extend on scutellum; latter with 2 lateral 1 strong decussate apical and 1 weak discal pair situated well behind middle; prescutellars and hindmost dorsocentral well developed and in a transverse row; two sternopleurals; prosternum, propleuron and postnotal slope bare. Legs black; claws and pulvilli a little shorter than apical tarsal segment. Wing gray hyaline; first posterior cell open well before wing tip; hind cross vein joining fourth about four-fifths distance from small cross vein to cubitulus, latter obtuse without stump or fold; costal spine vestigial; calypter opaque white; epaulet infuscated, subepaulet pale or whitish.

Abdomen rather slender and tapering distally, black with changeable gray pollen on three basal segments disposed in two broad more or less interrupted vittae on either side of dark median line; pollen on basal half of anal segment with a golden tinge at sides; one pair of median marginal bristles on second segment and a marginal row on last two; hypopygium moderately large, retracted, black. Female unknown.

[1] Contribution No. 2236, from the Department of Entomology, Texas Agricultural Experiment Station.

Length, 6 mm.

Holotype: "Utah, VI, '27"

The unusually short antennae, reduced vibrissae and wing venation readily distinguish the species from all known related forms. Although the type specimen has been in my collection since 1926, no additional material has come to light.

Senotainia opiparis n. sp.

Male.—Front at vertex 0.28 and at antennal base 0.22 of head width (average of four specimens measured); parafrontal yellow to pale golden pollinose, parafacial concolorous on upper part becoming paler below; frontalia reddish, gradually widened upwards and exceeding parafrontal width on upper half; frontal bristles about ten in a single row stopping before base of antennae; verticals two pairs; one reclinate and two proclinate orbital bristles; face strongly divergent downward, its sides narrow, bare; clypeus silvery, moderately depressed; epistoma strongly narrowed from clypeus and bowed forward from plane of same; vibrissae approximated and about length of second antennal segment above oral margin; facialia with one or two bristly hairs above vibrissae; antenna wholly golden, reaching to lower fourth of face, third segment three to four times length of second; arista bare, black, hardly equal to combined length of last two antennal segments, thickened and rather sharply tapered on basal third; cheek narrow in profile about one-twelfth eye height; eye large, reaching well below vibrissal level; proboscis rather slender but shorter than head height; palpus slender, pale yellow, with a few short black hairs on lower edge; back of head flattened, gray pollinose on dark background, sparsely clothed with short black hairs.

Thorax and scutellum black, gray pollinose, dorsal vittae poorly defined; two hindmost dorsocentrals and prescutellars well developed; sternopleurals normally two and two lateral scutellars besides an equally strong apical decussate pair; prosternum, propleuron and postnotal slope bare. Legs black; claws and pulvilli equal to or longer than last tarsal segment; hind tibia with a row of subequal bristles on outer posterior edge extending to slightly beyond middle. Wing hyaline; third vein with one or two small hairs near base; costal spine vestigial; epaulet black; calypter whitish.

Abdomen largely reddish in ground color, with pale or whitish pollen on last three segments which in a flat rear view extends thinly to hind margin on each; a dark median vitta usually apparent; third and fourth segments each with a marginal row of short but

well differentiated bristles; genitalia shining blackish; forceps short, but quite slender, divided almost to base and prongs slightly divergent; accessory process nearly as broad as long and convex on outer side with apex broadly rounded; fifth sternite lobes rather broadly exposed apically, sparsely fine-haired on inner margin.

Female.—Vertex 0.28 of head width, slightly narrower at antennal base; claws and pulvilli shorter than apical tarsal segment; genital segments black, small and retracted within tip of abdomen.

Length, 5.5–8 mm.

Holotype male and allotype female, College Station, Texas, May 14, 1929 (H. J. Reinhard). Paratypes: 27 males, 11 females, same locality as type, April 18 to October 1, 1917–51; 1 male and 1 female, Dilley, Texas, May 5 and 6, 1920, (H. J. Reinhard); 1 female, Bexar County, Texas, September 26, 1931 (H. J. Reinhard); 1 female, Austin, Texas, May 16, 1948; 1 male, Mission, Texas, May 14, 1946 and 1 female, Starr County, Texas, July 4, 1946 (F. A. Cowan); 1 male, Palacios, Texas, May 1, 1929; 1 male, Sherman, Texas, September 21, 1938; 1 male, A. & M. College, Mississippi, August 31, 1922 (H. W. Allen); 1 male, Arlington, Georgia, June 11, 1947 (P. W. Fattig); 1 female, Lima, Ohio. July, 1926 (D. G. Hall).

The species averages smaller in build than *flavicornis,* to which it is closely allied. In the latter species the male genital forceps are much more elongated and the accessory process tapers outward to an acute forward bowed tip; also, the sides of the front and face are gray to silvery pollinose.

Senotainia sinopis n. sp.

Differs from the preceding species mainly as follows:

Male.—Head gray pollinose on dark background; front at vertex 0.29 of head width and narrowed to 0.25 of same at antennal base; frontalia sublinear on anterior half and exceeding parafrontal before ocelli; third antennal segment two and one-half to three times longer than second; frontal rows separated by less than parafrontal width on anterior half; arista thickened about to middle; cheek sublinear in profile; claws and pulvilli small or shorter than apical tarsal segment; genital forceps a little longer and not so deeply divided as in *opiparis,* the base behind more prominent in profile, slender prongs hardly at all divergent as viewed from behind; accessory process over twice as long as wide at base, tapering distally to an acute tip; fifth sternite lobes small or narrowly exposed.

Female.—Front at vertex 0.32 of head width and nearly equi-

broad forward to antennal base; parafrontal with a faint but apparent yellow tinge; frontal bristles weaker than in male; claws and pulvilli minute; anal orifice slit-like, genitalia retracted.

Length, 6–7 mm.

Holotype male and allotype female, College Station, Texas, May 11, 1917 (H. J. Reinhard). Paratypes: 5 males and 1 female, same locality as type, May 11 to July 4, 1917–1929 (H. J. Reinhard).

Senotainia inyoensis n. sp.

Similar to *opiparis* except as follows:

Male.—Head pollen silvery white at most with a faint yellow tinge on upper half of front; vertex distinctly wider or 0.35 of head width (one specimen); antenna reaching almost to level of vibrissae, third segment nearly five times longer than second; arista thickened on basal three-fifths or more; cheek narrow in profile about one-tenth eye height. Thorax with dense pale cinereous pollen, with a slight greenish yellow tint on notum; latter with four narrow vittae, moderately defined before suture but barely visible behind. Abdomen wholly red in ground color, with rather sharply defined silvery fascia on basal half or more of last three segments; genital forceps moderately stout, deeply divided but not divergent toward tip; accessory process as long as forceps and in profile much wider than same, tapering to a small acute anteriorly bowed tip; fifth sternite lobes largely retracted or concealed.

Female.—Vertex 0.33 of head width, front slightly narrower at antennal base; antenna reaching to lower fourth of face, third segment three to four times length of second; claws and pulvilli shorter than last tarsal segment; anal orifice slitlike, genitalia retracted and largely concealed within tip of abdomen.

Length, 5.5–7 mm.

Holotype male and allotype female, (in Calif. Acad. Sci., Ent.) Deep Springs Lake, Inyo Co. Calif., July 7, 1953 (J. W. MacSwain). Paratypes: 12 females, same data as type; 1 female, "Phoenix, Ariz. Aug. D. K. Duncan"; 1 female, Santa Catalina Mts. Arizona, August 15, 1924 (A. A. Nichol); 2 females, Artois, Glenn Co., Calif., July 11, 1952 (H. L. Hansen); 1 female, Dugway Pr. Gd. Toole Co. Utah, July 9, 1953 (J. L. Eastin).

Spathidexia creolensis n. sp.

Female.—Differs from all known species in having the abdomen mostly red in ground color; head subsilvery pollinose; parafrontal sparsely clothed with pale short hairs, much wider than frontal

vitta; proclinate ocellars small but distinct; frontals in a single row, one bristle below antennal base; two stout proclinate orbitals and one (inner) vertical; vertex 0.26 of head width, gradually widening downward into facial angle; parafacial bare, strongly narrowed below; antenna subequal length of face, black tinged with red basally, third segment nearly four times length of second; arista black, slender and shorthaired to tip from near base; vibrissae stout, on oral margin; facialia practically bare; proboscis short, labella and palpus pale yellow; cheek narrower than width of third antennal segment; eye large, bare; back of head wholly short pale-haired.

Thorax and scutellum black, gray pollinose, notum not distinctly vittate and clothed with black hairs, pleura with a contrasting vestiture of pale hairs; acrostichal 3, 3 (one immediately before and behind suture small); dorsocentral 3, 3; intraalar 3; supraalar 3; presutural 1 (outer); humeral 4; pteropleural 0; sternopleural 1, 1; scutellum with 3 lateral (intermediate one small), 1 good-sized decussate apical and 1 weaker discal pair; propleuron and postnotal slope bare. Wing gray hyaline; third vein setulose to small cross vein; first posterior cell narowly open shortly before wing tip; costal spine vestigial; epaulets black. Legs black, tibiae more or less reddish, middle pair each with two stoutish bristles on outer front side near middle; claws and pulvilli short.

Abdomen slightly narrower but considerably longer than thorax, shining red, with a silvery pollen band on narrow basal edge of segments two to four; no discals; second segment with one pair of large median marginal bristles (broken off in type) and last two each with a marginal row; genitalia terminating in a flattened blunt-tipped larvipositor; sternites covered. Male unknown.

Length, 7.5–8 mm.

Holotype female, Miami, Florida, October 28, (C. H. T. Townsend) in the U. S. National Museum. Paratypes: 2 females, Creole, Louisiana, June 7, 1951 (Price, Beamer, Wood) in the Snow Entomological Collection, University of Kansas.

Pseudapinops rogalis n. sp.

A polished black species like the genotype, *P. nigra* Coq., from which it is at once distinguished in having the legs bicolored.

Female.—Parafrontal shiny black destitute of pollen, and distinctly narrower than red frontalia; short, weak frontal bristles in a single row extending slightly below antennal base; ocellars, two orbitals and verticals present but weak; front at vertex 0.32 of head width gradually diverging forward into facial angle; parafacial

subsilvery, bare and moderately narrowed below; vibrissae rather short, on oral margin; facialia setose on lower fourth; antenna reddish third segment largely infuscated, exceeding twice length of second; short arista black, bare, thickened to middle, basal segments small; cheek two-fifths eye height, shiny black but with a pruinose sheen apparent in some views, groove red in ground color; proboscis short, palpus absent; eye bare; posterior orbit silvery; occiput convex, shiny black and sparsely black-haired.

Thorax and scutellum polished black, weakly bristled; three sternopleurals and post dorsocentrals; prosternum, propleuron and postnotal slope bare. Legs rather stoutish, tibiae and tarsi black remainder sharply contrasting yellow; bristling considerably reduced or weak. Wing subhyaline, with a light brownish tint along costal margin; first posterior cell narrowly open a trifle before extreme wing tip; hind cross vein nearer small cross vein than cubitulus; latter without stump or fold; third vein with 2 or 3 small hairs near base; costal spine minute; epaulet and subepaulet black; calypter transparent, pale tawny.

Abdomen ovate, shining black, without any dorsal macrochaetae, marginal bristles on three basal segments hardly differentiated from hairs but somewhat stronger or bristly on anal segment which also bears longer but appressed hairs on upper surface; genitalia retracted within tip of abdomen.

Length, 5 mm. Male unknown.

Holotype: Marion Mt. Cmp., San Jacinto Mts., Calif., July 1, 1952 (E. M. Evans).

ON THE REAPPEARANCE OF A POSSIBLE ANCESTRAL CHARACTERISTIC IN A MODERN CHILOPOD (CHILOPODA: SCOLOPENDROMORPHA: CRYPTOPIDAE).

By Ralph E. Crabill, Jr.,[1] Saint Louis, Missouri

It is not unreasonable to assume that the remote ancestors of the modern pleurostigmophorous centipedes bore a pair of laterally-disposed spiracles (stigmata) on each pedal somite and that in the course of their long evolution, depending upon the group, certain of these pairs of spiracles have been lost. This could account for the variability that we encounter in the number of spiracle-bearing somites of modern centipedes. In the order Geophilomorpha each pedal somite, except the first and the last usually,[2] bears a

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[2] The only known exception is the Fijian genus *Azygethus* whose members reputedly have ultimate pedal spiracles.

pair of spiracles. But if we turn to the Lithobiomorpha and Scolopendromorpha, we find this evidently primitive plan usually modified in the direction of reduction. The two non-geophilomorphous extremes would seem to be found in the scolopendromorph genus *Plutonium*, where each pedal somite but the first and the last bears spiracles, and in the lithobiomorphous *Catanopsobius;* here only pedal somites three and ten bear spiracles.

Within the Scolopendromorpha all species possess spiracles upon the eighth pedal somite, but in addition certain species have seventh pedal somite spiracles; the majority do not. The presence of seventh somite spiracles seems to characterize the generic rather than familial or ordinal levels, for such a condition is encountered in several genera of the Otostigminae (Scolopendridae) as well as in three genera of the Cryptopidae. One is inclined to regard *the loss* of seventh somite spiracles in the remaining genera of each family as evidence of parallel evolution in this character. Here of course we assume the seventh somite spiracles to be primitive possessions.

In the New World two genera, otherwise fundamentally very similar, differ in that the species of one, *Dinocryptops* (formerly *Scolopocryptops*, 3, p. 96), possess seventh somite spiracles, whereas the more numerous species of the other, *Scolopocryptops* (formerly *Otocryptops*, 3, p. 96), do not. That this is a sound generic distinction cannot, at the present state of our knowledge, be seriously doubted.

The close evolutionary relationship between these two genera seems to be fortified by a bizarre specimen recently collected in Kentucky by T. J. Spilman of the United States National Museum. This specimen, clearly a member of the familiar eastern North American species *Scolopocryptops sexspinosa* (Say), does possess poorly-developed seventh pedal somite spiracles. (It will be recalled that in this genus the seventh somite lacks spiracles, that they are present in *Dinocryptops*.) This aberrant condition has never before been found, at least in the multitude of *sexspinosa* specimens that I have examined.

Upon studying the macerated seventh right and left pleura, it was seen that their spiracles, though noticeably smaller than those of the eighth somite, must have been functional for each gives rise to a reduced though otherwise typical tracheal tree. In each case the spiracle is situated in the free pleural membrane beneath, not between, the two successive stigmopleurites. In the eighth pleuron each normal spiracle lies between, not beneath, the two successive stigmopleurites.

Of course the suggestion comes to mind that this condition is an atavism, a phenomenon engendered possibly by the reproduction of a previous genetic condition through fortuitous recombinations of genes. On this basis, and taking into consideration the numerous other fundamental features common to the species of both genera, *Scolopocryptops* and *Dinocryptops* would seem phylogenetically very closely related.

But the discovery of this single atypical specimen gives rise to other speculations too. It compels one to wonder whether another such specimen might have been the partial basis for the baffling reports that *Dinocryptops miersii* (Newport) occurs naturally in the United States.

The belief that this form inhabits the United States seems to spring from two sources. In 1893 Bollman (2, pp. 128, 177), who admitted he was unfamiliar with the species, cited California as a *miersii* locality. He specified Kohlrausch and Karsch as the authorities for this information. However none of them apparently was aware of the spiracular difference between *miersii* and the members of the related genus *Scolopocryptops* (formerly *Otocryptops*). For instance, Kohlrausch (4, pp. 53, 55) in 1881, speaking of *Scolopocryptops* (with *sexspinosa* and *miersii* included) stated its species possess *ten pairs* of spiracles; this excludes seventh somite spiracles. In addition he regarded *miersii* as a junior synonym of *sexspinosa;* today they are not even considered congeneric.

Bollman quoted Karsch, whose key allied both *sexspinosa* (plus some of its true congeners) with *miersii* within the same genus. It is important to note that the Bollman-Karsch key (2, p. 177) distinguishes *miersii* (in California) on the basis of its marginless cephalic plate but without mentioning its seventh somite spiracles. This leads one to suspect that the California citation for *miersii* could very well have been based upon the well-known Californian *Scolopocryptops gracilis* which lacks cephalic margins, and which is congeneric with *sexspinosa* but not with *miersii*. In summary, I suggest that the report of *miersii* from California may have arisen from an initial misidentification.

The second source was Kraepelin who in 1903 (5, p. 78) reported *miersii* "vom wärmeren Nordamerika (Georgia, Virginia, Kalifornien ? . . . ", thereby presenting records that apparently had not previously appeared in the literature, except in so far as they were indirectly hinted at by Meinert who remarked in 1886 that "This species seems to prefer the more southern parts of North America" (6, p. 181). At the same time Meinert cited a number of New World localities but none in North America. The Attems' distri-

bution of 1930 (1, p. 256) is clearly based upon Kraepelin's 1903 information.

Furthermore Kraepelin believed *uiersii* to occur in Indiana because of his erroneous contention that Bollman's *S. calcarata* (2, p. 133) is probably a junior synonym of *uiersii*, viz. "Der *S. calcaratus* Bollm. von Indiana mit bürstenförmig behaarten Endglieder der Analbeine is vermutlich das ♂ der Art." It seems certain, however, that the Bollman species is a junior synonym of *S. nigridia* McNeill (7, p. 333).

Explaining the Georgia and Virginia records is more difficult. None the less, I strongly suspect them to be invalid and believe they may be clarified in one of two ways. Kraepelin stated he had access to material borrowed from the United States National Museum. It is possible that he discovered there one or more aberrant specimens which he did not recognize as *nigridia* or *sexspinosa* because of their abnormal possession of seventh somite spiracles. The other possibility is suggested by the question mark with which Kraepelin suffixed his states distribution. If he himself was uncertain of the reliability of his data, the heirs of this information can do no more than hold it in equal suspicion. Possibly he *guessed* Georgia and Virginia to be northern extensions of the more southern range arbitrarily alluded to by Meinert in 1886.

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EXCHANGES AND FOR SALE.

This page is limited to exchange notices and to small For Sale advertisements from members of the Society and from actual paid subscribers to the Bulletin exclusively. *Exchange notices* from members of the Society and from subscribers are limited to *three (3) lines each*, including address; beyond 3 lines, there will be a charge of $1.00 for each 3 lines or less additional. *For Sale* ads will be charged at $1.25 for each 3 lines or part of 3 lines. *Commercial or business* advertisements will not be carried in this page, but will go in our regular advertising pages at our regular advertising rates to *everybody*.

LEPIDOPTERA, Have spread local specimens and pinned specimens from Arizona and Florida for exchange.—Alex K. Wyatt, 5842 N. Kirby Avenue, Chicago 30, Ill.

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WANTED—Psyche, vols. 11, 13, 15; Trans. Amer. Ent. Soc., vols. 1–5. C. F. dos Passos, Mendham, New Jersey.

FOR SALE—Copies of the majority of the back issues of both Entomologica Americana and the Bulletin are available and for sale as individual items. Want lists will receive prompt attention —EDITOR.

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INSECT TUMORS

By MARTIN L. KAPLAN, Brooklyn, N. Y.

Willis (1948) defined a tumor as, ". . . an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of normal tissue, and persists in the same excessive manner after cessation of the stimuli which evoked the change." These abnormal masses can be further characterized as follows:

1. They are cellular in nature, appear at specific sites and may spread or metastasize.
2. Their incidence is affected by X-irradiation and nutritional variation.
3. They can be transplanted from one to another of the same species.
4. Hereditary factors for susceptibility are present.

By far the greater amount of investigation has been carried on with tumors of mammals while those of insects have received less attention. In general, insect tumors are similar to those of mammals except that they may regress during metamorphosis and they are sensitive to temperature changes.

The basic tumor process can be divided into two major phases; genesis and growth. During genesis the normal intra-cellular processes are upset in some way (tumor-inducing action), possibly through the loss of a strategic enzyme or by the alteration of specific substrates, and the tumor process is initiated. The end of the generative process may be identified by structural modifications of the "changed" cell. The onset of division in the tumor cell introduces the growth phase and terminates in an abnormal mass of cells which may spread to the other regions of the organism.

Except for the hereditary tumors of *Drosophila*, most of the reported insect tumors have not been analyzed with respect to their cellular constituents, or to their possible effects on the normal physiological activities of the insect. Naturally occurring tumors have been observed in six orders and induced (provoked by man) tumors have been noted in two. The available data are summarized in Table 1.

Table 1. Summary of tumors reported in insects

Type of tumor	Order	Genus	Reference
1. Spontaneous	Hymenoptera	Apis	White (1921)
		Bombus	Palm (1949)
		Formica	Brun (1925)
	Coleoptera	Phytodecta	Balazuc (1948)
	Orthoptera	Gryllotalpa	Palm (1948)
2. Parasitic	Ephemerida	Hepatagenia	Codreanu (1935)
		Ritherogenia	
	Hymenoptera	Gilpinia	Bird (1949)
3. Induced			
a. surgically	Orthoptera	Dixippus	Pflugfelder (1938)
		Leucophaea	Scharrer (1944; 1948)
b. nutritionally	Diptera	Drosophila	Hartung (1955)
4. Hereditary	Diptera	Drosophila mel. (25 strains)	Stark (1918; 1937) Burdette (1951)
	Lepidoptera	Pygaera	Federly (1936)

The pigmented tumors in *Drosophila*, the insect which has been used so extensively in the development of Genetics, have been vigorously investigated ever since these abnormal growths were first described by Stark (1918). There are several reasons which invite intensive study of these strains:

1. The chromosome number is small (8), and the gene loci of each chromosome has been adequately mapped thereby permitting the isolation of many pure strains; a condition not often realized in vertebrate studies.

2. Their life cycle is short—approximately 10 days from egg to

adult.

3. Environmental conditions (food, temperature, humidity) can be easily controlled thus permitting large colonies.

One of the most interesting types of tumors to be found in *Drosophila melanogaster* is a pigmented one called a melanoma which appears during the larval period. The gene thought to be responsible for tumor induction is usually found on the second chromosome. Other genes acting as modifiers also may be present. Manipulation of the nutritional environment of these tumor strains, such as by the feeding of the amino acid tryptophan (Plaine and Glass 1955) and by increasing the concentration of specific "B" vitamins in the media (Friedman 1955), have been shown to increase the incidence of melanomas in this species. Tumor incidence can also be altered by interfering with the hormone balance (Burdette 1954). Also of interest is the observation by Burton (1955) that tumors can be induced in a non-tumorous strain by the injection of cell-free extracts of whole larvae of a tumorous strain.

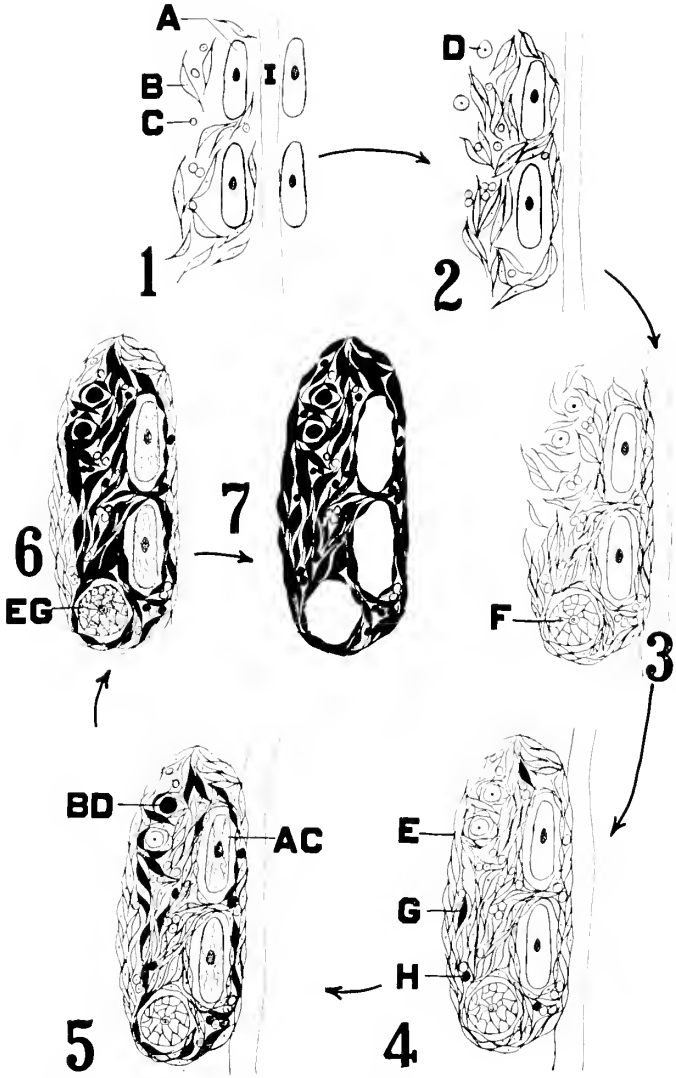
The development of vertebrate tumors has been extensively studied but, because of technical difficultis, little has been done with the development of insect tumors. Some of the difficulties have been overcome (Kaplan 1955) with particular reference to the histogenesis of the melanoma found in the *tu-e* strain of *Drosophila melanogaster* which is summarized here. At least six specific sites of tumor formation in the larva have been identified and their developmental histories elucidated. The chief site is the abdominal pericardial cell area, followed by the hemolymph, fat body, tracheal tubes, muscle, and imaginal discs. The common factor in the *tu-e* (tumorous) strain were spindle-shaped circulatory cells which first appeared in the caudal hemocoele at 72 hours of larval development.

Since the abdominal pericardial area tumor showed the greatest frequency, its development is described. (See plate). Three progressive phases can be identified in the development of the *tu-e* tumor. These are the, a) organization phase, b) enlargement phase, and c) melanization phase, which is divided into a peripheromelanotic stage and a centromelanotic stage. Since the process is a continuous one, some overlapping occurs in the figures used.

a During the organization phase, loose clusters of spindle cells (B) begin to aggregate around the abdominal pericardial cells (A), (Figs. 1 & 2); this aggregation is coupled with a rather slow increase in tumor size (Fig. 2) and occurs between 72 and 114 hours of larval development. Two types of spherical cells (C & D) become enmeshed in the organizing mass.

b) During the enlargement phase a major increase in tumor size

BULL. B. E. S. VOL. LI PLATE I



Figs. 1 & 2. Organization phase, (72–114 hours). Spindle cells (B) aggregating and isolating abdominal pericardial cells (A) located along the heart (I). Spherical cells (C & D) becoming enmeshed. Fig. 3. Enlargement phase, (114–120 hours). Major increase in tumor mass coupled with infiltration of the fat body

occurs (Fig. 3) in which individual pericardial cells are surrounded by large numbers of spindle cells. At this time adjacent fat cells (F) are incorporated in the tumor mass. In one such tumor, approximately 660μ in length, seven morphologically intact fat cells as well as six intact pericardial cells were counted. The end of the enlargement phase is indicated by the completion of a spindle cell sheath (E) which encloses the tumor mass (Fig. 4).

c) During the melanization phase (Figs. 4, 5, 6, 7) there is a gradual breakdown of some cellular components and a deposition of pigment (melanization) in others.

i) The breakdown of normal pericardial cells (AC) is first indicated in figure 5 and of the fat cells (EG) in figure 6. The destruction of these cells within the tumor mass and their maintenance in normal form in other body areas is clearly unusual.

ii) The onset of melanization is first indicated in figure 4 and occurs only in the spindle cells (G) and spherical cells (H & BD). Melanization in the *tu-e* tumor is an intra-cellular process, occurring only in those cells which are part of the tumor mass. The process of melanin deposition begins in the peripheral cells and progresses from cell to cell until all that remains of the tumor is an acellular mass containing necrotized fat and pericardial cells (Figs. 5, 6, 7).

Discussion

The *tu-e* tumors of Drosophila arise from abnormal spindle cells circulating in the hemolymph of the larvae which aggregate about certain normal cells (chiefly pericardial but also fat) at specific sites. The pigmented tumors are not destroyed (histolyzed) during pupal metamorphosis and persist in the adult as acellular melanotic masses. The exact origin of the responsible spindle cells is not known, but the association of spindle cells and tumorous strains in general is well established; conversely the absence of spindle cells

(F) by spindle cells. Fig. 4. Melanization phase, (114–120 hours). Onset of melanin formation in spindle (G) and spherical cells (H). Completion of the spindle cell sheath (E). Fig. 5. Peripheromelanotic stage, (120–126 hours). Melanized tumor cells are now arranged in a ring surrounding the central amelanotic mass. Pericardial cells are becoming necrotic (AC). Large spherical cells are melanized (BD). Fig. 6. Centromelanotic stage, (pupa and/or adult). The tumor mass has become completely melanized except for the peripheral sheath. Fat cells are now necrotic (EG). Fig. 7. Completely melanized, acellular mass, (pupa and/or adult).

in non-tumorous strains is recognized. It has also been demonstrated that spindle cells which have not undergone histological change (melanization) are destroyed during pupal metamorphosis while those that have melanized to any degree persist into the adult (Moser 1956).

Melanin deposition is a normal biological process found in a wide variety of animal tissues, both invertebrate and vertebrate, which basically involves the enzymatic polymerization of the amino acid tyrosine by tyrosinase. A distinct feature of the *Drosophila* melanoma is the precocious deposition of melanin within the tumor cell.

The foregoing statements represent the present thinking concerning the histogenesis of the *tu-e* melanoma. Less definite information is available concerning the lethal effects of this tumor. It does appear that this strain is more difficult to maintain than the non-tumorous, ebony-scarlet strain from which it was derived.

Several additional problems can be raised, the answers to which may shed light on the problem of mammalian tumor formation in general and on melanomas in particular. These are

1. the role of the gene in tumor cell induction
2. the factors involved in tumor localization
3. the relationship between tumor development and the hormones controlling growth and differentiation
4. the relationship between the tumor cells and the destruction of the tissues it infiltrates
5. the role of melanization in tumor development
6. the factors which govern the specific pattern of melanin deposition in the tumor mass.

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PHOSPHATASES OF THE HOUSE FLY, MUSCA DOMESTICA

By Morris Rockstein,* New York, N. Y.

The biological role of the monophosphoesterases in metabolism of proteins, in the possible dephosphorylation of certain hexose phosphates, in bone formation and in active transport across a gradient barrier in living organisms has been thoroughly reviewed by Moog (1). The relatively limited literature concerning the importance of these enzymes in insects more specifically has been reviewed by Fitzgerald (2) and by Rockstein and Herron (3). Since that time, comparative data on the quantitative differences in activity of alkaline and acid glycerophosphatase in six species of insects have appeared by this author and Levine (4) and with Inashima (5).

In an extended investigation of certain aspects of intermediary metabolism in the adult house fly, a preliminary study was undertaken to establish certain features of the chemistry of and optimal conditions for studying these enzymes in this insect. This report represents a summary of such data.

Experimental[1]

Enzyme activity was studied by modifications of methods described earlier (3), in which total homogenates are incubated with substrate in the presence of Mg ions, at 35° C., following which released phosphate is estimated in aliquots of the deproteinized incubation mixture.

Homogenizing Procedure: Adult house flies 24 hours old were inactivated by rapid freezing (6) and stored at −20°C. until needed. Twenty male flies were homogenized with 1 ml. of ice-cold water for three minutes in a mechanically-driven Elvehjem-Potter glass homogenizer (with Teflon pestle) in an ice-bath. The homogenate was decanted and the pestle and cup each washed three times with one-ml. quantities of cold water (deionized) onto a 20 mg. disc of washed glass wool (Pyrex 800) exactly fitting the 25-mm. inner diameter of a Hirsch (Coors 000A) funnel. The funnel was rinsed with 1-ml. volumes of cold water. The filtrate was collected under moderate suction directly into a 10 ml. volumetric flask by means

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[1] All procedures preceding incubation were done in the cold room at 5°C.; deionized water was employed in preparations of reagents or homogenate suspensions.

of a microsuction flask, for 10 minutes, and diluted to mark with cold water. Preceded each time by mixing by inversion three times, 0.5 ml. aliquots of diluted homogenate were delivered into individual shell vials, which later served as incubation tubes. These were either used immediately or stored frozen at −20°C.

Enzyme Procedure: Into each vial containing 0.5 ml. homogenate, was delivered 0.5 ml. of ice-cold 0.5M Na_2 beta-glycerophosphate (Eastman Kodak) dissolved in 0.424 per cent sodium diethyl barbiturate (barbital) (Merck) buffer, 0.25 ml. of 0.8M $MgCl_2$, plus a drop of chloroform.[2] The stoppered vials were inverted three times for complete mixing, placed in a constant temperature water bath and incubated for 25 minutes, in addition to an initial 5-minute warm-up period. Controls (one for each experimental) consisted of incubation mixture identical with experimental mixtures, except that they were inactivated exactly at the end of the 5-minute warm-up period.[3] Inactivation (and deproteinization) was effected at the termination of the incubation period by the rapid addition to each ml. of incubation mixture of 0.2 ml. of 30 per cent trichloroacetic acid; this was followed by complete mixing, a 5-minute wait, and filtration for 7 minutes through a (4.25 cm.) disc of (No. 42 Whatman) filter paper folded into a small (one-inch) glass funnel. Phosphate content of 0.2 ml. samples of this deproteinized filtrate was estimated by the author's adaptation (7) (to microgram estimation) of Sumner's ferrous sulfate-acid molybdate method for determining inorganic phosphate. Absorbance was read at 720 mμ in the Beckman (DU) spectrophotometer; final activity was calculated from the net absorbance (experimental minus control value) in relation to that of the standard phosphate sample.

Results[4]

[2] For each set of determinations concerned with variation in a particular parameter, conditions were exactly as stated, except for the particular variable under consideration. For details see legend of each figure (below).

[3] Preliminary determinations established that there is no significant difference between controls, identical with experimentals except for prior inactivation by heating, and such "zero-time" controls.

[4] Activity is expressed in micrograms P' released 25 min 0.2 ml. deproteinized incubation mixture, at 35°C. (except where time or temperature has been varied). Unless otherwise stated each plotted point in Figs. 1–5 represents the median value from five to eight sets of determinations.

Enzyme Concentration: Figure 1[5] shows a direct proportionality between activity and enzyme concentration, expressed as ml. of homogenate. All samples of this homogenate less than the usual 0.5 ml. were made to 0.5 ml. by addition of appropriate volumes of deionized water. On the basis of this study, for all future experiments 0.5 ml. volumes of diluted brei from homogenization of 20 flies were employed, each of the 0.5 ml. aliquots representing the

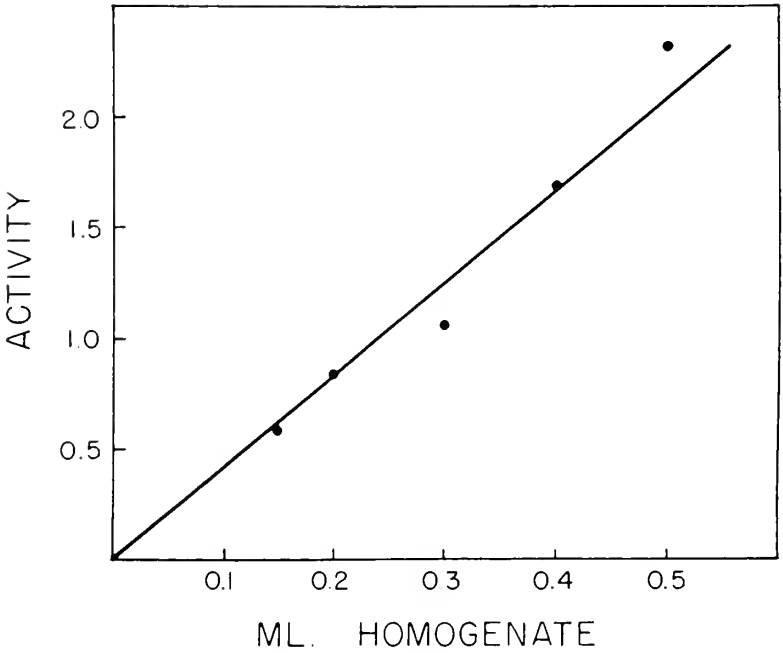

Fig. 1. Alkaline phosphatase activity and enzyme concentration; variable homogenate (30 male flies, 24 hrs. old, per 10 ml.), 0.5 ml. 0.5M substrate, 0.25 ml. 0.8M $MgCl_2$, pH 8.4; incubation time 25 min. at 35°C.

filtered and diluted homogenate from one fly (of 10 mg. average fresh weight) of known sex and age.

Substrate Concentration: Figure 2 shows the effects of increasing concentration of substrate[6] upon the enzyme activity, as the

[5] Straight line of figures 1 and 5 were drawn by the method of least squares.

[6] Serial dilutions were made with 0.424 per cent Na barbital buffer solution.

latter is maintained constant. Activity is seen to rise rapidly with increasing substrate concentration especially up to about 0.5M after which a decline in rate of increase in velocity is observed.

Varying pH: Figure 3 shows the effect of varying pH by the

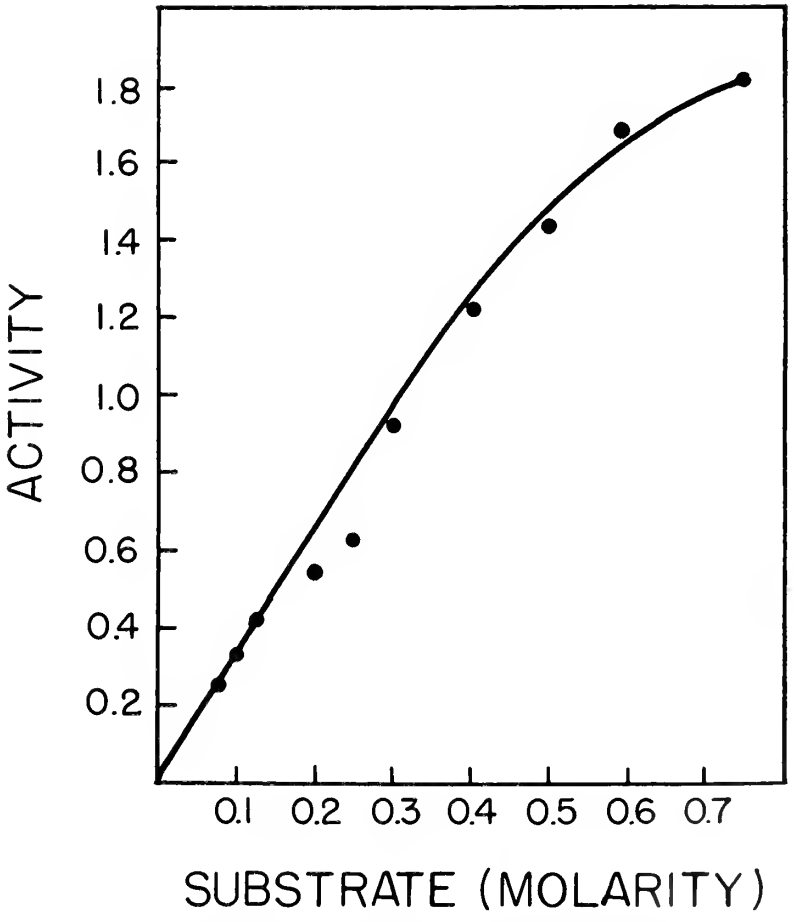

Fig. 2. Alkaline phosphatase activity and substrate concentration; conditions exactly as in Fig. 1, except substrate varied from 0.075 M- 0.75M- each dissolved in 0.424 per cent barbital buffer solution, homogenate 0.5 ml. (20 male flies 10 ml., 24 hrs. old).

addition of varying amounts of acetic acid or NaOH to an incubation mixture as described for the figure. A typical pH activity

curve is seen, except that at pH above 9.5 no further data could be obtained because of the formation of a white precipitate at higher pH values; optimum pH in the acid range is 5.7 with a secondary alkaline maximum somewhere above 9.0. (Table 1 shows the relation of pH of incubating mixture to acid or base added.)

Kinetics: Figure 4 shows the change in activity, expressed as

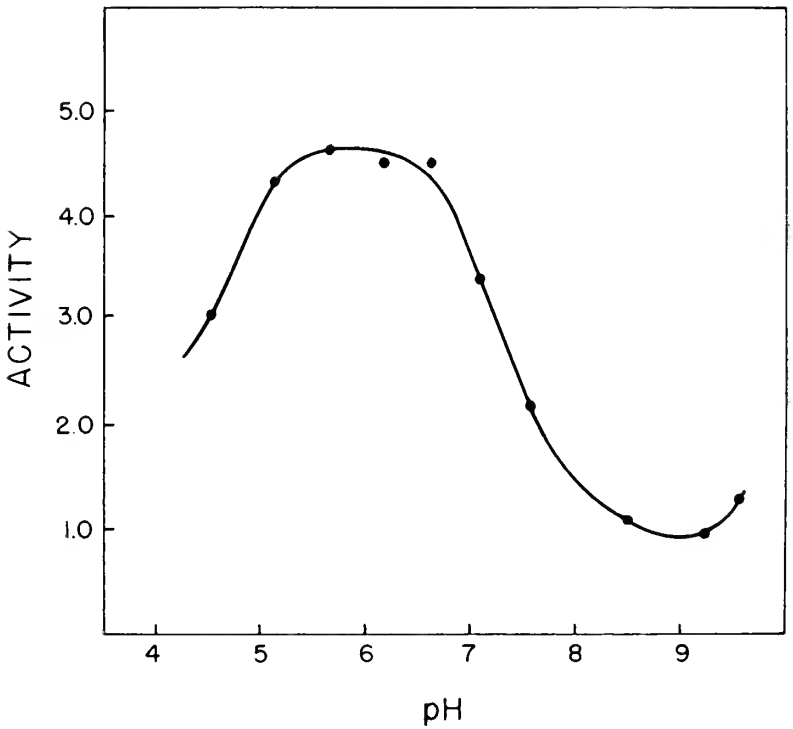

Fig. 3. Phosphatase activity and pH; 2 ml. homogenate (20 males/10 ml., 24 hrs. old), 0.8 ml. 1M substrate in 0.848 per cent Na barbital buffer solution, variable AcOH or NaOH (as shown in Table 1), 1 ml. 0.8M Mg Cl_2, pH variable from 4.5–9.5, incubation time 25 min. at 35°C.

total phosphorus released for each stated interval of time. For the first 40 minutes of time, under the particular conditions of enzyme study, a zero order reaction (*i.e.,* activity per unit time is constant) is seen to prevail. This, of course, indicates that the substrate is maintained in excess, with the (theoretical) substrate-enzyme com-

plex determining the speed of reaction. In this connection, it should be emphasized that preliminary studies of the kinetics of the alkaline enzyme were made for each of the previous studies, except for the pH study, to insure working under such conditions that substrate remained in excess and a zero order reaction was thus maintained for the limits of each experiment.

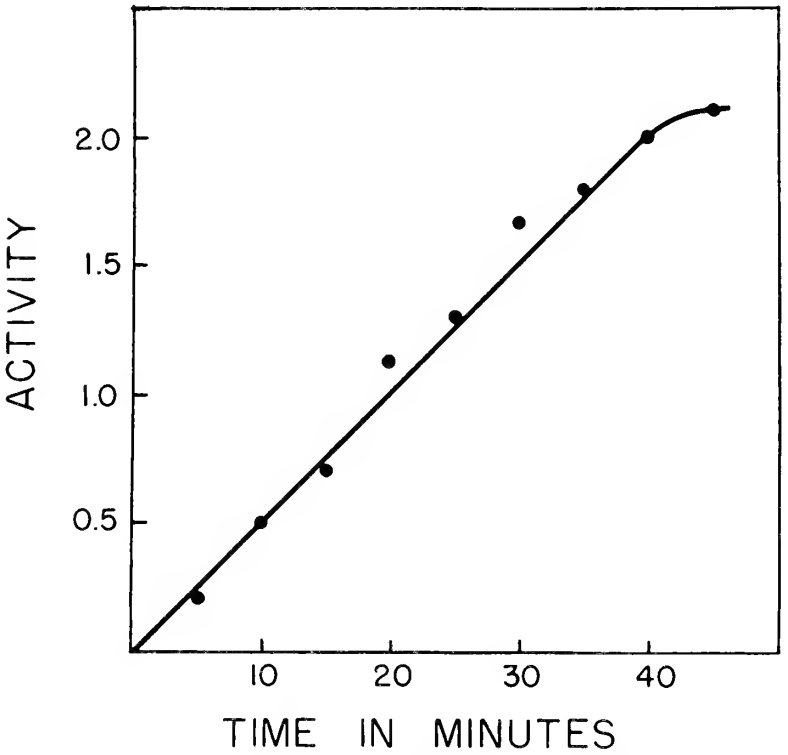

Fig. 4. Kinetics of alkaline phosphatase; conditions exactly as in Fig. 1, except 0.5 ml. of similar homogenate (20 males 10 ml., 24 hrs. old) and time varied from 5 to 45 min.

Temperature Effects: Figure 5 shows the effects of varying temperature upon enzyme activity, under time, enzyme and substrate conditions established to be optimal earlier. A representative curve is seen, with activity falling off above 40°C., the optimal temperature, which fall-off suggests inactivation of the enzyme itself. Below 20°C. activity was too low to be estimated, even by this sensitive colorimetric method.

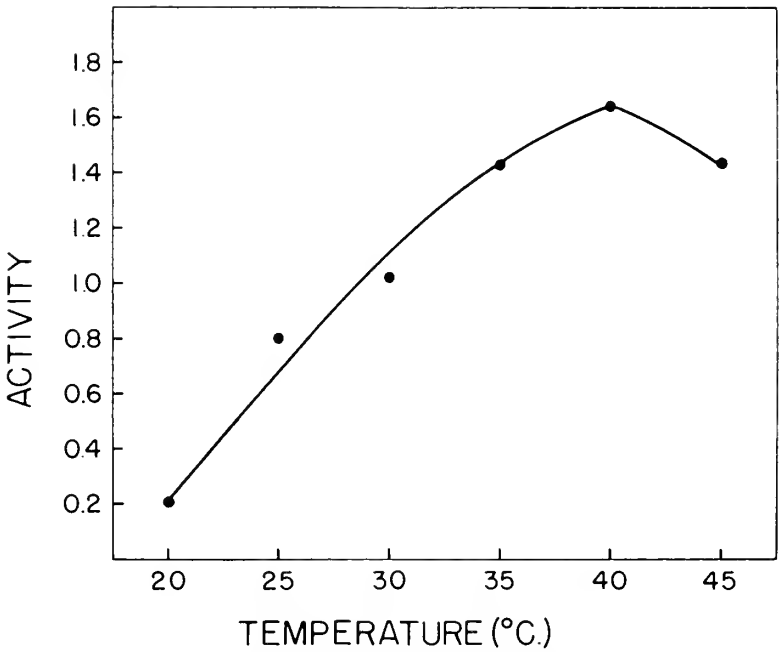

Fig. 5. Temperature and alkaline phosphatase; conditions as above, for 25 min. incubation periods at varying temperatures, as indicated.

Table 1. The pH of incubating mixture* with addition of acid or base

Acid or Base Added	pH
1.2 ml. 1N AcOH	4.5
0.7 ml. 1N AcOH	5.1
0.4 ml. 1N AcOH	5.7
0.2 ml. 1N AcOH	6.2
0.4 ml. 0.25N AcOH	6.6
0.2 ml. 0.25N AcOH	7.1
0.1 ml. 0.25N AcOH	7.6
1.2 ml. H_2O (deionized)	8.4
0.2 ml. 0.1N NaOH	9.2
0.8 ml. 0.1N NaOH	9.5

* 1M substrate in 0.848% barbital solution; where less than 1.2 ml. of acid or base was added, this total volume was obtained by addition of sufficient cold water.

Activating Ions: Table 2 shows the effects of varying concentrations of Mg ions and of employing other divalent cations in incubation mixtures for alkaline phosphatase estimation. pH values did not vary significantly for the various mixtures containing different $MgCl_2$ concentrations; the pH values for mixtures containing other

Table 2.† The effect of Mg^{++} and other divalent ions on alkaline enzyme activity

Ions		Net Absorbance
Series 1—$MgCl_2$	0.01M	0.019
	0.08M	0.023
	0.40M	0.025
	0.80M	0.029
	2.00M	0.027
Series 2—$MgCl_2$	0.20M	0.021
	0.40M	0.034
	0.80M	0.030
	1.00M	0.030
	2.00M	0.028
Series 3—$MgCl_2$	0.40M	0.040
	0.60M	0.040
	0.80M	0.041
	1.00M	0.042
	1.50M	0.035
	2.00M	0.025
Series 4—0.80M	$MnCl_2$ (7.8)	0.084
	$CoCl_2$ (7.4)	0.085
	$FeCl_2$ (—)	0.126
	$MgCl_2$ (9.0)	0.125
	$CaCl_2$ (8.5)	0.018

† Incubation mixture—0.5 ml. of homogenate (20 flies 10 ml.), 0.5 ml substrate (0.5M in 0.424 per cent barbital for all but series 4, where 1M in 0.848 per cent barbital buffer was used), 0.25 ml. of solution of divalent ions; incubated at 35°C. for 25 min.

cations are shown in parentheses. Original concentrations of ions are given for the 0.5 ml. volumes added. Each absorbance value is the median of three different determinations; for all incubation mixtures of each series of determinations, aliquots of the same homogenate were employed.

Discussion

Inasmuch as the major objective of this series of studies was a quantitative characterization and classification of a monophosphoesterase system concerned with splitting Na beta-glycerophosphate, the results obtained place the alkaline enzyme in class A1 of Folley and Kay (8, 9) or type I of Roche (10) on the basis of pH optimum and Mg ion activation, as in the case of the honey bee (3). However, purely in terms of pH optima, the alkaline enzyme would fall into category 1 and the acid enzyme into category 3 of the original Bamann-Meisenheimer classification of these phosphatases (11). As Roche states, crude tissue extracts, containing mixtures of isodynamic enzymes, are difficult to classify correctly in view of the uncertain comparative purity of different preparations. Nevertheless, it is significant that the alkaline enzyme of house fly extracts has a similar pH optimum and is activated strongly by Mg, Co and Mn but not by Ca ions like Roche's type I phosphomonesterase.

The optimal temperature of 40°C. found here corresponds closely to that reported previously for alkaline phosphatase in a number of other invertebrates (12) and in mammals by Bodansky (13).

Kinetics data agree well with those previously reported by Fitzgerald (2) and by the present author (3) for alkaline phosphatase as well as for hydrolytic enzymes in general by Van Slyke (14). Under the conditions described above, for further quantitative study of this enzyme system in the adult house fly it is suggested that a maximum of 30 minutes incubation be employed to insure the maintenance of a zero order reaction.

The possible role of this enzyme system in the normal biochemistry of the insect species in question has been suggested at length earlier by the present author (3, 15) in relation to previously reported correlative changes in glycogen content and motor ability with physiological fatigue in flying insects. Recent findings by this author (to be published) show a strong parallelism in quantitative distribution of this phosphatase system and of adenosine triphosphatase in the adult house fly, in relation to development, maturation and aging.

Based on the details of optima for the various parameters considered in this report, the following recommended conditions are currently being employed in a study concerned with certain aspects of phosphorus metabolism in the adult house fly:

Alkaline Enzyme	Acid Enzyme
0.5 ml. homogenate (as described)	0.5 ml. homogenate (as described)
0.25 ml. 0.8M $MgCl_2$	0.25 ml. 0.8M $MgCl_2$
0.5 ml. 0.5M substrate in 0.424% Na barbital	0.2 ml. 1M substrate in 0.828 % Na barbital
	0.3 ml. 0.33N AcOH

The author acknowledges the technical assistance of Mr. Don A. Belden, Jr.

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Summary

1. Details of preparation and study of an enzyme system hydrolyzing Na beta-glycerophosphate are presented, for total tissue extracts of the adult house fly.

2. A pronounced maximum activity was seen at pH 5.7 and a second maximum suggested somewhat above pH 9.0. Acid activtiy was considerably higher than alkaline.

3. Under the stated conditions of study a zero order reaction obtained up to 40 minutes of incubation.

4. The optimal temperature for conditions stated was 40°C.

5. Mg, Mn, Co and Fe ions strongly activated the alkaline enzyme; Ca ions were relatively ineffective as activators.

6. Based on these data, recommended conditions of study of alkaline and acid enzyme are presented.

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A LIST OF THE SPECIES OF ROMBLONELLA INCLUDING TWO GENERIC TRANSFERS (HYMENOPTERA, FORMICIDAE).

By Marion R. Smith,[1] Washington, D. C.

An examination of the types of *scrobiferum* Emery and *clysii* Mann originally described as *Tetramorium* indicates that these species belong in the genus *Romblonella*. Several species now standing in *Romblonella* are very closely related, but it has not yet been possible to determine their exact taxonomic status. Below are listed all known species of *Romblonella*, including *scrobiferum* and *clysii*, with original bibliographical references, type localities, and museums in which type material has been deposited. The names of most of these museums have been abbreviated as follows: United States National Museum (U.S.N.M.), Harvard University Museum of Comparative Zoology (M.C.Z.), Bishop Museum (Bishop M.).

Genus Romblonella Wheeler

Genotype: *grandinodis* Wheeler, Monobasic

clysii (Mann) n. comb.
(= *Tetramorium scrobiferum* var. *clysii* Mann), 1919, Harvard Univ., Mus. Comp. Zool. Bul. 63: 346–347, fig. 29, *worker;* Malapaina, Three Sisters, British Solomon Islands; U.S.N.M., M.C.Z.

grandinodis Wheeler, 1935, New England Zool. Club Proc. 15: 7–9, fig. 2, *worker;* Romblon Island, Philippines; U.S.N.M., M.C.Z.

palauensis M. R. Smith, 1953, N. Y. Ent. Soc. Jour. 61: 164–167, *worker, male;* Auluptagel (Aurapushekaru) Island, Palau Islands; U.S.N.M., M.C.Z., Bishop M.

scrobiferum (Emery) n. comb.
(= *Tetramorium scrobiferum* Emery), 1897, Term. füzet. 20: 587, pl. 15, fig. 31, *worker;* Berlinhafen, New Guinea; Museo Civico di Storia Naturale, Genoa, Italy.

townesi M. R. Smith, 1953 (1952), Hawn. Ent. Soc. Proc. 15: 76, 80, *worker;* Mt. Lasso, Tinian Island, Marianna Islands; U.S.N.M., M.C.Z.

vitiensis M. R. Smith, 1953 (1952), Hawn. Ent. Soc. Proc. 15: 76, 79, *worker;* Wakaya, Fiji Islands, Bishop M.

yapensis M. R. Smith 1953 (1952), Hawn. Ent. Soc. Proc. 15: 76, 78, *worker;* Yap Island, Caroline Islands; U.S.N.M., M.C.Z., Bishop M.

[1] United States Department of Agriculture.

KALM'S (1754) ACCOUNT OF THE NORTH AMERICAN "WOOD-LOUSE" (AMBLYOMMA AMERICANUM LINNÉ, 1758)

By Joseph C. Bequaert, Cambridge, Mass.

A recent issue of the *Annals of the Entomological Society of America* (1955, **48**, No. 3, pp. 178–181) brings a most welcome translation by Miss Esther Louise Larsen of Pehr Kalm's original Swedish account of the North American "wood-louse." To students unversed in the Swedish language this was available thus far only in Kästner's German translation of 1756 (*Abhandl. Kön. Schwedisch. Akad. Wiss., Hamburg and Leipzig*, 16, pp. 21–30). Kalm mentioned the "wood-louse" also briefly in Vol. 3 of his *"Resa till Norra Amerika"* (Stockholm, 1761, p. 233), of which translations were published in German (Leipzig, 1754–1764), English (London, 1770–1771) and Dutch (Utrecht, 1772).

Kalm's account is of considerable interest to American students of ticks. It is the first one detailed enough to be definitely assigned to an American tick and to be recognizable as to genus and species. For this reason a few points raised by Miss Larsen's translation should be clarified. In the early Swedish (1754) and German (1756) versions Kalm's creature is called "Skogs-Löss" or "Waldlaus." In Kalm's later *"Travels,"* however, the term "wood-lice" is followed by *"Acari americani"* or *"Acarus americanus* Linn.," a name which Linné had proposed meanwhile in the 10th Edition of the *Systema Naturae* (1758, 1, p. 615).

Although Miss Larsen translated the word "Skogs-Löss" correctly as "wood tick," her explanatory footnote (p. 178), "probably *Dermacentor variabilis* Say," is rather disconcerting. Most probably Kalm observed more than one species of ticks in the course of his extensive wanderings through what are now the states of Maryland, New Jersey, Pennsylvania and New York, so that his observations may be to some extent a composite. Nevertheless, there can be no doubt that his main description of 1754 refers only to the tick now generally called *Amblyomma americanum*.

It is not known whether or not Kalm brought back to Sweden specimens of North American ticks. His description is evidently based on a most careful examination of specimens and it is hard to believe that he could have done this in the field or from memory. In any case, it is so complete and precise that the identification of the species offers no difficulty. In the area visited by Kalm, there is only one tick in which "the body is dark red in color, shiny with a tiny white spot in the center of the back," namely the female of

Amblyomma americanum. Owing to this peculiarity, this species bears the vernacular name "lone star tick." Kalm's further statement that "the spot is in some instances lacking," refers correctly to the male of *A. americanum*. His Latin name, "*Acarus ovalis planus ruber, macula dorsali alba*," also mentions the specific character of the female. It is, of course, a descriptive phrase, as was customary before strict binomials came into use.

Linné's original description of *Acarus americanus* (1758) was very brief: "*A. obovatus rubicundus scutello geniculisque pedum albidis. Kalm Act. Stockh. 1754. Habitat in America.*" His species was recognized as a tick and transferred to *Ixodes* by Fabricius (1805, *Syst. Antliatorum*, p. 355) and later by C. L. Koch to his genus *Amblyomma* (1844, *Arch. f. Naturgesch.*, 10, Pt. 1, p. 229), where it is now generally accepted. So far as known, no original Linnean type of *Acarus americanus* exists at present. There is even a possibility that Linné never saw a specimen, but merely based his species on Kalm's unusually detailed and precise account. *Amblyomma americanum* of Kalm and of present-day students of ticks does not have white articulations ("knees") of the legs. These are not mentioned by Kalm, who describes the legs correctly as "pale red, not quite as red as the body." Could it be that Linné obtained specimens of some other American tick, either from Kalm or from some other source, which he thought by error to be the tick described by Kalm? Linné's description actually fits *Dermacentor albipictus* Packard, the northern "moose tick," better than *Amblyomma americanum*. Kalm might well have obtained moose ticks during the journey from Saratoga to Lake George which he describes in some detail, noting that ticks were more than usually plentiful (English Edition of his "*Travels*," 2, p. 303). In spite of this uncertainty, however, there is no need to replace *Amblyomma americanum* by one of the other names that were applied later to the "lone star tick," in view of Linné's reference to Kalm's article of 1754, where only this species is described.

In a footnote to Miss Larsen's translation (p. 179), the Editor of the *Annals* suggests that Kalm may have confused "chigger" mites and ticks in his description of the effects of the bite on humans, particularly where he mentions the lumps caused on the skin. Although Kalm may have confused these two pests in the southern part of the area he visited, it should be noted that he travelled more in the northern sections, where chigger mites are either uncommon or absent particularly in the woods. Moreover, all the symptoms described by Kalm as the effect of the bites, including the formation of hard lumps where the tick has been im-

bedded, actually result from the attacks of *Amblyomma americanum*, especially from those of its larvae or seed-ticks. In my own experience and that of others, the bite of *A. americanum* is more virulent to humans than that of most North American ticks, the effects being more troublesome and lasting longer than those of chigger mite bites. The irritation and other skin reactions persist in most persons for several weeks, even after the tick has been carefully removed, as Kalm noted for the lumps.

Additional information on the distribution and natural history of *Amblyomma americanum*, as well as more complete bibliographical references, may be obtained from my revision of the ticks of the Northeastern United States (1946, *Entomologica Americana*, 25, pp. 181–189).

Aphrophora alni In North America: I recently received shipments of unidentified spittlebug specimens from Mr. W. R. Richards, Insect Systematics and Biological Control, Science Service, Department of Agriculture, Ottawa, Ontario, and from Mr. G. B. Wiggins, Division of Entomology, Royal Ontario Museum of Zoology and Palaeontology, Toronto, Ontario, seventeen of which proved to be *Aphrophora alni* Fallén. This species was formerly known to be quite common in certain areas of the Palearctic region, but these are the first Nearctic records. The material of this species is as follows, the capital letters in parentheses following each citation indicating whether the material belongs to the Canadian National Collection or to the Royal Ontario Museum: Ontario, Canada.—Cedarvale [Toronto], August 6, 1927, C. Hope, 1 ♂ (ROM); East Oro, August 13, 1952, G. B. Wiggins, 2 ♀ (ROM); Leskard, July 7, 1952, G. B. Wiggins, 1 ♂ (ROM); Marmora, July 16, 1952, J. R. McGillis, 2 ♂, 1 ♀, August 5, 1952, C. Boyle, 1 ♀, September 10, 1952, R. Lambert, on goldenrod, 1 ♀ (CNC); Oro Station, August 12, 1952, G. B. Wiggins, 1 ♂ (ROM); Peterboro, August 16, 1952, C. Boyle, 1 ♂, 1 ♀ (CNC); Toronto, July 8–30, 1933, F. A. U., 2 ♂, 2 ♀, August, 1937, 1 ♂ (ROM).

Aphrophora alni might easily be mistaken for the Nearctic species *A. quadrinotata* or *angulata* on the basis of color pattern and for *A. parallela* on shape of male plates. However, this Holarctic species can be recognized from any other North American species north of Mexico by its broad dorso-lateral caudal projections on each side of the ninth segment. The apices of these projections are truncate and each bears a meso-ventrally extending hook-like process below.—Thomas E. Moore, Urbana, Illinois.

UNDESCRIBED CRANE-FLIES FROM TROPICAL AMERICA (DIPTERA, TIPULIDAE). PART I

By Charles P. Alexander, Amherst, Mass.

The novelties described herewith were received from various correspondents who are indicated under the various species. Except where stated to the contrary, the types are preserved in my personal collection of these flies.

Longurio (Tanypremna) fieldiana n. sp.

General coloration of head and body orange yellow; halteres small, the knobs weakly infuscated; wings with the ground faintly yellow, the base and costal border broadly bright yellow, stigma dark brown, conspicuous; basal section of vein M_{3+4} more than twice the second section.

Female: Length about 15 mm.; wing 11 mm.

Frontal prolongation of head light yellow, without nasus; palpi light brown, outer two segments broken. Antennae with scape and pedicel light yellow; flagellum broken. Head orange; anterior vertex broad, nearly four times the diameter of the scape.

Pronotum orange. Mesonotum chiefly yellow, unpatterned or virtually so. Pleura yellow. Halteres small, stem obscure yellow, knob more infuscated. Legs with the coxae and trochanters yellow; remainder of legs broken. Wings with a faint yellow ground, the prearcular and costal regions deeper yellow; stigma small, dark brown; veins heavy and very conspicuous, dark yellow in the brightened portions, elsewhere dark brown. Venation: Compared with *aurantiothorax*, *Rs* longer and more gently arcuated; *r-m* a little longer; basal section of M_{3+4} more than twice the second section.

Abdomen dull orange.

Habitat: Panama (Canal Zone).

Holotype, a broken ♀, Camp Butler, January 20, 1954 (Gordon Field).

I take great pleasure in naming this interesting species for Captain Gordon Field, to whom we are indebted for great series of insect specimens from Panama. The fly is allied to *Longurio (Tanypremna) aurantiothorax* Alexander, of the Cerro Azul, Amazonian Peru, agreeing in the general coloration of the body and wings, differing very evidently in the much heavier and conspicuous dark brown veins of the wing disk. Unfortunately, the male sex remains unknown.

Ozodicera (Ozodicera) carrerella n. sp.

Size large (wing of female over 20 mm.); flagellar branches of female stout, nearly as long as the segments; mesonotal praescutum gray, with four darker brown stripes, pleura and pleurotergite light silvery gray; femora brown, broadly brownish black basally, more narrowly so at tips, tarsi black; wings heavily patterned with brown and white, stigma light yellow; vein M_1 sinuous, cell M_1 broadly sessile; abdominal tergites gray brown medially above, blackened on sides.

Female: Length about 24 mm.; wing 21 mm.; antenna about 4.5 mm.

Frontal prolongation of head light brown; nasus distinct; palpi black. Antennae with the scape and pedicel light brown, flagellum brownish black, including the branches, the incisures narrowly yellowed; branches a little shorter than the segments but stouter. Head brownish gray; anterior vertex reduced to a narrow line that is only about one-third the diameter of the scape.

Pronotum brownish gray, clearer gray on sides. Mesonotal praescutum with the ground gray, clearer laterally, with four darker brown stripes, the intermediate pair separated by a capillary obscure yellow line that widens and darkens behind; posterior sclerites of notum light gray, each scutal lobe with two confluent brown areas; centers of scutellum and mediotergite weakly darkened. Pleura and pleurotergite light silvery gray; dorsopleural membrane dusky. Halteres with the stem brown, the base and the knobs brownish black. Legs with the coxae gray; trochanters brown; femora brown, more brownish black basally, more narrowly blackened at apex; tibiae reddish brown, the tips blackened; tarsi uniformly black. Wings heavily and handsomely patterned with brown and white, the dark ground more intense on the anterior two-thirds, paler as broad marginal darkenings in the outer medial and anal fields; the chief white areas include major marks in cells R and M; cell *1st* M_2 and bases of outer radial cells; outer half of cell R_1 and broad bases of all outer medial cells, most extensive in M_3, and broad bases of the Anal and Cubital cells; less evident brightenings at base of cell R_1 and end of cell R_3; stigma conspicuously bright yellow; prearcular region, except in anal portions dark brown; veins dark brown, more reddish brown in the whitened areas. Venation: Vein M_1 sinuous, widening cell R_5 at near two-thirds its length; cell M_1 very broadly sessile.

Abdominal tergites with the sublateral parts heavily gray pruinose, the lateral borders with a broad black stripe that is constricted

or narrowly interrupted at the cephalic part of each segment; mid-dorsal region of tergites paler brown, bordered by cinnamon brown; sternites infuscated, the basal rings paler; genital shield blackened.

Habitat: Brazil (Rio de Janeiro).

Holotype, ♀, Mount Itatiaya, 900 meters, October 3, 1951 (M. Carrera); type returned to Carrera.

This very attractive fly is named for Messias Carrera, distinguished student of Neotropical Diptera. In its striking wing pattern, the fly is most like the much smaller *Ozodicera* (*Ozodicera*) *eliana* Alexander, likewise from southeastern Brazil, differing in the coloration of the body, structure of the antennae, and in all details of wing pattern and venation.

Tipula (Trichotipula) selanderi n. sp.

Size large (wing, male, 14 mm.); abdomen very long; general coloration fulvous, the vertex and abdominal tergites patterned with darker; trochanters blackened; wings deep fulvous, stigma scarcely darker, veins dark yellow; male hypopygium with the posterior border of the tergite with a deep and narrow V-shaped notch, the margins with unusually abundant long black spines that are directed mesad.

Male: Length about 22 mm.; wing 14 mm.; antenna about 3 mm.

Described from an alcoholic specimen.

Frontal prolongation of head about as long as the remainder, orange; nasus long and slender; palpi brownish yellow, the outer segments darker. Antennae with the scape light brown, pedicel and first flagellar segment obscure yellow; remainder of flagellum black, the segments feebly incised, verticils shorter than the segments. Head above infuscated, the genae and the high entire vertical tubercle more fulvous.

Pronotum yellow, narrowly darkened medially above. Mesonotal praescutum and scutum orange, the posterior sclerites and pleura more yellowed; thorax glabrous. Halteres with stem pale, the knob a trifle darker. Legs with the coxae yellow; trochanters brownish black; remainder of legs broken except for a short fragment of a middle femur which is blackened, indicating the probability that the legs are uniformly black. Wings deep fulvous, the prearcular field, with cells *C* and *Sc*, more saturated, a little darker than the stigma; veins dark yellow. Macrotrichia in outer ends of cells R_3, R_5 and M_1, most numerous in R_5. Venation: R_8 gently arcuated; cell *1st* M_2 broader than in *vultuosa;* basal section of M_4 very long, perpendicular.

Abdomen very long, yellow, the tergites with a conspicuous

median brown stripe that is constricted at the incisures but is continuous; hypopygium yellow. Male hypopygium with the posterior border of the ninth tergite with a very deep and narrow V-shaped notch, the margins with unusually abundant long black spines that are directed mesad. Outer dististyle narrowed outwardly; inner style with the beak slender, lower beak heavily blackened.

Habitat: Mexico (Guanajuato).

Holotype, alcoholic ♂, Irapuato, 5,000 feet, August 1952 (R. K. Selander).

I name this distinct fly for the collector, Dr. Richard K. Selander, of the Illinois State Natural History Survey, student of the Meloidae. The most similar species is *Tipula* (*Trichotipula*) *vultuosa* Alexander, likewise from Mexico, which differs in all details of coloration of the body and appendages.

TWO NEW PARASITES OF THE YELLOW CLOVER APHID AND THE SPOTTED ALFALFA APHID (HYMENOPTERA: BRACONIDAE)

By C. F. W. Muesebeck[1]

Specimens of two species of the braconid subfamily Aphidiinae, which had been reared from the yellow clover aphid, *Pterocallidium trifolii* (Monell), and the spotted alfalfa aphid, *Pterocallidium* sp., at widely separated localities in Europe and in the United States, were recently submitted to me for identification. Since there has been no recent revision of the European Aphidiinae identification of European material belonging to this group is very difficult. Apparently, as is usual in such circumstances, misidentifications have been frequent and identified specimens in collections are accordingly often unreliable as a basis for comparison. In the case of the two species considered here, of which one belongs in *Trioxys* Haliday and the other in *Praon* Haliday, I have compared the available material with the descriptions of the known European forms and with authentic material of the known North American species, and have concluded that they are distinct. Since both species are being reproduced for liberation in areas of the United States that are infested with the two host aphids names are needed for them. They are accordingly described below.

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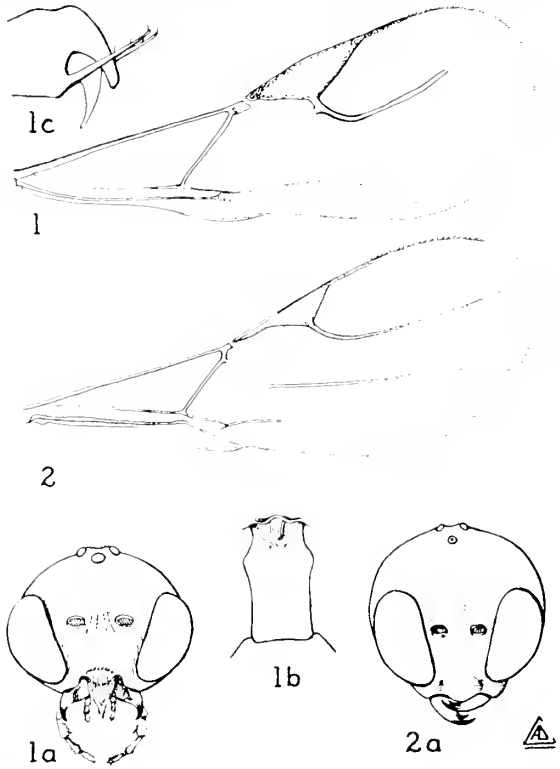
[1] U. S. National Museum.

Trioxys utilis n. sp.
(Figs. 1, 1a, 1b, 1c)

Apparently most similar to the European *complanatus* Quilis and the North American *aunicaceris* Smith, both of which it resembles in the unusual form of the first tergite. The former differs, however, in its smoother propodeum and in having the posterior prongs abruptly upturned at their apices, the latter in its



Trioxys utilis n. sp. 1, forewing; 1a, front view of head; 1b, first tergite; 1c, ovipositor, ovipositor sheath and posterior prongs. *Praon palitans* n. sp. 2, forewing; 2a, front view of head. Drawn by Arthur D. Cushman, Entomology Research Branch, U. S. Department of Agriculture.

distinctly areolated propodeum and in having the abdomen yellow apically.

Female: Length about 2 mm. Head smooth and polished; face at narrowest point not wider than extreme width of eye; eyes very

large; malar space not more than half as long as basal width of mandible; antennae shorter than body, 11-segmented. Mesoscutum smooth and shining, the notaulices sharply impressed on its anterior declivity, wanting on its dorsal surface; prescutellar sulcus deep and broad, not foveolate; propodeum mostly smooth but with some weak, indefinite carinae, the usual areas not distinctly defined; legs very slender; stigma more than twice as long as wide; radius about three time as long as width of stigma. First tergite nearly parallel-sided except for slight widening at the spiracles, smooth and shining, excavated at base, the spiracles before the middle; posterior prongs of last sternite virtually straight.

Black; scape, pedicel and first flagellar segment yellow; clypeus and mandibles light brown to piceous; legs yellowish brown, the femora, tibiae and tarsi, and sometimes even the coxae, more or less infuscated; wings hyaline, stigma clear, margined with brown; first tergite and base second yellow or yellowish; remainder of abdomen, including ovipositor sheaths and the prongs, black or blackish.

Male: Essentially like the female, but the antennae are 13-segmented and entirely blackish, and the legs are usually darker than in the female, sometimes largely blackish.

Type: U. S. National Museum No. 62983.

Type locality: Ciampino, Italy.

Described from 8 females and 5 males from the type locality, reared July 24, 1955; 2 females and 1 male from Cotia, Italy, reared August 9, 1955, and 2 females and 5 males from Bergerac, Dordogne, France, reared June 22, 1955. Although the individual aphids from which these specimens were reared were not identified it appears from identifications of similar aphid samples from the same areas that the specimens from Italy, reared by R. van den Bosch, were very probably from the spotted alfalfa aphid, and that those from France, reared by H. L. Parker were probably from the yellow clover aphid. Not included in the type series are several additional specimens, from Hopkinsville, Kentucky, reared July 14, 1955, from the yellow clover aphid by B. R. Bartlett, and a few from Lincoln, Nebraska, reared from the same host in 1955 by R. V. Connin. Detailed study has brought out no differences between these North American specimens and those from Europe.

Praon palitans n. sp.

(Figs. 2 and 2a)

Apparently more similar to the North American *simulans* (Provancher) than to any described European species. It resembles

simulans in the color of the head and thorax and in lacking a recurrent vein, but it may be easily distinguished from that species by its shorter malar space, narrower temples, smaller number of antennal segments, less hairy head and thorax and smaller size.

Female: Length about 1.7 mm. Head smooth and shining, weakly hairy; face at base of clypeus not distinctly as wide as an eye; malar space much shorter than basal width of mandible; temple at middle not, or barely, as wide as eye; antennae about as long as body, usually 17-segmented, rarely 16- or 18-segmented. Mesoscutum smooth and shining, sparsely hairy; notaulices complete, sharply impressed; propodeum polished, virtually bare; recurrent vein wanting or obsolescent; legs very slender. Abdomen smooth; first tergite parellel-sided from spiracles to apex, a little narrowed from spiracles to base, about one and one-half times as long as wide at apex.

Head black; face, clypeus and mandibles reddish yellow; antennae blackish, with scape, pedicel and first flagellar segment yellow; mesoscutum and scutellum black or blackish; remainder of thorax usually reddish yellow, with propodeum and upper part of the pleura occasionally more or less piceous; tegulae and legs yellow; wings hyaline, stigma and veins pale; first and second tergites yellow or yellowish; remainder of abdomen piceous or black.

Male: Like the female except that the antennae are normally 18- or 19- segmented and entirely blackish, the face is black, the entire thorax is piceous to black and the legs are more or less infuscated.

Type: U. S. National Museum No. 62984.

Type locality: Ostia, Italy.

Described from numerous specimens of both sexes from Ostia, Italy, reared August 9, 1955; Ciampino, Italy, reared July 24, 1955; Largiere, Villamblard and Bergerac, Dordogne, France, reared in June and July, 1955; Jordan and Hula Valleys, Israel, reared July 6, 1955; Yesodot, Israel, reared June 28, 1955, and Belgrade, Jugoslavia, reared August 22, 1955. Apparently the specimens from Italy, Israel and Jugoslavia, all reared by R. van den Bosch, developed as parasites of the spotted alfalfa aphid, *Pterocallidium* sp., while those from France, reared by H. L. Parker, came from the yellow clover aphid, *P. trifolii*. In addition to the above the National Museum has several specimens of the same species from Hopkinsville, Kentucky, reared from the yellow clover aphid July 12, 1955, by B. R. Bartlett.

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This page is limited to exchange notices and to small For Sale advertisements from members of the Society and from actual paid subscribers to the Bulletin exclusively. *Exchange notices* from members of the Society and from subscribers are limited to *three (3) lines each*, including address; beyond 3 lines, there will be a charge of $1.00 for each 3 lines or less additional. *For Sale* ads will be charged at $1.25 for each 3 lines or part of 3 lines. *Commercial or business* advertisements will not be carried in this page, but will go in our regular advertising pages at our regular advertising rates to *everybody.*

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BULLETIN

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BROOKLYN ENTOMOLOGICAL SOCIETY

VOL. LI APRIL, 1956 NO. 2

NEW SPECIES OF MOSQUITOES FROM THE SOUTHERN RYUKYU ISLANDS

By RICHARD M. BOHART,[1] Davis, California

During a survey of the mosquito fauna of Ishigaki and Iriomote Islands in the southern Ryukyus, two species were discovered which are apparently undescribed. They are given names here to facilitate the writing of a general paper on mosquitoes of the area. The collections were made while the writer was a participant in the SIRI Program of the Pacific Science Board, National Research Council, supported by contract funds from the Department of the Army. The types of the new species will be placed in the U. S. National Museum.

Relationships of the following species were worked out in part with the help of Dr. Alan Stone and Dr. K. L. Knight. Their assistance is gratefully acknowledged.

Toxorhynchites yaeyamae n. sp.

Male: Length of wing 6.0 mm. Head scales brownish purple with a narrow silvery anterior border widening laterally. Proboscis purple on basal one-half, greenish to blue on distal one-half; palpus about as long as proboscis, last segment nearly twice as long as penultimate, purple except for yellowish scales toward apex of II, broad medioventral spot on III and base of IV beneath; apn and ppn silvery, latter coppery above; scutum iridescent green tinted with copper behind head and with purple at wing base, some dark hairlike scales intermixed; scutellum brownish gold with a lateral silvery spot, bristles here and over wing base purplish; pleuron dark brown with heavy patches of silvery scales; wing membrane slightly darkened in crossvein area, crossveins close together; halter pale, knob silvery; legs mostly purple, femora yellowish toward

[1] University of California.

base and extensively beneath; tibiae all dark; fore tarsus all dark above, pale beneath toward base of I, a few scales on II, most of III and IV; mid tarsus dark outwardly, inner surface pale toward base of I, and whole length of II–IV; hind tarsus with inner surface of V and I toward base pale; abdominal tergites deep blue with some purplish lights, with laterobasal silvery spots on II–VIII; sternites pale golden except for an irregular median purplish line which is broadened into a band on VII. Dististyle very slender.

Female: Palpus purple, reaching middle of fourth flagellar segment; pale-scaled areas of tarsi more nearly encircling, broken mainly beneath; mid tarsus with II dark except for a few apical scales; laterobasal silvery spots on tergites I–III tending to form incomplete basal bands; sternites pale golden except for a few mediobasal dark scales on IV and a narrow purple line on VIII.

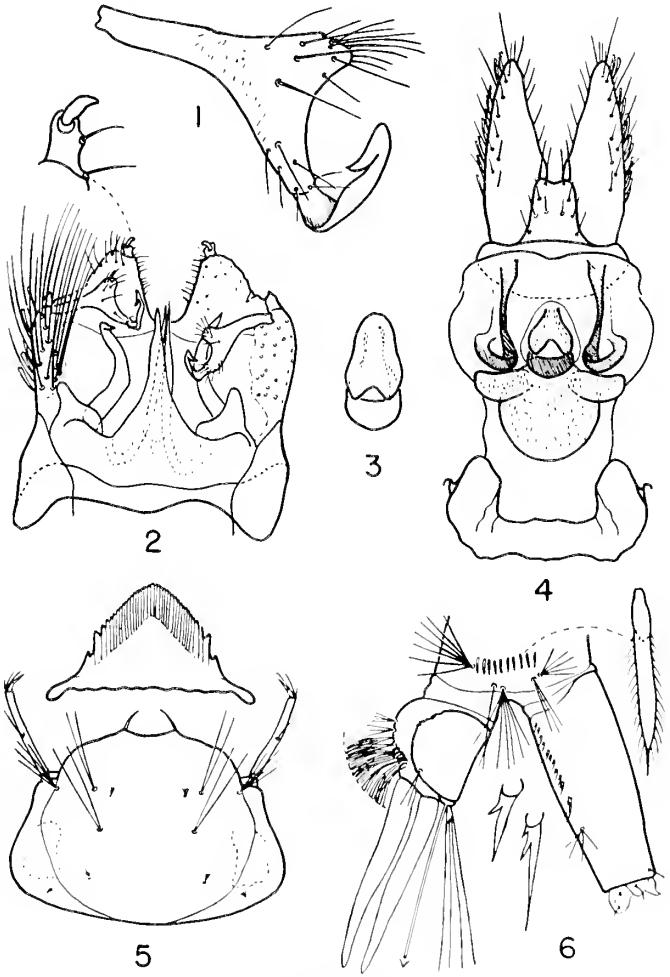
Pupa: Float hair of abdominal tergite I with about 4 main branches and many branchlets. On tergites II–VIII (numbering system of Belkin, 1953) hair 1 moderate and 3 to 5 branched on I and III, strong and single on IV and V, slender and inconspicuous on VI–VIII; hair 2 single, and strong only on IV–VI; hairs 3–6 inconspicuous; hair 7 usually single and small except on V and VI where it is stout and about a tergite in length. Paddle ovoid, distinctly emarginate near apex, an irregular dark line across basal one-seventh.

Larva: Head hairs 5 and 6 (or C and B) simple. Pronotal hairs 5 and 7 single and very stout, 5 about three-fourths as long as 7; mesonotal hairs 2 and 3 on separate small plate or plates; dorsolateral plate of tergites VI–VII with hairs, 1, 3 and 4 weak but 2 stout, nearly as long as siphon, and about equal to longer seta of plate on VIII; siphon tuft with 4 or 5 branches; siphon smaller than saddle but about as long; saddle margined distally with a row of alternating short and long setae on both sides of the lateral hair; isc with about 10 branches, osc with about 6.

Holotype: Male with associated larval and pupal skins, east fork of Nakara River, Iriomote I., Ryukyus, November 17, 1951, tree hole (R. M. Bohart). One female paratype and associated pupal skin, Shirahama, Iriomote Island, November 17, 1951, tree hole (R. M. Bohart); one paratype larva, same data but collected November 19, 1951; one female paratype, Yarabu Peninsula, Ishigaki I., November 4, 1951, tree hole (R. M. Bohart).

Systematics: The short female palpi place this species with the rest of the Oriental fauna in Edward's group C. Also, it belongs in the subgroup containing *kempi* (Edw.), *gravelyi* (Edw.), *metal-*

BULL. B. E. S. VOL. LI PLATE II



Anatomical details of *Culex ishigakiensis* n. sp. Fig. 1. Dististyle of holotype male. Fig. 2. Genitalia of holotype male from camera lucida drawing uncorrected for asymmetry due to mounting. Fig. 3. Atrial area of female genitalia from paratype. Fig. 4. Female genitalia from another paratype. Fig. 5. Head and mentum of fourth stage larval paratype. Fig. 6. Terminal segments of larval paratype.

licus (Leic.), *yamadai* (Ôuchi), *klossi* (Edw.), and *manicatus* (Edw.) in which there are no lateral scale tufts on the abdomen. From all of these *yaeyamae* differs in the tarsal markings. A particularly close relationship is seen with *yamadai* (northern Ryukyus and *manicatus* (Formosa) which occur on either side of it geographically. It differs from both by the silvery lateral scutellar spot and by having the tarsi more extensively white, with II–IV all white within but broken outwardly by a dark line. It is further distinguished from *yamadai* by the silvery halter knob, and from *manicatus* by the narrowly divided gold areas of sternites IV and VII.

Aedes (Aedes) ishigakiensis n. sp.

Male: Wing 2.3 mm. Antenna with about 10 verticillate bristles on most segments, torus light brown, darker within. Vertex with broad scales, dark except for a row along eye, a few between eyes and a lateral patch of pale ones; apn well covered with broad pale scales; ppn with 4 bristles posteriorly; scutum and scutellum with narrow brownish scales on a dark brown integument; pleuron with 4 patches of pale scales, 1 on propleuron, 2 on sternopleuron, 1 on upper mesepimeron; meteusternum bare, sternopleuron without hairs on anterior margin, no lower mesepimeral bristles; claws of fore and mid legs unequal, larger ones toothed; claws on hind legs small, equal, toothed. Abdominal tergites I–VII with laterobasal white spots, that on VII visible from above; sternites with basal pale bands. Genitalia (figs. 1, 2).

Female: Wing 2.8 mm. Posterior corner of ppn with 3 or 4 pale broad scales associated with bristles. Claws of all legs equal, toothed. Genitalia (figs. 3, 4).

Pupa (based on 22 skins): Trumpet with a sharp point at middle of outer edge. Abdominal hair 1 (C) moderate and with 3–6 fine branches on II–VII; hair 3 (B) stout, single and twice as long as hair 1 on II–III; hair 5 moderate and usually double on III, long and single (longest hair of abdomen) on IV–V; hair 7 (A) of VIII small, slender, double or triple. Paddle ovoid, apical and lateral margin finely serrate, paddle hair about one-sixth as long as rib, rather slender.

Larva (based on 36 paratypes): Head (fig 5): antenna sparsely spiculate, hair stout, single or double, located just before middle; clypeal spine slender, brownish; hair 4 (d) small, with 3 or 4 branches; lower head hair (5) double, stout and nearly as long as antenna, upper head hair (6) similar but rarely single; hair 7 with about 6 branches; mentum with about 33 fine teeth. Pronotal hairs

1–4 rather small and slender, 5–7 long and stout. Lateral abdominal hairs (6) single on II–VI; terminal abdominal segments as in fig. 6; comb of 9–12 scales; first pentad hair with 4 or 5 branches which are one-half as long as those of fifth; second triple, third with 5–9 branches, fifth with 6–8; pecten in a row of 11–14 gradually enlarging teeth with 1 or rarely 2 stout basal subteeth and 1 or more fine secondary teeth, pecten row on basal one-half of siphon, followed at distal two-fifths by 3–5 branched tuft; lh nearly twice as long as last pecten tooth, double; ventral brush of 10 large, branched hairs and 2 smaller ones before barred area; isc with 2–4 branches; gills equal, slender, tapering, nearly as long as siphon.

Holotype: Male, Mt. Banna, Ishigaki Island, Ryukyus, October 27, 1951, reared from a pure culture of larvae taken from a "fox-hole" in pine woods (R. M. Bohart).

Paratypes: 18 males, 56 females, 22 pupal skins, and 43 larvae and larval skins, same data as holotype.

Systematics: As pointed out by K. L. Knight (personal discussion, December, 1952), this species belongs in a group of the genus which includes *abditus* Barraud (India), *fragilis* (Leic.) (Malay Peninsula), *hamistylus* Laffoon (Philippines), *indecorabilis* (Leic.) (Malay Peninsula), *robertsi* Laffoon (Philippines), *uniformis* (Theo.) (India), and *yusafi* Barraud (India). The presence of white markings on the abdominal tergites differentiate it from *abditus, hamistylus, robertsi* and *uniformis.* From all of the species insofar as they have been described it differs by the spine-like median projection of male tergite IX, the shape of the dististyle and of the apical prolongation of the basistyle in the male, and the unusual bilobed shape of the bristly preatrial plate in the female.

Very few species of the subgenus *Aedes* have been described in the pupal stage. From the description and figure of *lineatus* (Taylor) by Penn (1949) *ishigakiensis* seems to differ chiefly in having hair 5 of abdominal tergites IV and V single rather than double, and hair 7-VIII fine and double or triple instead of medium coarse and 4–8 branched. In specimens of *cinereus* (Meigen) in my collection from Wyoming, hair 7-VIII is stout and single, and the longer oval paddles are more minutely serrate on the margin. Neither of the other species has the sharp, tooth-like projection on the trumpet rim that is found in *ishigakiensis.*

The larva differs from the 15 other species of the subgenus *Aedes* which I have seen figured in having the head hairs (5 and 6) almost invariably double whereas the other species have these hairs with 3 or more branches. According to the figures of Laffoon (1946) the

comb is much like that of *hamistylus*, and the siphon is similar to that of *dux* but with the distal pecten teeth less widely separated as a rule.

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RECORDS OF LANGURIID AND CALENDRID BEETLES (COLEOPTERA)

By Patricia Vaurie, New York, N. Y.

New distributional records for some of the species of the genera *Languria* and *Calendra* are published at this time to supplement revisions of these groups (Vaurie, 1948; 1951). Many new records have already been published for *Calendra* species in the United States and Mexico (McComb and Knowlton, 1952; Vaurie, 1954), and some for the family Languriidae in Missouri (Froeschner, 1953). Most of the material on which the additional data are based is in the collection of the American Museum of Natural History, but some of it has been examined from other sources.

Curculionidae
Genus Calendra Clairville and Schellenberg
Calendra tarda (Fall)

In my revision (1951, p. 74) the distribution of this species was given as Southern California and Wilcox, Arizona. Two specimens from Davis, California (McClay Collection), June 15, 1935, extend the range northward in California.

Calendra championi Vaurie

This species, described from southern Chihuahua, Durango, and Aguascalientes, Mexico, and subsequently taken in the state of Guanajuato (Vaurie, 1954), occurs also in Jalisco, as shown by 6 males and 2 females from Lagos de Moreno, Jalisco, August 3, 1954 (Cazier, Gertsch, Bradts).

Calendra venatus vestita (Chittenden)

This subspecies from the southeastern United States occurs also in Cuba, Puerto Rico, the Dominican Republic, and the Bahamas. In the latter group of islands, we now have one specimen each from two additional islands, from Grand Bahama Island, May 12, 1953, which is north of New Providence, and from San Salvador or Watling Island, March 18, 1953, which is southeast of New Providence. The collectors are Hayden, Giovannoli, and Rabb of the Van Voast-A.M.N.H. Bahama Expedition.

Calendra aequalis discolor (Mannerheim)

The occurrence of this northern California subspecies in Oregon was assumed to be a fact although I had seen no specimens from that state. I have now seen three males from Oregon (Kansas University Collection); they are typical specimens, nearly solid black above.

Languriidae

Genus Languria Latreille

Languria californica Fall

This rather uncommon species (I have seen only 10 specimens), known previously from southern California only, evidently ranges southward down the Pacific coast, as evidenced by a specimen from Santo Tomas, Baja California, Mexico, July 8, 1953 (J. W. & W. J. Gertsch).

Languria convexicollis Horn

Previous records of this species are from California, Arizona, Utah, and British Columbia. Additional records are from Washan Mts., Nevada, July 8, 1950 (H. B. Cott), and the following from Mexico: Arroyo Santa Maria, Baja California, 30°, 24′, March 29, 1950 (G. A. Marsh), in *Argemone platyceros hispida* (prickly poppy); 6 miles east of Villa Union, Sinaloa, July 23, 1954 (Cazier, Gertsch, Bradts).

Languria mozardi mozardi Latreille

In my 1950 paper, Texas was given as part of the range of *L. mozardi occidentalis*, as well as Arizona, Utah, and northern Mexico, all the Texas localities being in the central and southern part of the state. Additional specimens show that nominate *mozardi* occurs also in Texas, but in the extreme eastern part along the Louisiana border. These specimens are from Tenaha, Shelby County, May 9, 1952 (Cazier, Gertsch, Schrammel); Lufkin, Angelina

County, same data; 5 miles south of Huntsville, Walker County, same data; Longview, Gregg County, April 16, 1952 (J. C. & E. M. Hall). The eastern subspecies (*mozardi*) usually has the last three, instead of the last two, abdominal segments dark in color, and the femora with less (usually half) dark color than in the western subspecies (*occidentalis*).

Languria lacta LeConte

Three specimens of this central United States species were reported from Mexico (Vaurie, 1948) but without further locality. These localities were Paso del Macho, near Orizaba, Veracruz, and Jalapa, Veracruz. An additional specimen comes from farther north at Llera, San Luis Potosi, May 21, 1952 (Cazier, Gertsch, Schrammel).

The three other genera of the Languriidae that contain species inhabiting the United States (*Dasydactylus*, *Acropteroxys*, and *Langurites*) are not treated here because the additional species in these groups are all from Mexico and it is not certain which species they are. Further study of the Mexican species of this famiy is required.

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STUDIES OF THE GENUS EMPOASCA (HOMOPTERA-CICADELLIDAE) XV. FIVE NEW SPECIES OF MEXICAN EMPOASCA.

By Dwight M. DeLong and Magdalene P. Liles,[1]
Columbus, Ohio

The group of species described in this report are all pale in color and are marked with red or orange spots or broken longitudinal bands and superficially resemble species of *Erythroneura* of the *comes* or *obliqua* groups. The types of all of these species are in the DeLong collection.

Empoasca allera n. sp.

Resembling in general appearance an *Erythroneura* of the *obliqua* group with longitudinal reddish markings. Length male 3.5 mm.

Form narrow, crown well produced, blunt at apex, a little wider between eyes at base than median length. Wings appearing long and narrow.

Color, crown white with a pair of elongate reddish spots just above apex and a longitudinal band either side extending from the anterior margin across pronotum, basal angles of scutellum and onto basal portion of clavus. Each tegmina has an elongate reddish spot on the posterior portion of the clavus along the commissural line and an elongate reddish interrupted stripe extending from near base onto disc of the tegmina. Beneath pale yellowish.

Genitalia: Male plates rather broad. Styles short and thick with the apices abruptly narrowed, sharply pointed and curved outwardly. The lateral processes are rather long with the apical portions curved outwardly. The aedeagus is the usual type without accessory processes. The dorsal spine is rather broad at base and extends caudally then curves ventrally and is rapidly narrowed near apex to form a sharp pointed tip which is directed ventro anteriorly.

Holotype male collected on the Acapulco Rd. Mexico, November 22, 1938 by Dr. J. S. Caldwell.

Empoasca zebulona n. sp.

Resembling *allera* in general appearance but broader and more robust. Length male 3.5 mm.

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Crown broad, bluntly angled at apex with tip rounded, almost twice as wide between eyes at base as median length.

Color, crown, pronotum and scutellum white. A broad longitudinal stripe varying from yellow to red extends from apex of crown next the eye on each side across the pronotum, basal angles of scutellum and onto base of clavus. The tegmina are white with six rather large red spots or blotches distributed on the claval and discal areas resembling the markings of an Erythroneura. Beneath yellow.

Genitalia: Male plates long. The styles are short, broadened near middle with the apical half gradually narrowed to form outwardly curved pointed tips. The lateral processes are long, gradually narrowed on apical half to form divided pointed apices. The aedeagus in form is the usual divided apical third but the two portions are widely separated. The dorsal spine is rather long, widened beyond the middle so as to form a rounded lobe on the caudal margin from which a narrow anteriorly and slightly dorsally curved apical spine arises on the ventro anterior margin.

Holotype male collected at Puebla Pue, Mexico (K-78), October 18, 1941 by Good, Caldwell, Plummer and DeLong.

Empoasca sobella n. sp.

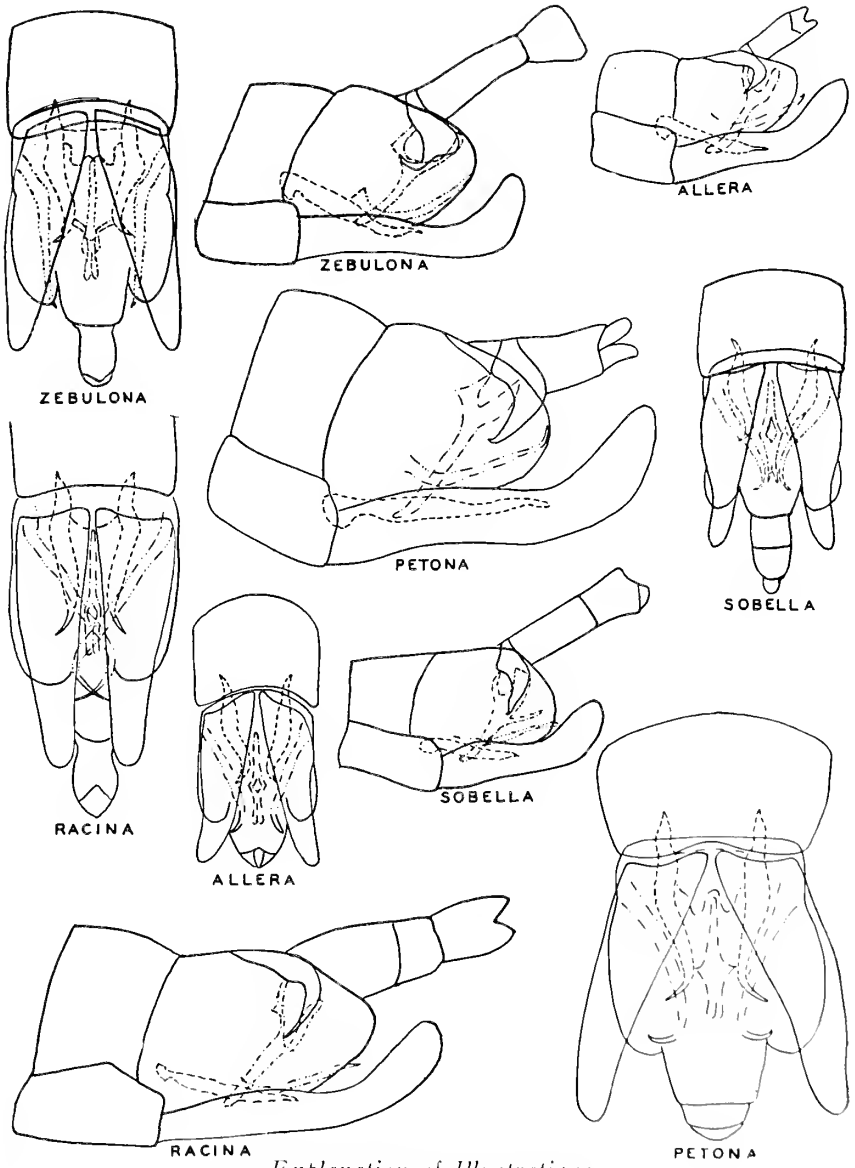
Resembling *allera* in general appearance and coloration but with broad head and distinct genitalia. Length male and female, 4 mm.

Crown broad, bluntly angled, not quite twice as wide between eyes at base as median length.

Color white with red and yellow markings. A dark yellowish longitudinal stripe extends from the margin of the crown across crown, pronotum and basal angles of scutellum. The portion on the crown encloses a pair of white areas on margin and a white spot next to either eye. The tegmina are marked with elongate reddish spots, two on clavus and three extending from base across corium. Face dark yellow with a broad white median longitudinal stripe.

Genitalia: Female seventh sternite with the posterior margin produced and bluntly rounded. Male plates elongate, apices rounded. Styles short broadened at middle, gradually narrowed to sharp pointed apices which are curved outwardly. Lateral processes long, gradually narrowed to slender pointed apices which are curved outwardly. The aedeagus is broadened at about two-thirds its length with the caudal apical portion continuing as a broadened portion. Two caudal processes arise on the ventro-caudal margin.

BULL. B. E. S. VOL. LI PLATE III



Explanation of Illustrations

Ventral and lateral views of male genitalia of species of Empoasca as labeled.

The one nearest the base is long and narrow. The process arising at about the middle of the aedeagus is less than half the length of the ventral process. The dorsal spine is broad and long, convexly curved on the caudal margin, concavely curved anteriorly on the anterior margin forming a rather thick, gradually narrowed and pointed apex.

Holotype male, allotype female and female paratypes collected at Rio Frio D. F. Mexico (K-56), October 21, 1941 by Caldwell, Plummer, Good and DeLong.

Empoasca racina n. sp.

Resembling *allera* in general form and appearance. White with faint farkings. Length male and female, 4 mm.

Crown angularly produced, apex blunt, one-third wider between eyes at base than median length.

Color white, crown, pronotum, scutellum and tegmina marked with pale yellowish elongate spots. The longitudinal line on each side across the crown, pronotum and scutellum is broken, especially on the crown. The pale elongate yellow spots of the tegmina are on the claval, discal, and basal portions.

Genitalia: Female seventh sternite with posterior margin produced and bluntly rounded. Male plates long, rounded at apex. Styles short with the apical fourth narrowed, sharply pointed and curved outwardly. The lateral processes are long, narrowed to pointed apices and are curved outwardly on the apical fourth. The aedeagus is bifid on the apical one-third, both apical portions are slender. The dorsal spine is long. The basal half is rather broad and extends caudally along the dorsal margin of the pygofer. It is then narrowed by a concavity on the ventral margin and is narrowed and bent sharply ventrally forming a long gradually narrowed, ventrally directed sharp pointed spine.

Holotype male and allotype female collected at Tres Cumbres D. F. Mexico (K-52), October 21, 1941 by Plummer, Caldwell, Good and DeLong.

Empoasca petona n. sp.

Resembling *allera* in general appearance but with distinct male genitalia. Length male and female, 3.5 mm.

Crown bluntly angled, one-third wider between eyes at base than median length.

Color white with orange reddish markings. A pair of orange red, longitudinal stripes extend from the margin of the crown

across crown, pronotum and basal angles of scutellum on to the clavus. The tegmina are marked with elongate reddish orange spots. There are four on clavus and three extending from base of tegmina almost to the anteapical cross veins and just anterior to claval vein.

Genitalia: Female seventh sternite produced and rounded on the posterior margin. Male plates long, apices rounded. Styles broadened at middle, then gradually narrowed on apical half to form slender pointed apices which are curved outwardly. The lateral processes are long, tapered from base to form slender apices which are bent sharply outwardly at right angles to the processes. The aedeagus is bifid on the apical one-fifth. The caudal portion continues with about the same width as the body of the aedeagus. The dorsal spine is long and broad, extending cando ventrally at base. At about its middle it is bent anterio ventrally and is narrowed to form a pointed apex.

Holotype male and allotype female collected at Tres Cumbres (K-52) D. F. Mexico, October 21, 1941 by DeLong, Plummer, Caldwell and Good.

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MISCELLANEOUS PREY RECORDS OF SOLITARY WASPS. II.[1] (HYMENOPTERA: ACULEATA)

By Karl V. Krombein, Arlington, Va.

Pompilidae

Anoplius (*Anoplius*) *ithaca* (Banks)

An unworn female (82855 A), 7.7 mm. long, was captured at 10 a.m. on August 28, 1955, at Derby, Erie Co., N. Y. She was walking backward, dragging a paralyzed spider, 5.6 mm. long, over the shale flats along the edge of Eighteen Mile Creek. The spider was a penultimate instar female lycosid, *Pardosa milvina* (Hentz) [det. B. J. Kaston].

Sphecidae

Trypoxylon (*Trypoxylon*) *backi* Sandhouse

A female (6654 B), 5.9 mm. long, was taken at 11:45 a.m. on June 6, 1954, at Arlington, Va. She was crawling on the outside wall of my cowshed and carried in her mandibles a paralyzed spider 2 mm. long. The spider was an adult female linyphyiid, *Tennesseelum formicum* (Emerton) [det. B. J. Kaston].

Stigmus americanus Packard

The following females were taken on the wall of my cowshed carrying paralyzed aphid nymphs which have been determined by Miss L. M. Russell:

5254 A, 3 p.m., May 2, 1954, prey belonging to Aphinae
52254 A, 10:30 a.m., May 22, 1954, with *Drepanaphis* (?) sp.
52254 B, 11:15 a.m., May 22, 1954, with *Rhopalosiphum* sp.
52254 C, 11:30 a.m., May 22, 1954, with *Aphis* sp.
52254 D, 3:30 p.m., May 22, 1954, with *Myzocallis* (?) sp.
52354 C, 2:30 p.m., May 23, 1954, prey belonging to Panaphini
53154 A, 11:30 a.m., May 31, 1954, prey belonging to Panaphini

Passaloecus mandibularis (Cresson)

This is another pemphredonid wasp having an early emergence date. The first females were taken from May 20 to 22 in 1951, 1954 and 1955 on the inside wall of my cowshed in Arlington, Va. This species nests in abandoned larval borings of the anobiid beetle, *Xyletinus pettatus* (Harris). In 1954 females were provisioning

[1] The preceding contribution in this series was published in this journal, 50: 13–17, 1955.

their nests with paralyzed aphid nymphs by May 23. Two wasps (52354 A and B) were captured at 12:05 and 12:10 p.m., each with a nymph of a species of *Macrosiphum* [det. L. M. Russell]. Stocking of some of the nests was completed by May 29, for on that date I observed a female bringing in large drops of a clear plant gum or resin with which to construct a closing plug at the boring entrance. There was no nesting activity at this site after June 5. In Arlingon there is only one generation a year, for the plugs closing seven marked borings remained unbroken until May 15 the following year.

Philanthus gibbosus (Fabricius)

A female (71154 B) was captured while flying with a paralyzed bee at Glencarlyn, Arlington Co., Va., at 2 p.m. on July 11, 1954. The bee was a female halictid, *Halictus* (*Chloralictus*) *versatus* (Robertson).

Cerceris atramontensis Banks

Several years ago there was a small colony of this species in an oak-hickory woods with scanty ground cover at Dunn Loring, Fairfax Co., Va. The wasps were nesting in soil containing a rather large amount of gravel. The flight period lasted from the latter half of July until mid September. In 1949 one wasp was captured on July 24 flying with an unusual male form of the weevil, *Conotrachelus posticatus* Boheman, and on July 30 three wasps were caught while flying with females of *C. posticatus* and four wasps with three females and one male of *C. naso* Leconte [det. L. L. Buchanan]. Mr. Buchanan told me that *naso* breeds chiefly in acorns, and *posticatus* probably in acorns. This nesting site was destroyed a few years ago by a housing development.

Oxybelus bipunctatus Olivier

A female (61354 B) was captured at 3:30 p.m. on June 13, 1954, on a sandstone outcrop at Glencarlyn, Arlington Co., Va., carrying a paralyzed male anthomyid, *Hylemya cilicrura* (Rondani) [det. C. W. Sabrosky]. Two wasps (82055 A and B) were captured on sand with their paralyzed prey at Ithaca, N. Y., at 11 a.m. on August 20, 1955. The specimens of prey were larvaevorids, 82055 A a female of *Hyalomyodes triangulifera* (Loew), and 82055 B a male of *Leucostoma aterrima* (Vill.) [det. C. W. Sabrosky].

Oxybelus inornatus (Robertson)

A female was taken on the ground in Arlington, Va., with her

paralyzed prey on June 15, 1947. The prey was a male milichiid fly, *Pholcomyia indecora* (Loew) [det. C. W. Sabrosky].

Oxybelus quadrinotatus Say

A female (71154 A) was captured on a sandstone outcrop at Glencarlyn, Arlington Co., Va., at 1:35 p.m. on July 11, 1954. Her prey, a paralyzed female *Sarcophaga* (*Helicobia*) *rapax* (Walker) [det. C. W. Sabrosky], was impaled on her sting.

Hibernation of the diopsid fly, Sphyrocephala brevicornis Say.—The reputedly rare diopsid fly, *Sphyrocephala brevicornis* Say, has been reported mainly from specimens taken on foliage, especially that of skunk cabbage (Symplocarpus foetidus L. Nutt.), during the spring and summer. The following records then may be of considerable interest.

Specimens of adult flies were taken on October 18, 1952, in a road cut about two miles east of New Salem, New York, on route 85. The first individuals were seen crawling on the surface of the fractured limestone. When the rock was hammered, individuals were seen crawling out of a small crack between two large blocks. Later the same day, during the examination of a cut on the road into Thatcher State Park, more diopsids were noticed. Tracing the flies to where they were thickest and removing several small rocks, revealed the diopsids in great numbers several inches from the surface. They were packed on all available surfaces, over 150 were taken with a small killing vial before they all flew away.

The next year the same general vicinity was visited and on October 3 in a road cut near Thompson's Lake they were found again. As before, they were present in numbers under loose rock, but when the dry moss covering the cut was lifted, a black cloud of them flew out into the air. Undoubtedly there were thousands present. The next day near Canajoharie, they were found again in smaller numbers walking on the cliff above a small stream.

Around Amherst, Massachusetts, the flies have been found in smaller numbers (25 or so) during October and as late as November 25 on warm days either flying or walking on bridge abutments.

These records indicate that the flies evidently overwinter as adults in protected locations and in tremendous numbers.—Oliver S. Flint, Jr., Ithaca, New York.

STUDIES IN PANAMA CULICOIDES (DIPTERA, HELEIDAE). IX. TWO NEW SPECIES RELATED TO LEONI BARBOSA AND REEVESI WIRTH.

By Willis W. Wirth[1] and Franklin S. Blanton,[2]
Washington, D. C.

There are five closely related species of *Culicoides*, subgenus *Oecacta*, *debilipalpis* group, which have the following characters in common: size small, wing 0.63–0.75 mm. long; wing broad at the apex with very sparse macrotrichia; one large, round, distal pale spot in cell R_5 nearly filling the space between the anterior wing margin and vein M_1; the two post-stigmatic pale spots in cell R_5 nearly in line transversely and usually broadly fused, with the posterior spot extending nearly or quite to vein M_1 one pale spot in distal part of cell M_2 and one in distal portion of anal cell; antennal segments with a characteristic repetition of increasing lengths in the proximal and distal series, segment XI thus slightly shorter than segment X; distal sensory tufts present on segment III, and VII or VIII to X; second palpal segment usually longer than third segment and one pyriform spermatheca present.

In this group are *leoni* Barbosa from Ecuador, *beuarrochei* Ortiz and Mirsa from Venezuela, *reevesi* Wirth from California, and the two new species from Panama and Honduras here described. We take this opportunity to offer redescriptions of the females of *leoni* and *reevesi* and to describe the hitherto unknown male of *leoni*.

There are several terms the precise definitions of which are essential to the descriptions. Wing length is measured from the basal arculus to the wing tip; we use the Tillyard modification of the Comstock-Needham terminology of wing veins, whereby the two branches of the anterior fork become veins M_1 and M_2 and the branches of the posterior fork are called M_{3+4} and Cu_1. The antennal ratio is obtained by dividing the combined lengths of the last five segments by those of the preceding eight. The length of the spermatheca includes the sclerotized portion of the duct. Our measurements are of single specimens unless followed by values

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in parentheses, in which case the values are "mean (minimum – maximum, n = number of measurements)."

The types of the two new species here described are deposited in the U. S. National Museum in Washington. Unless otherwise stated, all specimens were collected in light traps in Panama by the junior author.

Culicoides leoni Barbosa
(Figure 2)

Culicoides leoni Barbosa, 1952, Nov. Subs. Conhec. *Culicoides* Neotr. p. 17 (female; Ecuador; fig. wing, palpus).

Characters of Female. Length of wing 0.63 (0.56 – 0.66, n = 5).

Head: Eyes moderately separated, with short interfacetal hairs. Antenna with flagellar segments in proportion of 12 : 8 : 10 : 11 : 12 : 12 : 13 : 14 : 10 : 10 : 13 : 15 : 22, antennal ratio 0.75 (0.72 – 0.78, n = 5); distal sensory tufts present on segments III, VII–X. Palpal segments in proportion of 7 : 16 : 15 : 6 : 8, third segment moderately swollen, 1.7 (1.5 – 1.9, n = 5) times as long as greatest breadth, with a deep sensory pit opening through a small pore. Mandible with 12 (12 – 14, n = 5) teeth.

Thorax: Mesonotum seen in slide mounted specimens apparently without conspicuous pattern, dark brown. Scutellum, postscutellum and pleuron dark brown. Legs brown; trochanters and extreme bases of femora, apices of fore and mid femora and bases of all tibiae, yellowish; hind tibial comb with 4 spines, the one nearest the spur longest, half as long as basitarsus.

Wing: Pattern as figured, one large post-stigmatic pale spot in cell R_5 usually extending caudad to vein M_1; distal pale spot in cell R_5 large and usually rounded, nowhere meeting margins of cell; one pale spot in cell M_1 near base; one continuous pale spot in cell M_2 between medial and mediocubital forks, only one pale spot in apex of cell; one large pale spot in cell M_4 and one large pale spot filling apex of anal cell. Macrotrichia sparse, only a few on distal third of wing; costa extending to 0.55 of distance to wing tip. Halter whitish.

Abdomen: dark brown; cerci yellowish. Spermatheca one, pyriform, measuring 0.042 by 0.031 mm., the duct sclerotized only a short distance.

Male Genitalia. Ninth sternum with moderately deep caudomedian excavation, the posterior membrane bare; ninth tergum broad at apex, with long, slender, apicolateral processes. Basistyle with ventral root foot-shaped, with a very prominent posterior heel; dististyle nearly straight, slender, with bent, pointed tip.

Aedeagus with rounded anterior arch, the basal arms slender and curved, distal portion slender, with rounded tip. Parameres each with basal knob, stem slender at base, swollen at the abruptly bent mid portion, abruptly twisted distad, with short apical point bearing two or three fine subapical barbs.

Distribution—Ecuador.

Specimens examined—ECUADOR: Macas, Santiago, Zamora, 6 February 1955, R. Levi-Castillo, 4 females. Echianda, Bolivar, 25 February 1955, R. Levi-Castillo, 1 female. Milagro, San Miguel, Guyas, May 1955, R. Levi-Castillo, 1 male.

Discussion—A peculiar feature which greatly aids in the recognition of this species is the caudal extension of the post-stigmatic pale spot in cell R_5 usually to meet vein M_1, this spot not extending so far caudad in the related species.

Culicoides glabellus n. sp.
(Figure 1)

Characters of Female. Length of wing 0.68 (0.66 – 0.76, n = 11) mm.

Head: Eyes narrowly separated, with short interfacetal hairs. Antenna with flagellar segments in proportion of 15 : 11 : 12 : 13 : 13 : 13 : 14 : 17 : 15 : 15 : 18 : 18 : 29, antennal ratio 0.91 (0.88 – 0.95, n = 8); distal sensory tufts present on segments III, VIII–X. Palpal segments in proportion of 6 : 16 : 15 : 7 : 8; third palpal segment slightly swollen, 1.8 (1.7 – 2.1, n = 11) times as long as greatest breadth, with small deep sensory pit. Mandible with 12 (11 – 13, n = 13) teeth.

Thorax: Mesonotum very dark brown, with faint pattern as figured, consisting of a sublateral pair of blackish bands. Scutellum uniformly dark brown; postscutellum and pleuron dark brown. Legs dark brown; fore and mid femora with subapical, all tibiae with sub-basal and hind tibia with apical, narrow whitish rings; hind tibial comb with 4 (n = 10) spines, the longest one next to the spur.

Wing: Pattern as figured, post-stigmatic pale spot in cell R_5 only rarely incompletely divided into two separate spots, these located at same distance from base of wing, the spot never extending caudad as far as vein M_1; pale spot in apex of cell R_5 large and rounded, usually filling most of the space between anterior wing margin and vein M_1; two pale spots in cell M_1, only one pale spot each in apices of cell M_2 and anal cell, pale spots present lying in front of mediocubital fork and behind medial fork. Macrotrichia

very sparse in extreme apices of cells R_5, M_1 and M_2; costa extending to 0.65 of wing length, wing broader than usual on distal half. Halter whitish.

Abdomen dark brown, cerci yellowish. Spermatheca one, pyriform, measuring 0.059 by 0.038 mm., with long sclerotized duct.

Male Genitalia. Ninth sternum with very shallow, broad, caudomedian excavation; the posterior membrane bare; ninth tergum short, the apex distinctly notched in middle with prominent, triangular, apicolateral processes. Basistyle with short ventral and dorsal roots, the posterior heel not developed on ventral root; dististyle slender, only slightly curved. Aedeagus with broad, distally rounded, basal arch, the basal arms distinctly curved; distal stem broad at base with a pair of hyaline, sublateral, rounded lobes, the median point slender and rounded at tip. Parameres each with large basal knob, stem slender and gradually curved on basal portion, more swollen toward apex of straight portion, ventral lobe absent, apex abruptly tapered to simple filiform tip directed ventrad.

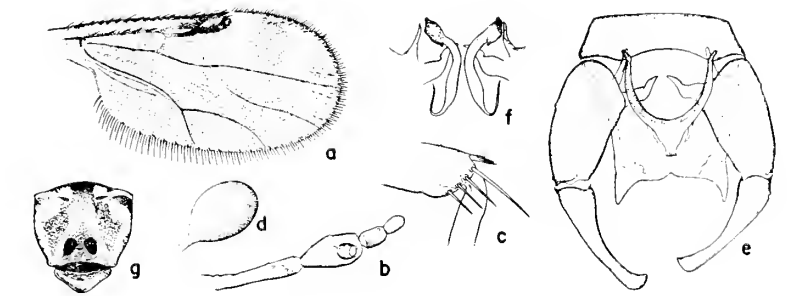
Holotype female, Almirante, Bocas del Toro Province, Panama, 18 March 1953, F. S. Blanton, light trap (type no. 63129, U.S.N.M.). Allotype, same data except date November 1952. Paratypes, 12 males, 52 females: PANAMA—Bocas del Toro Province: 6 males, 26 females, Almirante, October 1952 to March 1953. Canal Zone: 1 female, Camp Butler, 20 January 1954, G. Field; 2 males, 21 females, Mojinga Swamp, 18 December 1951, 24 June 1952, 13 October 1952, 15 November 1953. HONDURAS—1 male, 4 females, Lancetillo, 13 August, 23 December 1953, 27, 29 January 1954, P. Galindo, light trap. NICARAGUA—1 male, Guapinola, 29 October 1953, P. Galindo, light trap. TRINIDAD—1 male, Grandwood Navy Base, 20 October 1955, T. H. G. Aitken, light trap; 1 male, Port of Spain, June 1953, 25 Med. Det., U. S. Army, light trap.

Explanation of Plate IV

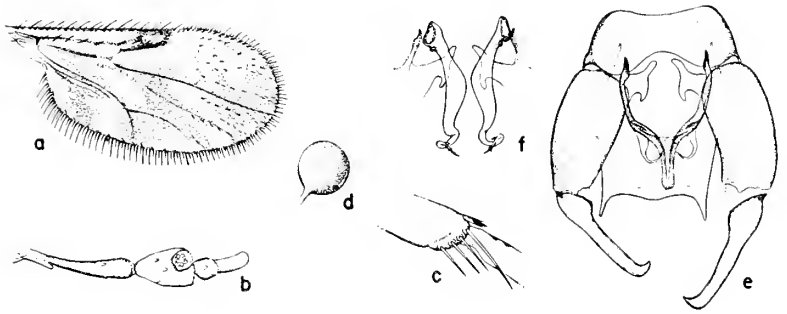
Fig. 1. *Culicoides glabellus* (from Almirante, Panama). Fig. 2. *Culicoides leoni* (from Ecuador; ♀ from Macas, ♂ from Milagro). Fig. 3. *Culicoides fieldi* (from Lancetilla, Honduras). Fig. 4. *Culicoides reevesi* (from Kern County, California).

a, female wing; b, female palpus; c, apex of hind tibia showing spur and comb of tibial spines, female; d, female spermathecae, e, male genitalia, paramers omitted; f, male parameres; g, thoracic color pattern, female. (Drawings by Thomas M. Evans.)

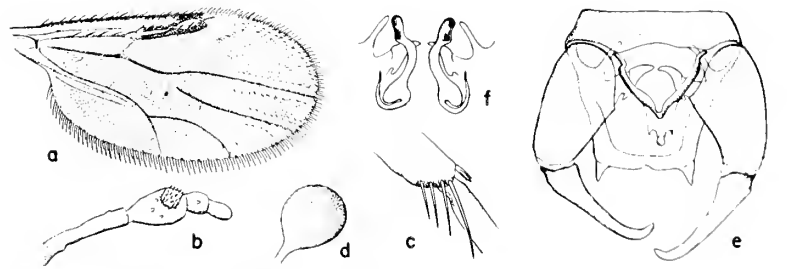
BULL. B. E. S. VOL. LI PLATE IV



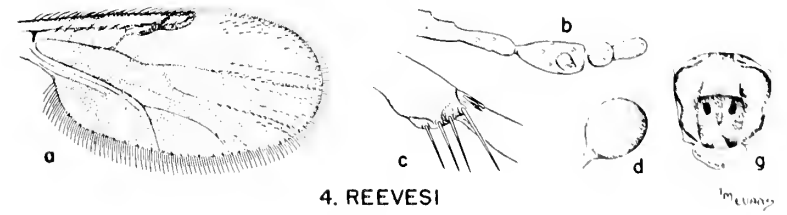
1. GLABELLUS



2. LEONI



3. FIELDI



4. REEVESI

Discussion—In general appearance, size and in wing markings *glabellus* is practically identical with *leoni* Barbosa and *gabaldoni* Ortiz. There are two spermathecae, however, in *gabaldoni*, and *leoni* differs in having an antennal ratio of only 0.75 and sensoria present on segment VII as well as on III, VIII–X. All three species have the remarkable repetition of increasing lengths of segments in the antennal series with segments XI always shorter than X. The male genitalia of *glabellus* can be readily distinguished by the gradually curving base of the paramere, the stem swollen at the distal part of the straight portion, beyond which the paramere tapers rapidly to a simple, filamentous tip.

Culicoides fieldi n. sp.
(Figure 3)

Characters of Female. Length of wing 0.72 (0.66 – 0.76, n = 9) mm.

Head: Eyes contiguous, with long interfacetal hairs. Antenna with flagellar segments in proportion of 14 : 11 : 13 : 14 : 13 : 13 : 14 : 17 : 15 : 15 : 18 : 18 : 19, antennal ratio 0.85 (0.80 – 0.92, n = 6); distal sensory tufts present on segments III, VIII–X. Palpal segments in proportion of 7 : 15 : 15 : 7 : 7, third segment moderately swollen, 1.8 (1.7 – 1.9, n = 8) times as long as greatest breadth, with a small, deep, sensory pit. Mandible with 12 (11 – 13, n = 11) teeth.

Thorax: Mesonotum (only slide mounted specimens available) apparently without prominent pattern, dark brown. Scutellum, postscutellum and pleuron dark brown. Legs brown, fore and mid femora with very faint subapical pale rings, all tibiae with subbasal and hind tibia with apical, distinct pale rings; hind tibial comb with 4 (n = 10) spines, the longest one nearest the spur.

Wing: Pattern as figured; pale spot over r-m crossvein small; poststigmatic pale spots in cell R_5 more or less separated into two, distinct, small round spots, the posterior one located distinctly proximad of the anterior one; distal pale spot in cell R_5 small and round, located in center of cell; two pale spots in cell M_1; only one pale spot each in apices of cells M_2, M_4 and anal cell; pale spot usually present behind medial fork but no pale spot in front of mediocubital fork. Macrotrichia very sparse on distal fourth of wing, none located proximad of level of end of costa; costa extending to 0.60 (0.59 – 0.62, n = 9) of distance to wing tip. Halter infuscated.

Abdomen: Blackish, cerci yellowish. Spermatheca one, pyriform, measuring 0.057 by 0.038 mm., the base of the duct sclerotized a considerable distance.

Male Genitalia. Ninth sternum very narrow, caudomedian excavation not developed, the posterior membrane not spiculate; ninth tergum short with truncate apex, apicolateral processes long and slender. Basistyle with ventral lobe large and foot-shaped, the posterior heel pointed, dorsal root slender; dististyle long and slender with hooked apex. Aedeagus with basal arch extending to more than half of total length, mesal apex of arch narrow, the basal arms nearly straight and well sclerotized; distal portion tapering to a slender rounded tip, with a subapical, lateral pair of sclerotized points arising near juncture with the arch. Parameres each with small basal knob, stem slender, abruptly bent near base, the straight portion comparatively short with a long ventral lobe distad, beyond which the paramere is very slender, tapering rapidly to a simple fine-pointed tip.

Holotype female, Lancetilla, Honduras, 27 November 1953, P. Galindo, light trap (type no. 63130, U.S.N.M.). Allotype male, same data but collected 3 July 1953. Paratypes, 13 males, 17 females: HONDURAS, 3 males, 7 females, same data as type, but dates 3 July 1953 to 29 January 1954. PANAMA, Bocas del Toro Province—3 males, 2 females, 10 March, 22 April, November 1953. Canal Zone—1 male, Fort Clayton, 7 December 1953; 2 males, 2 females, Fort Davis, 7 October 1953; 3 males, 1 female, Huile Sia Clara, 12 October 1952; 1 male, 3 females, Loma Boracho, 29 November 1951, 19 June 1952; 1 female, Mindi Dairy, 13 June 1952. Chiriqui Province—1 female, El Volcan, 25 March 1954.

Discussion—Culicoides dasyophrus Macfie has a wing pattern almost identical with that of *fieldi* but the antennae of *dasyophrus* are much different, segment XI and distal segments at least 1.5 times as long as X and those proximad. The antennae of *fieldi* are much like those of the closely related *benarrochei* Ortiz, *glabellus* n. sp., *leoni* Barbosa and *reevesi* Wirth, but the presence of two separate, post-stigmatic pale spots in cell R_5 with the posterior one located distinctly proximad of the anterior one is characteristic only of *fieldi* and *benarrochei*. *Benarrochei* can be separated from *fieldi* by its shorter second palpal segment (9 13 as long as third), antennal segments XI, XII, XIII and XIV subequal in length and by the presence of a distinct pale spot in front of the mediocubital fork. The long ventral lobe on the male paramere is diagnostic of *fieldi*.

Culicoides reevesi Wirth
(Figure 4)

Culicoides reevesi Wirth, 1952, Univ. California Pub. Ent. 9: 193 (female; California; fig. wing).

Characters of Female. Length of wing 0.69 mm.

Head: Eyes narrowly separated, with long interfacetal hairs. Antenna with flagellar segments in proportion of 14:11:12:15:-15:14:14:15:12:11:15:16:25, antennal ratio 0.72; distal sensory tufts present on segments III, VIII–X. Palpal segments in proportion of 7:19:18:6:8, third segment slightly swollen, 2.0 times as long as greatest breadth, with a small, very deep sensory pit. Mandible with 14 teeth.

Thorax: Mesonotum subshining brown, with very indistinct pattern consisting of a sublateral pair of narrow darker brown bands. Scutellum dark brown in middle, slightly paler on sides; postscutellum and pleuron dark brown. Legs pale brown; fore and mid-femora with subapical, all tibiae with sub-basal and hind tibia with apical, indistinct pale rings; tarsi pale; hind tibial comb with 4 spines, the longest one next to the spur.

Wing: Pattern as figured; the common, poststigmatic pale spot large, extending caudad nearly to vein M_1, the distal pale spot in cell R_5 large and rounded, nearly filling apex of cell but not attaining wing margin; two pale spots in cell M_1; one pale spot each in apices of cell M_2, cell M_1 and anal cell, the spot in anal cell broadly attaining wing margin and extending along margin nearly to base of cell, the pale spot in cell M_4 filling apex of cell; a pale spot lying ahead of mediocubital fork and another lying behind medial fork. Macrotrichia sparse in extreme apices of cells R_5, M_1 and M_2; costa extending to 0.58 of distance to wing tip.

Abdomen dark brown, cerci yellowish; spermatheca one, subspherical, measuring 0.053 by 0.034, the entrance of the duct sclerotized for a considerable distance. (Redescribed from a paratype from State Elk Refuge, Kern Co., California).

Male. Unknown.

Distribution—California.

Specimens examined—CALIFORNIA: Holotype female, 1 female paratype, Bakersfield, Kern County, 28 August 1946, B. Brookman, biting man; 2 female paratypes, State Elk Refuge, Kern County, 11 July 1946, B. Brookman, biting man; 1 female, Bartlett Mountain, Lake County, 17 July 1941, A. W. Lindquist, biting man; 1 female, Big Sur State Park, Monterey County, 23 July 1954, W. McDonald, biting man at dusk.

Discussion—The wing markings of *reevesi* are very similar to those of *glabellus* and *leoni*, but the antennal segments resemble in their proportions those of *fieldi*, in which segment XII is shorter than XI. In *fieldi*, however, the wing is hairier, the poststigmatic pale spots in cell R_5 are more or less separated, the third palpal segment is only 1.8 times as long as broad and the antennal ratio is much greater (0.85).

SOME PLEIDS AND WATER-STRIDERS FROM THE DOMINICAN REPUBLIC (HEMIPTERA).

By Carl J. Drake[1] and J. Maldonado-Capriles[2]

Very little is known relative to the aquatic and semiaquatic Hemiptera of many islands of the West Indies. During the latter part of last December (1955) the junior author spent ten days collecting Hemiptera in the Dominican Republic. The present paper is confined entirely to the pleids and water-striders netted by him on this trip. The types of the new species are in the Drake Collection, paratypes and other specimens in collections of both authors. In the measurements of structures in the descriptions, 80 units is the equivalent of one millimeter.

Family Pleidae Fieber 1851

Paraplea puella (Barber): Several specimens, netted in a permanent pond, Bajos de Haina, Prov. de Trujillo, Dec. 29. This species is widely distributed in the West Indies, Panama, Mexico and Gulf States (Fla., Miss., La., Tex.). *Neoplea punctifer* (Barber): One specimen, Bajos de Haina, Dec. 29, taken in the same pond as puella. Known heretofore only from the types (Arecibo, Puerto Rico).

The subgenera *Neoplea* Esaki and China and *Paraplea* Esaki and China are here elevated to the generic level. *Plea nilionis* Drake and Chapman also belongs to the genus *Paraplea*. *Plea striola* (Fieber) and apparently all of the other American pleiids belong to the genus *Neoplea*, though the very large *Plea borellii* Kirkaldy from Argentina and Brasil needs further study.

Family Gerridae Leach 1815

This family is represented in the collection by four species, including one species of the genus *Gerris* described herein as new to science. *Eobates vittatus* (Shaw): 8 specimens, Hicaco Creek, Altagracia, Prov. Trujillo, Dec. 27. *Trepobates taylori* (Kirkaldy), many specimens, Bajos de Haina. *Rheumatobates bergrothi* (Meinert): Several specimens, Bajos de Haina, Dec. 29. *Limnogonus guerini* Lethierry et Severin: Many specimens; Valle Nuevo, Prov. la Vega, altitude 2,200 meters, Dec. 28; and Bajos de Haina, Dec. 29, in permanent pool.

[1] Iowa State College, Ames, Iowa.

[2] University of Puerto Rico, Mayaguez, P. R.

Gerris dominicus n. sp.

Apterous male: Dark brownish black with sides of and a large U-shaped mark at base of head, upper half of pleura, entire metanotum and a median longitudinal stripe on anterior two-thirds of pronotum yellowish brown; body beneath stramineous with a silvery lustre; rostrum yellowish with terminal segment black, extending a little beyond prosternum. Width of head across eyes shorter than the length of first antennal segment (100:90). Antennae blackish fuscous, measurements—I, 90; II, 72; III, 72; IV, 80. Anterior legs blackish fuscous, the femora brownish testaceous, becoming darker apically; femora strongly curved, slightly flattened and strongly concave beneath on basal three-fifths, with a prominent patch clothed with short brownish hairs at apical fourth, there slightly enlarged but without a distinct prominence; tarsi composed of two segments of nearly equal length.

Pronotum divided into two distinct lobes; anterior lobe only slightly raised, impressed on disc, with darkened area subquadrate; posterior lobe or projection triangular or perhaps more shieldlike as the sides are a little convexly rounded, basal width a little greater than median length (78:70), with the hind part of mesonotum beyond apex of hind pronotal projection a little longer than median length of hind pronotal lobe (90:70). Omphalium not especially prominent, abdomen slowly tapering posteriorly, with a median longitudinal pale stripe on last five tergites, the connexiva not extended posteriorly at apex; last segment of venter nearly twice as long as preceding segment, rather deeply, broadly roundly notched behind. First four segments of venter with a median, longitudinal ridge. First genital segment beneath practically as long as last ventrite, cylindrical in shape.

Winged male: Hemelytra longer than abdomen, provided with some grayish and golden pubescence. Pronotum with anterior part much shorter than hind projection (17:37). Other structures as in apterous form. Female unknown.

Length, 6.75 mm. (apterous male) and 8.00 (macropterous male); width, 1.55–1.75 mm.

Type (macropterous male) and 1 *paratype* (apterous male), Valle del Rio, Prov. La Vega, Dec. 28, 1955.

This waterstrider belongs to the group of Neotropical species, such as *kahli* D. & H., *G. beieri* D. & H. and *G. carmelus* D. & H., which have the posterior lobe of pronotum more or less strongly extended posteriorly (not covering entire mesonotum) and the fore femora strongly bowed (concave beneath) from the base and

with a more or less large tubercle or prominence at the apex of the ventral concavity. The prominence is generally provided with a dense vestiture of very short, stiff, brown hairs. *G. dominicus*, n. sp. differs from the above mentioned species and also from *G. carniventris* Champion by the length of the bowed part of the anterior femora and the shape and size of posterior process of pronotum as described in the description.

Family Mesoveliidae Douglas and Scott 1867

The common and very widely dispersed *Mesovelia mulsanti* Buchanan-White was taken at Valle Nuevo, Prov. Vega, Dec. 28, elevation 2,200 meters. This species is widely distributed in all of the Americas.

Family Veliidae Dohrn 1859

Eight species, including a new formed described below, of this family were netted in the Dominican Republic. *Velia brachialis* Burmeister: One specimen, Bajos de Haina, in permanent pool, Dec. 29. *Microvelia pulchella* Westwood: Common species, Valle Nuevo, altitude 2,200 meters, Dec. 28. *Microvelia albonotata* Champion; 2 female specimens, Bajos de Haina, Dec. 29. *Microvelia hinei* Drake: 2 specimens, Bajos de Haina, Dec. 29; and 6 kilometers west of Cuidad Trujillo, Dec. 16–20. *Microvelia longipes* Uhler; Numerous specimens, Valle Nuevo, Dec. 28, and Bajos de Haina, Dec. 29, in permanent pool. *Rhagovelia secluda* Drake and Maldonado-Capriles: Several specimens, Valle Nuevo, altitude 2,200 meters, near bank in ripples of running water (recently characterized by the authors from the Dominican Republic). The third antennal segment of the male *secluda* is very strongly compressed, nearly flat, and thus subovate in form, the latter character separates it at once from all described American *Rhagovelia* Mayr, even from species of the Old World too.

Rhagovelia vegana n. sp.

Apterous form: Moderately large, blackish with anterior part of pronotum, uncovered apical part of mesonotum and connexiva (save the dark exterior margin) brownish testaceous; body beneath straminous with metasternum and first ventrite blackish. Head with a very distinct, median, longitudinal, impressed line and the usual basal impressions; rostrum testaceous with last segment black and shining. Antennae dark with basal third of first segment pale testaceous, segments I and II with the usual long bristly hairs, measurements—I, 70; II, 40; III, 46; IV, 44.

Male: Pronotum black, with approximately the anterior one-fifth slightly brownish testaceous, with median length shorter than width of darkened part (50:80), slowly broadly rounded behind; mesonotum moderately tumid, broadly blunt behind, with uncovered posterior part about two-fifths as long as median length of pronotum. Abdomen tapering posteriorly, with considerably bluish pruinose bordering sutures, sparsely provided with dark erect hairs (slightly more numerous than on pronotum); connexiva tapering posteriorly, not produced behind, terminating at apex in a narrow acute angle. All acetabula, coxae and trochanters pale testaceous. Anterior femora mostly testaceous, becoming darker apically; tibiae widened and flattened distally and medially longitudinally hollowed out beneath. Middle legs very long, with femora slightly longer than tibiae (140:110); tarsi II and III subequal in length (60:58). Hind femora only feebly incrassate, with inferior surface testaceous, armed beneath with a moderately long bent spine at basal two-fifths, thence followed by a row of seven or eight shorter spines to apex which decrease slowly in size apically and then which is preceded to base by a row of eight or nine very short, blunt, brown teeth; trochanters with one or two very short teeth, without spines; tibiae straight, unarmed, much longer than femora (112:150), tarsi II and III subequal in length (58:60).

Female: Abdomen tapering posteriorly but wider at apex than in male; connexiva wider than and more slowly narrowed apical, with apex fairly wide and truncate, suberect to penultimate segment, then strongly reflexed and resting or nearly resting on tergites (last two segments) but with outer margins considerably separated. Head and thorax as in male. Antennal measurements —I, 78; II,42; III, 45; IV, 45. Other characters very similar to male. Legs unarmed.

Length, 3.25 mm.; width, 1.60 mm.

Type (male) and *allotype* (female), Valle Nuevo, Prov. La Vega, Dec. 28, 1955. *Paratype:* 1 male (slightly teneral), same labels as type. Macropterous form unknown.

This insect belongs to the group of *Rhagovelia* Mayr that have the pronotum (in both sexes) extended posteriorly so as to cover around half of the mesonotum in the apterous form. *R. vegana* may be separated from other similarly colored species in the apterous condition by feebly enlarged hind femora and the more wider and more broadly roundly produced posterior part of pronotum. The third antennal segment is not strongly compressed and flattened in the male as in *R. secluda* from the Dominican Republic.

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BULLETIN

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BROOKLYN ENTOMOLOGICAL SOCIETY

VOL. LI JUNE, 1956 No. 3

SIX NEW SPECIES OF THYANTA STAL. (HETEROPTERA, PENTATOMIDAE).

By HERBERT RUCKES,[1] New York, N. Y.

In the course of a comprehensive study of the genus *Thyanta* the following new species have come to light. These all (except *T. cornuta*) appear to have either direct or indirect relationship with *Thyanta maculata* (Fabricius) as is evidenced by the structure of their respective male genitalia, the heads of the parameres of which are shown in the accompanying figures. Most of the specimens have been residual in the collections of the American Museum of Natural History but some became available through loans of material made by numerous entomologists, to all of whom thanks are due for their generous cooperation.

In the descriptions the various ratios given are dimensions measured through a binocular microscope using a ×4 objective and a ×9 ocular fitted with a micrometer scale divided into one hundred linear units; they are not in terms of millimeters except as mentioned in connection with the holotypes and allotypes.

Thyanta humeralis n. sp.

In form, size and nitidous appearance like *Thyanta maculata* (Fabricius) but differing in color markings and puncturation. Color olivaceous with reddish and concolorous punctures which are arranged in three distinctly graded bands across the pronotum, each occupying about one third the area of that structure. The anterior band is made of finer, denser and shallow punctures, the intermediate band of larger, deeper and more widely spaced ones, while on the posterior band the punctures are still more widely

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spaced but much more shallow. The intermediate band has a tendency to become somewhat more darkly colored than the others.

Head evenly and finely punctured, about three quarters as long as wide through the eyes (72 × 90), the margins before the eyes weakly sinuate with the edges sometimes black; ocelli moderate in size and well removed from the eyes, farther from them than the diameter of an ocellus; antennal ratios: 15/30/48/52/52 i.e. segments II to IV gradually increasing in length with segments IV and V subequal; segments I and II and the bases of the others pale, the apical portions of III, IV and V fuscous.

Pronotum at least three times as wide across the humeri as long medianly (240 × 80); the humeri produced and prominent, acutely angled but not spinose; the antero-lateral margins weakly sinuate at the middle, thickish but not calloused, the edges thinning toward the humeri and there becoming black; pronotal puncturation as previously described.

Scutellum equilateral (144 × 140) the frenum ending at a point about two thirds the distance from the base; the apex narrowly rounded but not acute; punctures widely spaced and even at the base where there is some evidence of rugosity. Hemelytra evenly and coarsely punctate, the membrane hyaline with a few light brown dots or obsolescent ones.

Connexivum only narrowly exposed; apical angles of the abdominal segments black. Ventral abdominal disc weakly and evenly punctate laterally, medianly impunctate; no evidence of post-spiracular black points. Legs concolorous throughout with long setose hairs on the tibiae and femora each longer than the diameter of the tibia.

Male genital cup with a prominent chin-like protuberance below the apical margin and bearing impressed areas below the apical lateral angles which are bluntly rounded and not at all prominent; apical margin of the cup widely U-shaped and the apical aspect of the paramere concave and transversely narrowly ovate (Figure 2).

Described from nine male and ten female specimens.

Holotype: Male: 9 mm. long; 5.75 mm. across humeri. Miranda, Matto Grosso, Brazil. October 1939. Deposited in the American Museum of Natural History.

Allotype: Female: 9.5 mm. long; 6 mm. across humeri. Miranda, Matto Grosso, Brazil. October 1939. Deposited in the American Museum of Natural History.

Paratypes: BRAZIL: Parana, Iguassu, December 1941, two females; Matto Grosso, Bodoquena, November 1941, four males and

two females; Salobra, October 18–29 1938, one female, all the above in the collection of the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil. Alagohinas, January 3, 1903, one female in the collection of the Museum of Natural History, Vienna, Austria. Santa Catarina, Nova Teutonia, two females, September 22, 1948 and December 24, 1950 in the collection of Mr. John C. Lutz, Philadelphia, Pennsylvania. Sao Paulo, one male, March 1939 in the collection of the United States National Museum, Washington, D. C. PARAGUAY: Villarrica, September 1934, one male in the collection of the United States National Museum. Horqueta, March 24, 1934, one male in the collection of Mr. John C. Lutz. ARGENTINA: February 4, 1942, one male in the collection of the United States National Museum.

Originally it was thought that this species was an example of *Thyanta testacea* (Dallas) but comparison with the type in the British Museum has proved that it is not at all like that form. Mr. W. E. China was kind enough to send me sketches showing wherein the two species differ suggesting that one described above is new. There is some similarity to *Thyanta maculata* (Fabricius) but the absence of the striking dark squarish pronotal blotches so characteristic of that species are missing. In *humeralis* the puncturation is different, the pilosity of the legs much greater, the antero-lateral margins of the pronotum more distinctly sinuate at the middle and the humeri much more robust and pronounced. The parameres of the two, however, are somewhat alike, those of *maculata* (Fig. 1) being perhaps slightly narrower in diameter apically and not quite so robust.

Thyanta planifrons n. sp.

Obovate, about the size of *T. maculata* (Fabricius), somewhat glossy and in color ranging from light green to olivaceous (four females in the type series are testaceous) with no contrasting red or dark markings except as noted below. Rather densely and irregularly punctured, particularly on the head, pronotum and scutellum.

Head three quarters as long as wide through the eyes (70 × 90); surface definitely depressed and very flat between the ocelli and weakly impressed between and before the eyes; anteocular margins sinuate and gradually converging to a moderately rounded apex; ocelli exceptionally large and slightly elliptical in form, each ocellus closer to the inner margin of the eye than the diameter of the ocellus; antennal ratios: 15/40 45 50 43 i.e. segment IV the

longest and one fourth longer than segment II; segments I, II and the base of III pale, usually yellowish green, the remainder darkening to brownish-green or reddish apically.

Pronotum less than three times as wide across the humeri as long medianly (225 × 85); punctures confused on the anterior half; posterior half finely transverse rugose; antero-lateral margins essentially straight and weakly impressed inside the margins; humeri bluntly rounded and not at all produced.

Scutellum slightly longer than wide across the base (140 × 132); surface definitely convex especially on the anterior half and vaguely rugose transversely; the frenum ends at a point about three quarters the distance from the base so that the tongue is relatively short, its margins converging to a moderately rounded apex. Hemelytral punctures coarser, deeper, more widely and more evenly spaced than those on other parts of the body, those on the embolium perhaps slightly denser.

Connexivum very narrowly exposed and concolorous; apical abdominal angles not produced but terminating in very minute (sometimes invisible) black tips.

Entire venter dull yellowish-green, the legs strongly setose and darkening distally, the tarsi darkest; abdomen finely and evenly punctured laterally with a narrow median impunctate area; no rows of post-spiracular black points present. Thoracic pleura coarsely and deeply punctured; rostrum darker green, its last segment, for the most part, fuscous to piceous.

Male genital segment widely open above, the orifice elliptical in outline and the contents readily visible; apical margin of the segment widely and very shallowly U-shaped, subtended by a moderate chin-like protuberance on the disc above which the wall is somewhat impressed; lateral angle narrowly rounded but not acute and not much produced; apical aspect of the paramere broadly oval and concave (spoon-shaped) and terminating dorsally in an acute, almost acuminate short spur (Fig. 3).

Described from six male and eight female specimens.

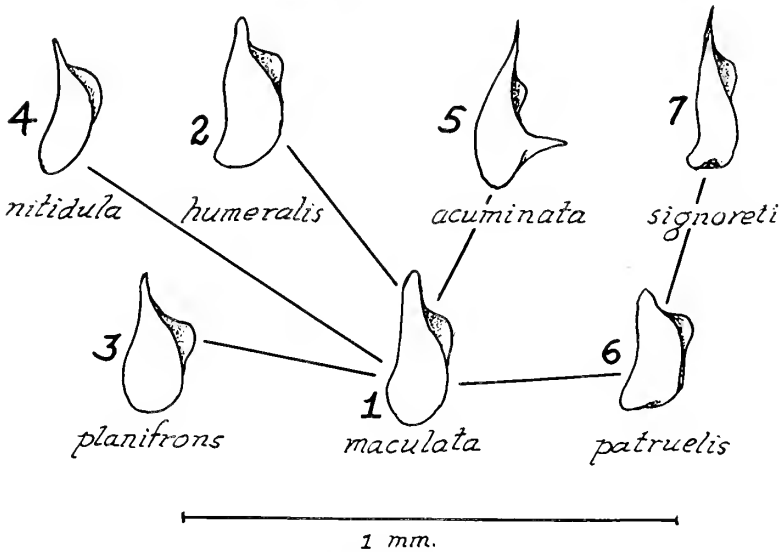
Holotype: Male: 8.75 mm. long; 5 mm. across humeri. 10 miles west of Alamos, Sonora, Mexico. July 21, 1954 (Cazier, Gertsch and Bradt). Deposited in the American Museum of Natural History.

Allotype: Female: 10.75 mm. long; 6 mm. wide across humeri. 10 miles west of Alamos, Sonora, Mexico. July 21, 1954 (Cazier, Gertsch, Bradt). Deposited in the American Museum of Natural History.

Paratypes: MEXICO: Sonora, Alamos, July 21, 1954 (Cazier,

Gertsch, Bradt), one male and two females; Kino Bay, July 14, 1952 (C. and P. Vaurie) two females; Tiburon Island, July 13, 1952 (C. and P. Vaurie), one male and one female; La Choya, June 12, 1952 (Cazier, Gertsch and Schrammel), one male; Minas Nuevas, August 7, 1952 (C. and P. Vaurie) one male; Baja California, San Felipe, June 15, 1952 (Cazier, Gertsch and Schrammel) one male and one female.

On the basis of the build of the male genital segment there is evidence to believe that this form shows relationship to the South American species like *maculata* and *patruelis* rather than to the



Figs. 1–7. Parameres of *Thyanta* species as indicated.

more northern complex of *custator, pallido-virens* and *calceata.* In the former the orifice of the male segment is more or less elliptical in outline, widely open, the contents visible and the apical margin is widely and shallowly U-shaped subtended by a chin-like protuberance on the posterior surface of the cup. In the latter the orifice of the segment is more or less rhomboidal in outline, only narrowly open so that the contents are difficult to see, the apical margin is less U-shaped and is not subtended by a chin-like protuberance on the disc of the cup. The species described here as *planifrons* has all the attributes mentioned first above. Moreover the apical aspect of the paramere is somewhat like that found in *maculata* and totally different from that in *custator* or any of its relatives.

Thyanta nitidula n. sp.

Broadly ovate, glossy, intermediate in size (7 mm. to 8 mm.). Body only half again as long as wide across the humeri; drab green to olivaceous; dorsal surface quite glossy and not at all rugose, rather coarsely punctured except as noted below.

Head slightly shorter than wide through the eyes (60 × 70), the anteocular margins definitely sinuate; disc coarsely and evenly punctate; apex moderately rounded, not acute; eyes paler than body color; ocelli quite small and each almost twice as far from the adjacent eye as the diameter of the ocellus. Antennal ratios: 15/30/40/40/42 i.e. segment III one third longer than segment II and subequal to IV and V; segments I, II and base of II greenish the remainder fulvous or fulvous red, slightly paler at the bases.

Pronotum at least three times as wide across the humeri as long medianly (200 × 65); humeri acutely angulated and prominent but not produced spinosely; antero-lateral margins weakly sinuate in their middle the edges becoming fuscous to piceous toward the humeri; a vague impressed area just inside each margin; punctures evenly and widely spaced and no evidence of transverse rugosity; punctures in the region of the collar finer and slightly confused.

Scutellum slightly longer than wide at the base (120 × 110); punctures widely and evenly spaced, rather shallow and no evidence of rugosity or confusion; the frenum ends two thirds the distance from the base. Hemelytral punctures very widely spaced with smooth glossy areas between them, slightly denser on the embolium; membrane hyaline with tan maculations clustered centrally.

Connexivum very narrowly exposed, the apical abdominal angles distinctly acute and fuscous to piceous in color, sometimes minutely so. Abdominal venter punctured obscurely laterally and not at all medianly leaving most of the disc glossy; no rows of postspiracular black points present. Femora and tibiae green to pale yellow, tarsi testaceous to fulvous; pilose hairs on the tibiae conspicuous and long and numerous.

Male genital segment widely open above, exposing its contents; the apical margin very broadly and very shallowly U-shaped, subtended by a moderate blunt chin-like protuberance on the surface of the cup; lateral angles not prominent, narrowly rounded but not acute; the apical aspect of the paramere resembles that of *maculata* but on a smaller scale and is less concave but more lunate in its curvature (Fig. 4). The basal valves of the female genitalia

are widely separated from one another so that their inner margins are not at all contiguous.

Described from twelve male and three female specimens.

Holotype: Male: 7.5 mm. long; 5.0 mm. across the humeri. Rio Grande do Sul, Brazil. No date. Deposited in the American Museum of Natural History.

Allotype: Female: 7.8 mm. long; 5.2 mm. wide across the humeri. Nordeste, Brazil, 1933. Deposited in the American Museum of Natural History.

Paratypes: BRAZIL: Rio Grande do Sul, no date, one male and one female in the Museum of Natural History, Vienna, Austria (Signoret collection). Matto Grosso, Bodoquena, no dates, six male, one in the collection of the American Museum of Natural History and five in the collection of Professor A. Costa-Lima. Salobra, one male in the collection of Professor A. Costa-Lima. Nordeste 1933, three males and one female in the collection of Professor A. Costa-Lima.

Intermediate in size, between the smaller *Thyanta humilis* Bergroth and the larger *T. maculata* (Fabricius) but differing from both by lack of specific color banding and maculation on the thorax and the much more glossy appearance. The heads of the parameres resemble those of *maculata* but are narrower and less concave.

Thyanta acuminata n. sp.

Small in size (6 mm. or less long) and similar in appearance to *T. humilis* Bergroth, but much more depressed. Drab reddish-green to olivaceous and somewhat glossy.

Head a little shorter than wide through the eyes (55 × 70), densely and evenly punctate, the anteocular margins definitely sinuate and converging to a narrowly rounded apex; ocelli proportionately large and as close to the inner edge of the eye as the diameter of an ocellus; antennal ratios: 15/31 31/40 40 i.e. segments II and III subequal, IV and V subequal, each of the latter about one third longer than each of the former; the basal three segments concolorous pale olivaceous the terminal one darker, usually brown.

Pronotum no more than three times as wide across the humeri as long medianly (150 × 50); antero-lateral margins straight, humeri blunt to rectangular, not prominent, hardly extending beyond the line of the elytral bases; disc evenly, clearly but moderately punctate, neither large punctures nor small ones present, a slight congestion in the vicinity of the collar; no color banding between the humeri, sometimes a slight darkening of the ground color.

Scutellum as long as wide across the base (90 × 90), the frenum ending at a point three quarters the distance from the base so that the tongue is rather short with its margins converging rapidly to a narrowly arcuate but not acute apex; punctures on the disc larger, more shallow and confused than those on pronotum. Hemelytra punctured like the pronotum, the lateral punctures more congested; membrane vitreous without a trace of brownish dots or dashes.

Connexivum barely exposed, its margins concolorous, apical angles of the abdominal segments rectangular, neither produced nor dark colored; ventral abdominal surface sparsely and shallowly punctate laterally the median area impunctate; no row of post-spiracular black-points evident; basal portions of the legs concolorous with the body, the terminal portions of the tibiae and all the tarsi much darker, usually brown; tibiae with a recognizable but sparse setose pile.

Apical margin of the male genital cup very shallowly and widely U-shaped, so wide and shallow as to be almost straight; lateral angles of the segment not at all prominent but bluntly rounded; apical aspect of the paramere distinctly concave (spoon-shaped) with a lateral projecting acuminate tooth near the lower end and an acuminate, tapering dorsal tip (Fig. 5).

Described from thirteen male and four female specimens.

Holotype: Male: 6 mm. long; 4 mm. across the humeri. Rosario de la Frontera, Republica Argentina, June 1916. Deposited in the American Museum of Natural History.

Allotype: Female: 6.5 mm. long; 4.25 mm. across the humeri. Chaco Republica Argentina, May 25, 1945. Deposited in the American Museum of Natural History.

Paratypes: ARGENTINE: Chaco, May 25,1945, two males and one female deposited in the American Museum of Natural History; three males and one female in the United States National Museum; Ruiz de los Llanos, May 7, 1920 (Goldbach) one male in the P. Wygodzinsky collection; Tucuman, February 26, 1946 (P. A. Perry) four males and one female in the Cornell University collection. URUGUAY: Montevideo, no date, one male deposited in the United States National Museum. PARAGUAY: Villarrica, June 1934, one male in the United States National Museum.

Although there is a superficial similarity between this species and *Thyanta humilis* Bergroth I believe that there is closer relationship to *Thyanta maculata* (Fabricius) from which species *humilis* is likewise descended. Both *humilis* and *acuminata* are in

reality small editions of the large *maculata* but differ in color markings and puncturation and in structure of the male parameres. In *acuminata* the second and third antennal segments are about equal while those of both *maculata* and *humilis* show segment II usually considerably shorter than III. The unique structure of the head of the paramere in *acuminata,* with its lateral sharp tooth and tapering dorsal tip has suggested the application of this characteristic to the specific name.

Thyanta signoreti n. sp.

Obovate, glossy, intermediate in size (7 mm. to 8 mm. long), uniformly clear olivaceous yellow except on the posterior half of the pronotum which tends to become dull green. Dorsal surface coarsely and uniformly punctured throughout; totally devoid of reddish or darker markings, only the terminal segment of the rostrum being piceous.

Head one eighth shorter than wide through the eyes (70 × 80); ocelli small and farther from the inner margin of the eye than the diameter of an ocellus; anteocular margins only weakly sinuate, then more parallel terminating a moderately rounded apex; antennal ratios: 15/35/45/50/50, i.e. segment II about four fifths the length of III; segments IV and V subequal, all segments concolorous with no paler or darker markings at the joints.

Pronotum less than three times as wide as long medianly (187 × 68), antero-lateral margins perfectly straight, humeri subrectangular and only weakly produced beyond the margins of the hemelytra; disc coarsely punctate with vague rugose lines between the punctures, particularly in the central area.

Scutellum slightly longer than wide across the base (125 × 115); coarsely punctate and vaguely transverse rugose; the frenum ends at a point about two thirds the distance from the base so that there is a relatively long tongue which has a narrowly rounded but not acute apex. Hemelytra evenly and coarsely punctate throughout; membrane hyaline without brown dots or dashes.

Connexivum hardly exposed, the apical abdominal angles rectangular, not at all prominent and not darkly colored; abdominal venter somewhat glossy with the punctures very fine and vague; punctures on the thoracic pleura few and shallow; legs concolorous dull straw colored, only the tarsal claws black; femora and tibiae moderately pubescent.

Apical margin of the male genital segment weakly trisinuate; ventral surface of the cup only weakly produced into a chin-like

protuberance; heads of parameres narrowly subtriangular with a dorsal sharp, almost acuminate, tip but with a slightly concave surface (Fig. 7).

Described from four specimens, one male and three female.

Holotype: Male: 7.8 mm. long; 5.0 mm. wide across the humeri. Colombia, South America. Signoret collection. Deposited in the Museum of Natural History, Vienna, Austria.

Allotype: Female: 8.5 mm. long; 5.5 mm. wide across humeri. Colombia, South America. Signoret collection. Deposited in the Museum of Natural History, Vienna, Austria.

Paratypes: Two females with the same data as above. One deposited in the Museum of Natural History, Vienna, Austria, the other in the American Museum of Natural History.

These four specimens were found in a shipment of *Thyanta* from the Museum of Natural History of Vienna and sent here for study by Dr. Max Baier. They belong to the Signoret collection; unfortunately the three female specimens are not in good condition but the male is almost perfect. They merit a specific name; indeed, Signoret himself recognized their distinctiveness for each specimen bears a label in his handwriting "*lucida*" suggesting that the prime feature of them is their concolorous clear aspect. However, Signoret never undertook to publish a work including descriptions of these four. It is now my privilege to name them after this eminent hemipterist.

Unfortunately only the locality "Colombien" is given on the labels and no collecting dates occur.

This species is apparently related to either *maculata* or *patruelis* Stål, but *patruelis* is probably related to *maculata* in turn. It differs from either in several distinctive ways, particularly in the absence of bright red color markings on the head, pronotum, elytra and scutellum; also by the absence of black apical angles of the abdominal segments. There is greater obscurity and vagueness to the abdominal puncturation and the humeri are less pronounced. The weakly trisinuate apical margin of the male genital segment is distinctive and the heads of the parameres are dissimilar to either of the probable related species.

Thyanta cornuta n. sp.

Body subtriangular in outline, almost as wide across the humeri as long; intermediate in size (7 mm. to 8 mm. long); olivaceous in color, almost uniformly so and not at all glossy; rather evenly and coarsely punctured with the interpunctural areas forming a vague reticulum.

Head slightly shorter than the width through the eyes (60 × 65); anteocular margins weakly sinuate and converging to a very narrowly rounded apex, at which point the tylus is slightly longer than the juga; ocelli small and farther from the inner margins of the eyes than the diameter of an ocellus; antennal ratios 17/35/-36 35/36 i.e. the terminal four segments all subequal; segments I, II and the basal half of III olivaceous, the remainder becoming rubescent.

Pronotum more than three times as wide across the humeri as long medianly (245 × 75); humeri greatly produced outward and upward into projecting horn-like extensions with acuminate apices that gradually become fuscous; antero-lateral margins straight, thickish and vaguely vertically rugose.

Scutellum quite evenly and coarsely but shallowly punctured, very slightly longer than wide (140 × 135); the frenum ends just beyond the middle and the margins of the tongue converge to a narrowly rounded apex. Hemelytral punctures deep and wide-spaced, those laterally becoming more dense; membrane hyaline with a few faint brown dots scattered centrally.

Connexivum widely exposed, concolorous, perhaps a little paler than the elytra and scutellum; apical abdominal angles rectangular, weakly produced and not colored fuscous or piceous. Ventral abdominal surface irregularly punctured, punctures becoming finer and more congested laterally; the median disc for the most part impunctate; a longitudinal row of moderately sized post-spiracular black points present on each side; all thoracic pleura very distinctly and coarsely punctate; legs concolorous except the tarsi which become rubescent like the terminal segments of the antennae.

Described from three specimens, two female and one male.

Holotype: Female: 8.5 mm. long; 7.2 mm. wide across the humeri. Chapada, Matto Grosso, Brazil. A.M.N.H. accession number 23739. Deposited in the American Museum of Natural History.

Allotype: Male: 6.8 mm. long; 6 mm. wide across the humeri. Chapada, Matto Grosso, Brazil. A.M.N.H. accession number 23739. Deposited in the American Museum of Natural History.

Paratype: One female, same data as above.

This species is being described from material collected by the late Dr. Herbert H. Smith, naturalist and explorer, who travelled extensively in Brazil during the period 1870–1880. Since no dates are assigned to these specimens it must be assumed that they were captured sometime during the above mentioned decade. Unfortu

nately the male specimen lacks the terminal abdominal segment; therefore the form of the genital cup and the nature of the parameres cannot be described at this time. In general the species superficially resembles *Thyanta acuta* Ruckes recently described from Paraguay, but differs markedly in color and color pattern, in having coarser puncturation, in size and of course in the presence of short, stout and more prominent horn-like humeri.

COLLECTIONS OF A BIRD TICK, IXODES BRUNNEUS KOCH FROM GEORGIA.

Robert D. Lee[1] and Gordon L. Hight, Jr.[2]

The following collections of *Ixodes brunneus* Koch were made by the junior author from Rome, Floyd County, Georgia: 1 tick from a Song Sparrow, XI-15-54; 2 ticks from two Cardinals, X-17-54, XI-29-54; 1 tick from a Fox Sparrow, XI-27-54; and 1 tick from a White-throated Sparrow, XI-28-54. All ticks were females.

I. brunneus has been reported from Fulton County by Cooley and Kohls (1945) and from three other localities in Georgia by Bishopp and Trembley (1945). This is the first report of this species from Floyd County; however, since the species has a rather wide distribution this locality record is, according to Kohls (*in litt.*), "not surprising."

Although *I. brunneus* has been taken from a number of birds, it has not previously been reported from a Cardinal.

The authors wish to thank Dr. Glen M. Kohls, Rocky Mountain Laboratory, for identifying the specimens.

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Cooley, R. A. and G. M. Kohls. 1945. The genus *Ixodes* in North America. Nat. Inst. Health Bull. No. 184. 246 pp.

[1] School of Tropical and Preventive Medicine, Loma Linda, California.

[2] Rome, Georgia.

SOME NEW GENERA OF ASILIDAE (DIPTERA).

By Frank M. Hull,[1] Oxford, Mississippi.

Recent studies of Diptera have brought to light several new genera of flies, two of which are described in this paper.

Apotinocerus n. gen.

Rather small flies, the abdomen tapered in females, cylindroid in males, with rather long stiff flat appressed pile on legs and abdomen. Mesonotal pile fine, sharp and setate. Antennal style exceptionally short, only as long as the second antennal segment. Not closely related to other genera, although the antennae resemble *Glaphyropyga* Schiner. Length 17 mm.

Head, lateral aspect: of normal length. Face scarcely visible on the upper fourth, but prominent and protuberant below on the remainder. Bristles begin at the lower third of occiput and consist of approximately twenty-two pair of stout moderately long bristles. The proboscis is short and rather slender. The palpi is of one segment. The antennae are slender, rather elongate, the first segment at least twice as long as the second, the third segment, excluding style, is as long as the first two segments together. The third segment is a little thickened at the base, slightly attenuate near apex, and bears a short style which is one-third as long as the third segment, slightly flattened, with a minute spine at apex.

Head, anterior aspect: head nearly circular in outline, divergent below. Face with numerous, moderately stiff bristles confined to the middle of the facial protuberance and with, at the epistomal margin, four pair of extremely stout, longer bristles directed downward. Vertex deeply excavated, ocellar protuberance low, with three or four pair of short divergent bristles.

Thorax: pollinose, including pleura. Acrosticals present; the dorsocentrals posteriorly become long and slender, with the last two pair quite stout. Bristles of mesonotum quite long and very stout; notopleura with two, the post supra-alar with one, post calli with two. Scutellar margin with a wide band of rather long slender bristles. Whole scutellum thick and convex, without distinct margin. Metanotal slopes bullose and pubescent only. Post meta coxal area membranous.

Legs: the femora are rather stout, especially the anterior four. Hind femora everywhere flat appressed pilose, with the following

[1] University of Mississippi.

bristles: six dorsolaterals, six ventrolaterals, one ventrobasal, five ventromedial, and four medials, which are confined to the basal third. Middle femora with three anterior bristles, three posteriors near the middle, four posteriorly at the apex, seven posteroventrally on the basal half, five anteroventrally through the middle. Anterior femora somewhat stouter, with long stiff white pile below and some erect white pile above but no bristles. End tarsi with long pulvilli. Claws sharp.

Wings: rather slender and hyaline; marginal cell closed with stalk, R_4 and R_5 end well before the wing apex, cell R_4 slightly narrowed at apex, fourth posterior cell closed with a long stalk, anal cell closed with a stalk. Ambient vein complete. Marginal cell distinctly widened. Costa and costal cells not expanded.

Abdomen: strongly tapered in females; only slightly tapered near the base in males. Abdomen considerably longer than the wings, especially in female; seven tergites present in the male with the eighth barely visible linearly. Seven tergites in the female, with the eighth quite elongate, conical and incorporated in ovipositor. Stout, white bristles present as follows: six pair on tergite one; five to eight pair posteriorly, subapically, encircling tergite two and three; and similarly with reduced numbers on tergite four, five and six. Male terminalia conspicuous, elongate, nonrotated, the upper forceps tightly opposed; middle forceps short, ventral plate deeply bilobed in the middle with a posteroventrally thick long opposed brush of stiff, bristly, white pile. Female terminalia as wide dorsally as laterally; apical portion dorsally split and pointed; spines absent.

Genotype: Proctacanthus brevistylatus Wulp.

Material studied: a male and a female from the Hermann collection.

Distribution: neotropical, 1 species (Argentina).

Strobilopygius n. gen.

Flies of medium size or smaller, of dark coloration, sparsely pilose. The lower two-thirds of the face is strongly protuberant, with many long bristles. The legs are stout and rather bristly. The abdomen is tapered, but rather wide at the base and distinctly flattened; the fourth posterior cell is closed. These flies suggest *Hypenetes* in appearance, differing sharply in the non-attenuate third antennal segment and the absence of spines on the female terminalia. Length 12 mm.

Head, lateral aspect: the face strongly convex and protuberant,

but the protuberance restricted to the lower two-thirds, leaving the upper third barely visible. Occipital bristles becoming stronger near the vertex, where they are strongly proclinate. Proboscis short, stout, held almost horizontally, slightly compressed laterally. Palpi clearly of two segments; first segment burst, second segment porate. The antennae rather short, the first segment nearly twice as long as the second, and both with abundant, rather long pile dorsally, laterally and ventrally. Third segment strongly swollen dorsoventrally, laterally compressed, and narrowed only at base and apex.

Head, anterior aspect: the face has numerous extremely long, stout bristles directed for the most part forward but slightly downward, the upper bristles more or less curved, the greater portion spread out as a triangular patch on the anteromedial part of the protuberance. The ocellar protuberance is low with oblique sides.

Thorax: pollinose and generally dull; the pile is scanty, fine and erect. Acrosticals and dorsocentrals present anteriorly. Humeri with numerous fine, long hairs. Material studied shows the following complement of bristles: humerals none, post humerals none, notopleurals two, supra-alars two, post callars three, scutellar marginals four pair.

Legs: all femora stout, especially upon the anterior and middle pair. Hind pair slightly attenuate basally; tibia not greatly thickened. The femora bear stout moderately long bristles; one dorsal near apex, two dorsolaterals in a row shortly removed from apex and three laterals situated over the middle area. The hind tibiae are thickly appressed pilose with a few long scattered bristly hairs ventrally and laterally and medially near the base and bearing stout, curved, moderately long bristles as follows: three dorsomedials, three dorsolaterals; three ventrolaterals; apex of anterior tibiae without spur. All end tarsi bear well developed pulvilli.

Wings: of normal breadth. Marginal cell widely opened. R_1 ending before the wing tip, fourth posterior cell closed and stalked, the vein closing this cell nearly parallel or continuous with the lower vein closing the discal cell. Anal cell closed and stalked. Alulae moderately wide; ambient vein complete.

Abdomen: as long as the wings, gently tapered, distinctly flattened, the first tergite laterally swollen and convexly ridged and this segment as wide as the mesonotum. Female with more strongly attenuate and pointed abdomen. Six tergites are well developed in the male, the seventh is visible dorsally but quite short, the eighth can also be seen from above but is a mere linear ridge.

Seven tergites present in the female; the eighth forms part of the ovipositor. Two to three weak bristles or coarse bristly hairs are present in the posterior corners of tergites two to six. Male terminalia conspicuous with upper forceps well developed, nonrotated. Female genitalia short, thrust obliquely upward with the terminal portion held at right angles; no spines.

Genotype: Dasypogon hirtipes Macquart.

Material studied: a male and a female from the Hermann collection.

Distribution: neotropical, 1 species (Chile area).

THREE NEW NEOTROPICAL TYPHLOCYBINE LEAFHOPPERS FROM ECONOMIC PLANTS.

By David A. Young, Jr.,[1] Washington, D. C.

Among the many new species of exotic leafhoppers submitted for identification each year, some are associated with economic plants, and names for these species are desirable, especially when taxonomic treatment of the groups to which they belong is not to be completed in the immediate future. The three species described below are examples.

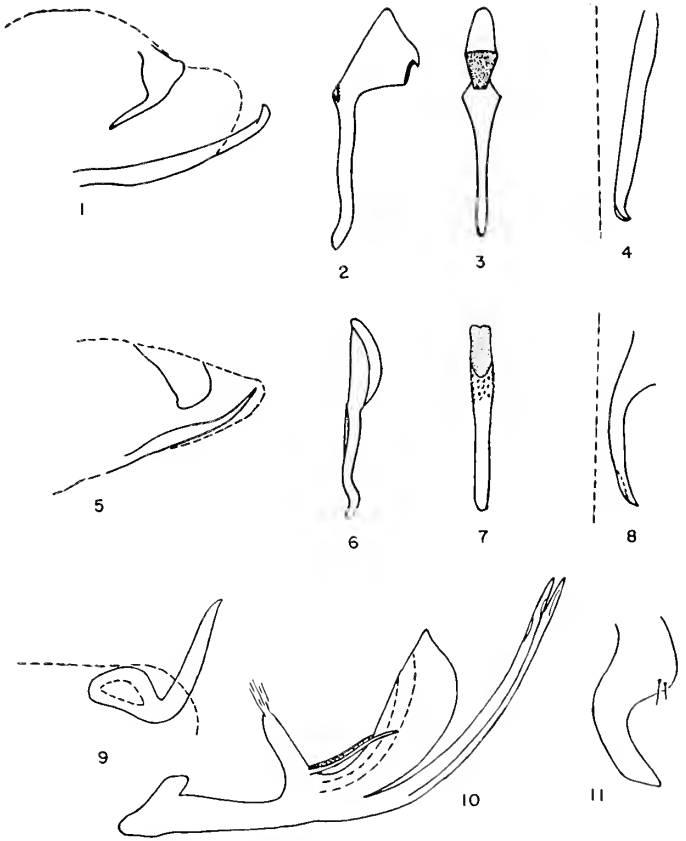
Empoasca yusti n. sp.

Length of male 3.3 mm., of female 3.6–3.8 mm. Alcoholic material with an area on crown next each eye, and the basal angles of the scutellum, buff; forewing with yellow reflections. Male with sternal abdominal apodemes traversing two or three abdominal conjunctivae; genital capsule with anal processes broad basally, each tapered abruptly in basal half, slender and gradually tapered in apical half to acute apex, directed anteroventrad and extending to middle of pygofer disc; ventral pygofer processes exceeding posterior pygofer margin, each in lateral aspect gradually, slightly curved dorsad through most of length, the apex curved sharply dorsad and rotated laterad, in ventral aspect the two ventral pygofer processes convergent throughout length but not contiguous apically; aedeagus in lateral aspect with shaft abruptly tapered, appearing truncate at gonopore which is apical.

Male type (cat. no. 63034) and a series of paratypes of both

[1] Entomology Research Branch, Agricultural Research Service, United States Department of Agriculture.

BULL. B. E. S. VOL. LI PLATE V



Figs. 1–4. *Empoasca yusti* n. sp.: 1, male pygofer, lateral aspect; 2, aedeagus, lateral aspect; 3, same, caudal aspect; 4, pygofer process, caudoventral aspect (broken line represents midline of specimen). Figs. 5–8. *Empoasca fontesi* n. sp., same structures as in *yusti*. Figs. 9–11. *Dikrella* (*Readionia*) *gossypii* n. sp.: 9, male pygofer, caudodorsal portion; 10, aedeagus, lateral aspect; 11, apex of right style, dorsal aspect.

sexes, Pomasqui, Ecuador, 8-X-53, from potato, and paratypes of both sexes, Paute, Ecuador, Aug. 11, 1955 (H. R. Yust), on walnut, in U. S. National Museum collection.

The form of the anal process is similar to that of *martorelli* Metcalf from Puerto Rico, *acantha* Davidson and DeLong from Mexico, and *caverna* Davidson and DeLong from central United States, but the form of the pygofer process will serve to separate *yusti* from any of these.

Among the species of *Empoasca* received from Mr. Yust from potato in Ecuador were this new species, *fabae* (Harris), *stevensi* Young, and a species near *cothurna* Davidson and DeLong.

Empoasca fontesi n. sp.

Length of both sexes 3.0–3.2 mm. Alcoholic material evenly suffused with yellow dorsally except disc of scutellum which is white. Male with sternal abdominal apodemes traversing two abdominal conjunctivae; genital capsule with anal processes broad and lobelike, directed ventrad and extending to middle of disc of narrow pygofer; ventral pygofer processes not attaining posterior pygofer margin, each in lateral aspect gradually tapered, acute at apex, curved gradually caudodorsad, in ventral aspect the two processes shaped like reversed parentheses; aedeagus without processes, with axis of shaft only slightly diverging from axis of preatrium; shaft with caudoventral surface ornamented with minute denticles; gonopore anteapical on caudoventral surface.

Male type and a series of paratypes of both sexes, Bahia, Brazil, 26-IX-1955 (J. T. Fontes), from fig tree, in U. S. National Museum collection (Cat. No. 63035).

This species is not very similar in genitalia to any of the species known to me. It appears to be the first species of *Empoasca* described from fig.

Dikrella (Readionia) gossypii n. sp.

Length of both sexes 2.7 mm. Alcoholic material without differentiating color characteristics. Male with pygofer processes short, each curved through 90° near base, apex directed caudodorsad. Style in dorsal aspect with anteapical lobe rounded, not pronounced. Connective papilioniform. Aedeagus with preatrium as long as free portion of shaft; shaft broad, strongly convex on ventral margin, tapered abruptly at apex; gonopore anteapical on anterodorsal surface; a pair of slender processes arising on dorsal apodeme near base of shaft, extending caudad to midlength of

shaft, parentheses-shaped in ventral aspect, and a pair of broader, longer ventral cylindrical processes arising at base of shaft and extending caudodorsad beyond apex of shaft, crossed anteapically in caudoventral aspect. Sternal abdominal apodemes traversing one conjunctiva. Female seventh sternum with hind margin broadly and very slightly convex at middle.

Holotype male and a series of paratypes, Quevedo, Ecuador, October 24, 1955 (H. R. Yust), from cotton, in U. S. National Museum collection (Cat. No. 63036).

This species is related to *bimaculata* Ruppel and DeLong, and to *dentata* Ruppel and DeLong, judging from their illustrations of those species. It differs in having a much broader shaft and in the crossed ventral aedeagal processes.

UNDESCRIBED SPECIES OF NEMATOCEROUS DIPTERA. PART IV.

By Charles P. Alexander, Amherst, Mass.

The preceding part under this title appeared in 1953 (Bull. Brooklyn Ent. Soc., 48: 97–103). In the present report I am describing three new species of Ptychopteridae and one Blepharoceridae and am providing further notes on the remarkable Trichocerid fly *Kawasemyia imanishii* (Tokunaga).

PTYCHOPTERIDAE

Ptychoptera chalybeata n. sp.

Size small (wing of male 6 mm.); general coloration of head and thorax black with bluish reflections; femora yellow, the tips narrowly brownish black, tibiae and basitarsi obscure yellow, the tips narrowly darkened; wings whitish, the broad tip and a narrow band at cord brown; abdomen yellow, the posterior borders of the intermediate segments black, the subterminal segments uniformly blackened to form a ring.

Male: Length about 6 mm.; wing 6 mm.; antenna about 3 mm.

Mouthparts, including palpi, light yellow. Front and clypeus brownish black. Antennae moderately long; scape brown, pedicel and first flagellar segment obscure yellow, succeeding segments dark brown, cylindrical, with short verticils. Head black, with bluish reflections.

Prothorax chiefly dark brown. Mesonotum black, with steel blue reflections, most evident on the praescutum. Pleura black,

the dorsopleural region pale. Halteres with stem yellow, knob broken. Legs with all coxae and trochanters pale yellow; femora yellow, the tips narrowly but conspicuously brownish black; tibiae and basitarsi obscure yellow, the tips narrowly more darkened, remainder of tarsi black. Wings whitish, with an unusually heavy brown pattern, including the apex basad to just beyond the level of the forks, the wing tip a trifle paler; a brown band at cord, narrowed posteriorly, extending to the bend of vein *Cu*; a small postarcular spot in bases of cells *R* and *M*; cells *C* and *Sc* more yellowed than the ground; veins brownish black. Venation: *Rs* very short and straight, about twice the basal section of R_5; cell R_4 a trifle deeper than cell *2nd* M_2.

Abdomen chiefly yellow, the posterior borders of the intermediate segments black, subterminal segments uniformly black to form a ring; hypopygium obscure yellow. Male hypopygium with the tergal lobes relatively long and narrow, their tips weakly expanded, on inner surface provided with strong retrorse setae. Dististyle small, pale, shallowly and unequally bilobed at tip, the lower lobe longer. Phallosome heavily blackened.

Habitat: Thailand.

Holotype: ♂, Huey Kao, June 14, 1953 (Manop Ruttanapradith).

Type in my collection.

The only generally similar regional species is the larger *Ptychoptera distincta* Brunetti, of the eastern Himalayas. This has the wing pattern and venation very much as in the present fly, differing in the coloration of the body and legs. The male sex of *distincta* is still unknown.

Ptychoptera schoutedeni n. sp.

Mesonotum orange, the praescutum chiefly black, the cephalic fourth pale; posterior sclerites of notum black, the posterior two-thirds of the mediotergite fulvous yellow; basal palpal segments yellow; antennal scape fulvous; halteres with stem fulvous, knob infuscated; femora and tibiae obscure yellow, the tips weakly darkened; wings pale yellow, with a brown seam over cord, the wing tip paler brown; vein R_2 oblique, basal section of R_5 conspicuous; male hypopygium with the elongate lobes of the tergite terminating in slender glabrous spines; dististyle trilobed, the basal lobe small, capitate.

Male: Length about 9 mm.; wing 8 mm.; antenna about 4.8 mm.

Rostrum blackened, pale basally; palpi yellow basally, the outer

segments brownish black. Antennae relatively long, a little more than one-half the body; scape and pedicel fulvous, flagellum black, the proximal third of the first segment obscure yellow; flagellar segments elongate-cylindrical, with short verticils. Front reddish; head behind the antennal bases metallic blue.

Mesonotal praescutum chiefly black, the cephalic fourth, with the pronotum, obscure yellow; posterior sclerites of notum black, the posterior two-thirds of the mediotergite and all of the pleurotergite fulvous yellow. Pleura fulvous yellow. Halteres with stem fulvous, knob infuscated. Legs with all coxae and trochanters fulvous yellow; femora obscure yellow, the tips weakly darkened, tibiae similar with more narrowly darkened tips; tarsi yellowish brown basally, outer segments dark brown. Wings with the ground pale yellow, the prearcular and costal regions more saturated yellow; a narrow but conspicuous brown crossband at cord (presumably crossing the wing but the posterior part damaged in the unique type); wing tip darkened as far back as the level of fork of R_{4+5}; veins brown, more yellowish brown in the brightened parts. Abundant macrotrichia in the outer cells, in R_3 occupying all but the base, in cell R_5 less than the outer half. Venation: *Rs* subequal in length to *r-m*, straight; basal section of R_5 conspicuous; vein R_2 oblique, as in *hopkinsi*, fully as long as R_{1+2}; cell R_4 about two-thirds its petiole, cell M_1 about one-third this length.

Abdominal segments yellow, their posterior borders dark brown; fifth and succeeding segments dark brown, including the hypopygium and appendages. Male hypopygium with the tergite profoundly divided into two slender arms that are directed dorsad and thence caudad, broad at base, thence more narrowed, at tips suddenly produced into long straight spines, these provided with weak setae, the extreme tips glabrous. Dististyle produced into a long slender arm, near base with a second smaller branch that is slightly more than one-third as long, its tip obtuse, with conspicuous setae; at extreme base of style with a short-stemmed club, with long coarse setae. Sternal lobes in profile appearing subtriangular, the lower and outer points obtuse.

Habitat: Belgian Congo.

Holotype: Volcan Karissimbi, Nya Muzinga, January 1926 (H. Schouteden); Museum of the Belgian Congo, Tervuren.

I take great pleasure in dedicating this fly to Dr. Henri Schouteden. The species is closest to *Ptychoptera hopkinsi* Edwards, of Uganda, which agrees in the oblique vein R_2 of the wings, disagreeing in the coloration of the palpi, antennae, thorax, legs and wings. The male hypopygium of *hopkinsi* has not been described.

Ptychoptera stuckenbergi n. sp.

Anterior sclerites of mesonotum chiefly black, posterior part and the pleura yellow; wings grayish, conspicuously patterned with brown, including an irregular band along cord and broad seams over the veins beyond the cord; vein R_2 transverse; abdominal tergites black, the bases of the fourth and fifth segments obscure yellow, genital segment and ovipositor orange.

Female: Length about 9 mm.; wing 8.5 mm.

Rostrum fulvous yellow; palpi black, basal segment paler. Antennae with scape and pedicel light brown, first flagellar segment obscure yellow, succeeding segments passing into black; flagellar segments subcylindrical, longer than the verticils. Head with front fulvous; vertex and occiput polished black.

Pronotum fulvous. Mesonotal praescutum chiefly polished black, the anterior third fulvous, isolating a small black median triangle on cephalic end; scutal lobes chiefly fulvous, the median area narrowly black; scutellum fulvous, parascutella black; postnotum and pleura uniformly yellow. Halteres brownish black, only the base of stem pale. Legs with all coxae and trochanters yellow; femora obscure yellow to brownish yellow, the tips narrowly brownish black; tibiae dark brown, tarsi passing into black. Wings with the ground grayish, conspicuously patterned with dark; prearcular and costal regions light brown; a dark brown seam over cord, its margins very irregular or erose due to pale spots in the abutting cells; veins beyond cord conspicuously seamed with dark brown, leaving the centers pale, involving about the outer half of the included veins; a faint dusky suffusion over most of cell *R* and in the base of *M;* a dusky seam along vein *Cu;* veins brown. Macrotrichia of outer cells extending basad to beyond the radial fork. Venation: R_2 transverse, R_{1+2} unusually long, approximately two-thirds to three-fourths *Rs;* basal section of R_5 very short to punctiform; cell R_4 about as long as its petiole, cell *2nd* M_2 about one-third its petiole.

Abdominal tergites black, the bases of the fourth and fifth segments obscure yellow; genital segment and ovipositor orange; basal sternites chiefly darkened.

Habitat: Southern Rhodesia.

Holotype: ♀, Rhodes-Inyanga National Park, near Inyanga, January 14, 1955 (B. Stuckenberg & P. Graham); Natal Museum, Pietermaritzburg.

This interesting fly is named in honor of Dr. Brian Stuckenberg, who has added most materially to our knowledge of the Dip-

tera of South Africa. The species is quite distinct from *Ptychoptera capensis* Alexander and *P. matongoensis* Alexander, the only other known regional species of the genus, in the coloration of the thorax and wings. The irregular darkened band along the cord of the wing is very different from the condition found in the above mentioned species though similar to that of *P. ghesquierei* (Collart), of the Belgian Congo, an otherwise quite different fly.

TRICHOCERIDAE

Kawasemyia imanishii (Tokunaga)

Alfredia imanishii Tokunaga; Annot. Zool. Japon., 15: 98, pl. 14, fig. 2 (adult ♀); 1935.

Trichocera imanishii Tokunaga; Annot. Zool. Japon., 15: 468; 1936.

Trichocera imanishii Esaki et al., Icon. Insect. Japonicorum, Ed. 2: 1512, fig. 4337 (adult ♀); 1950.

Kawasemyia imanishii Alexander; Trans. Shikoku Ent. Soc., 3: 14–16, fig. (venation, ♂); 1952.

The type, a female, was taken on Mount Sasagamine, Echigo, Honshu, Japan, on March 17, 1932, by Kinji Imanishi. Later, both sexes were discovered by Eiji Kawase, also in Echigo, and not far from the type locality. In January 1955, Kintaro Baba found still further specimens at Kurokawa, Echigo. To my knowledge, the fly still is known only from the Province of Echigo.

A very distinct fly, very different from all other species in the family by the nearly wingless females and by the males having the wing shape and venation quite unlike that of any Trichocerid hitherto made known. The remaining genera in the family, including *Trichocera* Meigen (Holarctic, introduced by accident in various places in the southern hemisphere), *Diazosma* Bergroth (Holarctic), *Paracladura* Brunetti (Eastern Palaearctic, western Nearctic, Maorian, Chilean), *Nothotrichocera* Alexander (Australasian), and *Palaeopetaurista* Séguy (Kerguelen Island, Indian Ocean), all have a uniform type of venation that differs but slightly in the various genera. *Kawasemyia*, on the other hand, has the wing shape and venation so different that the latter cannot be homologized with any of the above.

The figure of the male provided at the time I proposed the genus, as above cited, shows the wing shape and trichiation satisfactorily but the venation as there shown and described is evidently variable within certain limits. In the specimens now available, there are two outer forks on the wing disk, interpreted as being *R* and

M, connected by what seems to be the *r-m* crossvein. As in the other specimen, there are no veins at all in the anal field or behind the single vein interpreted as being *Cu*. In the new material, *Sc* is present, ending beyond the level of *r-m*, Sc_2 only moderately retracted; no crossvein in the radial field, as in the earlier specimen; *r-m* connecting at fork of *M* but far before the fork of *Rs*. The wing veins are very pale against the milky white ground.

BLEPHAROCERIDAE

Paulianina robinsoni n. sp.

General coloration dull black, the thoracic pleura clear pale yellow; antennae, halteres and legs chiefly black; wings nearly hyaline, stigmal area narrowly blackened, veins black; abundant macrotrichia in outer wing cells; *Rs* before level of *r-m*; basal section of M_{3+4} about its own length before *r-m*, not fused with Cu_1.

Female: Length about 4 mm.; wing 6.2 mm.

Mouthparts castaneous; palpi brownish black, 4-segmented, the segments progressively shortened. Antennae 15-segmented; scape and pedicel brown, flagellum black; flagellar segments subequal in length, gradually decreasing in diameter, covered with a delicate white pubescence. Head brownish gray; a compressed tubercle immediately behind each antenna; ocellar tubercle conspicuous.

Thoracic dorsum dull black, subnitidous, the surface sparsely pruinose, more heavily so laterally and on posterior sclerites. Pleura clear pale yellow. Halteres black, the base of stem yellowed. Legs with the coxae yellow, trochanters a little darker; remainder of legs dark brown, the bases of the fore and middle femora slightly paler; legs, especially the femora, conspicuously more slender than in *hova*. Wings nearly hyaline; stigmal area narrowly blackened; veins black, conspicuous. Abundant macrotrichia in all outer cells, especially numerous in the radial and medial fields but including the entire margin back to the anal lobe; rows of trichia in cells R_5, M_2, M_3 and M_4. Venation: *Rs* before level of *r-m*, the spur about as long as either section of *Rs*; basal section of M_{3+4} about its own length before *r-m*, not fused with Cu_1.

Abdomen dark brown, sternites with paler posterior borders. Genitalia appearing as two compressed blades, their inner faces closely applied.

Habitat: Madagascar.

Holotype: ♀, km 57, Route Anosibe-Tananarive, February 1955 (A. Robinson); Institute Scientifique de Madagascar.

I am pleased to name this fly for the collector, Mr. Andria Robinson, Preparator at the Institute Scientifique de Madagascar, to whom, and to Dr. Renaud Paulian, I am indebted for great assistance in making known the crane-flies and some other groups of Diptera of Madagascar. The only other species of *Paulianina* known to this date is the genotype, *P. hova* Alexander, which differs evidently from the present fly in coloration and in details of wing venation.

It is of great interest to know that Paulian discovered no fewer than seven distinct types of larvae in the mountain streams of Madagascar that are referrable to the subfamily Edwardsiinae and presumably to the genus *Paulianina* Alexander. The following papers bear on this subject.

Alexander, C. P. A new genus and species of net winged midge from Madagascar. Mem. Inst. Scient. Madagascar, E. I: 227–230, 1 fig.; 1952 (description of *Paulianina* and *P. hova*).

Paulian, R. Fauna des Eaux douces de Madagascar. Ibid., E, IV: 431–441, 15 figs.; 1953.

The fly herewith described may well be the species of which Paulian described the larva from material taken in the forest north of Anosibe in January 1951 (Paulian, l.c., p. 435, fig. 10).

ANNOUNCEMENT

Starting with volume 52 (1957) the annual subscription to the **Bulletin** will be increased from $3.50, established in 1942, to $4.00

Publication Committee

A NEW SPECIES OF CICADULINA (HOMOPTERA: CICADELLIDAE) FROM COLOMBIA.[1]

By Robert F. Ruppel[2] & Dwight M. DeLong[3].

While investigating possible vectors of a stunt disease of small grains in the Department of Nariño, Colombia, the senior author collected from wheat and barley many specimens of a macrosteline leaf hopper which proved to be a new species of *Cicadulina*. Since species of this genus are known to be vectors of virus diseases of grass crops (Oman, 1949), and furthermore species of a closely related genus, *Dalbulus*, are known to be vectors of a stunt disease of corn (Kunkel, 1946, Niederhauser and Cervantes, 1950), this species was of special interest. It is described below as *pastusae*, a name derived from the region where it was first collected.

Cicadulina pastusae n. sp.

In form and coloration the species resembles *Dalbulus maidis* (DeL. and Wol.) but it differs from this species in the characteristic wing venation and genitalia.

The apex of the crown is rounded; the basal width of the crown is about twice as great as its medial length.

Length. Males, 3.4 mm.; females, 3.7 mm.

Color. Crown tan with a round, black spot on each side near the anterior margin. These spots are broadly margined by yellow. Pronotum and scutellum olive with the anterior margin of the pronotum greenish-yellow. Wing uniform golden, subhyaline. Face black with the genae and lora greenish-yellow and the eyes margined with yellow. Legs tan to dark brown. Venter of male black. Venter of female black with the pygofer, proximal portion of the ovipositor sheath, and the posterior margins of the abdominal segments greenish-yellow.

Genitalia. Lateral portions of the posterior margin of the seventh

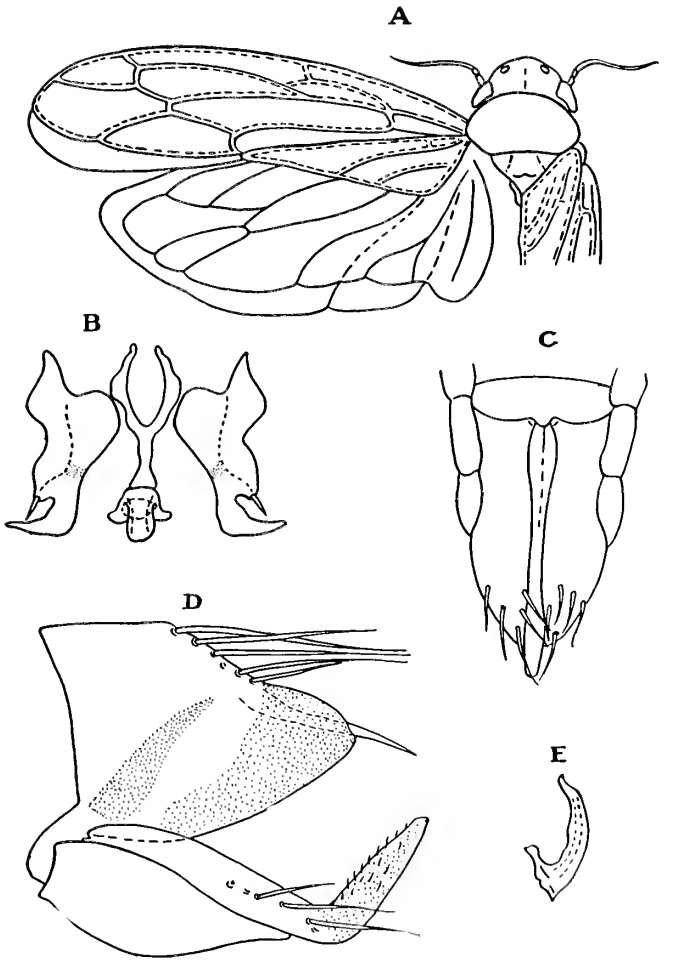
[1] Paper No. 45, Agricultural Journal Series of The Rockefeller Foundation.

[2] Associate Entomologist, Colombian Agricultural Program, The Rockefeller Foundation.

[3] Professor of Entomology, Ohio State University, Columbus, Ohio. The authors would like to express their gratitude to Dr. D. A. Young, Insect Identification and Parasite Introduction Section, United States Department of Agriculture, for his aid in the proper placement of this species.

BULL. B. E. S. VOL. LI PLATE VI

CICADULINA PASTUSAE



A. Dorsal view of head, thorax and wings, allotype female. B. Ventral view of internal genitalia; male paratype. C. Ventral view of terminal abdominal segments, allotype female. D. Lateral view of genital capsule, holotype male. E. Lateral view of aedeagus, holotype male.

sternite of the female rounded; the center portion of this margin produced into a small, rounded tooth.

Male pygofer heavily pigmented, with a triangular section on the disk and the apex hyaline. Long, slender, tapered pygofer hooks arise on the dorso-caudal margin of the pygofers and extend ventro-caudally beyond the apices of the pygofer. The valve is large, conical, and covers the mesal margins of the plates for half of their length. The bases of the plates are broad and heavily pigmented while their apices are hyaline, thin, and turned sharply dorsad. The bases of the styles are broad and heavy; their lateral lobes are blunt and bear a terminal, thick spine; the apical lobes are turned sharply laterad and their apices are pointed. The arms of the connective are slightly curved and are a little longer than the shaft. The base of the aedeagus is ring-like with prominent dorsal processes; the phallicata is broad, nearly parallel-sided, and curved dorsad.

The type series of this species was collected from wheat and barley by the senior author at an elevation of about 2,800 meters near Pasto, Nariño, on 15 July 1955. The holotype male is specimen number 5700 and the allotype female is numbered 5674. Other specimens are at hand from the same locality, collected from potatoes and wheat by Miguel Revelo P. on 29 September and 29 October 1954. Type specimens are deposited in the DeLong collection and paratypes in the United States National Museum.

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Oman, P. W. 1949 The Nearctic leaf hoppers. A genetic classification and check list. Mem. Ent. Soc. of Washington No. 3. 253 pp., 44 pl.

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BULLETIN

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EMPOASCA (HOMOPTERA: CICADELLIDAE) FROM HIGHLAND CROPS OF COLOMBIA[1]

By ROBERT F. RUPPEL[2] & DWIGHT M. DELONG[3].

Corn, potatoes, beans, and several other legume crops grown in the mountainous areas of Colombia are attacked by leaf hoppers of the genus *Empoasca*. The species of this genus have been thoroughly studied in the Nearctic Region, but the Neotropical forms, with the exception of the Mexican species, are little known (Young, 1952). Therefore, the specimens of these insects collected from the crops of the *clima medio* and *tierra fría* (elevation approximately 1,000 to 2,000 m. and 2,000 to 3,000 m. respectively) of Colombia were critically examined by the authors. Six species were found to be adundant: *fabae* (Harris), *prona* Dav. and DeL., *bispinata* Dav. and DeL., and three species described as new in this paper.

The green-colored *Empoasca* tend to fade rapidly after death and in many species the markings become obscured or even change. There is also great variation in intensity of color and in the size of the markings in freshly killed specimens. The color descriptions in this paper are based on well-marked dead specimens. The size data given for the species are based on the average length (from the apex of the crown to the apex of the closed wings) of the best specimens of each series. Although color and length aid in

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separating species of this genus, the male genital structures are diagnostic of the species and reference must be made to these structures in order to identify the species properly. The collections were made from crops near the localities cited and the elevations given are close approximations of the elevations of the actual collection sites.

Types of the species described as new are deposited in the collection of D. M. DeLong and in the United States National Museum.

Empoasca fabae (Harris)

E. fabae is a highly variable species with an involved synonymy (Medler, 1942). It is a widespread pest of many crops in the Neotropics which during the summer months extends its range deeply into the Nearctic Region. In Colombia it is the most important insect pest of beans and during some seasons completely destroys fields which have been left unprotected. The control of this species as a bean pest in Colombia has been studied by Losada (1948) and Benavides (1955).

Length. Males, 3.34 mm.; females, 3.54 mm.

Color. The crown is pale green with a pair of dark green spots on each side of its disk and with a white, median, longitudinal stripe. A spot near each eye is white. The pronotum is pale green with a series of round, white spots along its anterior margin. The scutellum is pale green with its disk white. The wings are pale green, hyaline. The face is pale yellow with a white, median, longitudinal stripe and with a pair of white, transverse, dorsal stripes. The apex of the clypellus is dark green.

Male genitalia. The apices of the pygofers are rounded and bear a row of spines. The ventral processes of the pygofers are straight with their dorsal margins appearing swollen and with their apices truncate. The ventral processes of the Colombia specimens vary slightly from those of the North American *fabae*. Dr. D. A. Young (personal correspondence) noted that this character is variable in *fabae* from the United States of America and Ing. José Guevara C. (personal conversation) noted that pygofer processes of the *fabae* from Mexico are variable also. The Colombian specimens are therefore referred to *fabae* pending the evaluation of these differences. The anal hooks are broad at their bases and narrow on their posterior margins to form pointed apices. The plates are long, bend dorsad near their center, and bear a row of long hairs. The styles are slender with their apices curved laterad. The connective is straight and hyaline. The base of the

aedeagus is long, straight, and slender. The phallicata is rectangular.

This species is the most common and damaging of the *Empoasca* found in the *clima medio* and is described from many specimens collected from beans, corn, *Crotalaria*, cowpea, soybeans, and "weeds" at Palmira, V. del Cauca (elev. 1,000 m.), and Medellín, Ant. (elev. 1,500 m.).

Empoasca prona Dav. and DeL.

Prona is a slender leaf hopper which, although superficially resembling *fabae*, is larger and more strikingly marked than *fabae* and has distinctive male genitalia.

Length. Males, 3.83 mm.; females, 3.85 mm.

Color. The crown is pale green with a white, median, longitudinal line and with a pair of white spots near the posterior margin. The ocelli are outlined in white. The pronotum is pale green with a series of white spots along its anterior margin and with a basal, logitudinal, white band. The scutellum is white with its basal angles dark green. The wings are light green, hyaline. The face is yellow with a longitudinal white bar near the center of its dorsal margin and with the apex of the clypellus dark green.

Male genitalia. The genital capsule is similar to that of *fabae*. The ventral processes of the pygofers are slender and long, and their apices are sharply pointed and curve abruptly laterad. The anal hook is sharply pointed and curves gently anteriorly. The phallicata is broad, its apex is rounded, and its ventral margin is conspicuously thickened.

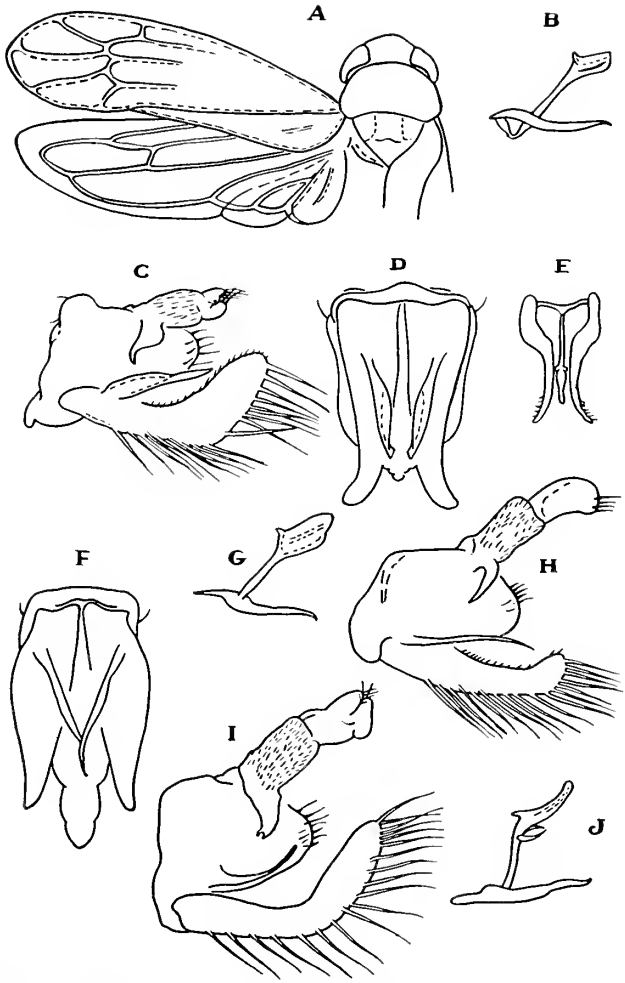
This species was described by Davidson and DeLong (1940) from specimens from Costa Rica, Brazil, and Mexico. In the *clima medio* of Colombia it occurs in small numbers and has been collected from beans and *Crotalaria* at Bello, Ant. (elev. 1,500 m.), and from beans, cowpea, and soybeans at Palmira, V. del Cauca. *Prona* has also been taken from potatoes at Las Palmas, Ant. (elev. 2,300 m.), and La Ceja, Ant. (elev. 2,300 m); from *Crotalaria*, and from vetch, beans, corn, peas, and "weeds" at Bogotá, Cund. (elev. 2,700 m.).

Empoasca papae n. sp.

In general appearance this species is very similar to *prona* but it is slightly different in color and has genitalia approaching those of *cothurna* Dav. and DeL.

Length. Males, 3.90 mm.; females, 4.00 mm.

Color. The crown is pale green with its anterior margin bordered



Empoasca fabae A. head, thorax and wings of female, dorsal view; B. aedeagus and styles, lateral view; C. genital capsule, lateral view; D. genital capsule, ventral view; E. aedeagus and styles, ventral view. *E. prona*—F. genital capsule, ventral view; G. aedeagus and styles, lateral view; H. genital capsule, lateral view. *E. bispinata*—I. genital capsule, lateral view; J. aedeagus and styles, lateral view.

with tan. The pronotum is pale green with its anterior margin bearing a series of white spots. The scutellum is pale green with the basal angles outlined in white. The wings are pale green, hyaline. The face is uniformly greenish yellow.

Male genitalia. Genital capsule, plates, styles, and connective are similar to those of *fabae*. The ventral processes of the pygofers are nearly straight; their apices are blunt and somewhat flattened. The anal hook is broad at its base and bifurcate, the posterior lobe being small and blunt while the anterior lobe is long, slender, and curved mesad. The phallicata is slender and its apex is extended into a small dorsal point.

This species is very numerous in the Department of Nariño and is described from series of specimens collected at Pasto, Nar. (elev. 2,800 m.), 28 Sept. 1954, from potatoes, by M. Revelo; at La Ceja, Ant., 18 Jan. 1955, from potatoes, by E. Cardona; at Pasto, Nar., 15 July 1955, from potatoes and alfalfa, by R. F. Ruppel; at Las Palmas, Ant., 2 Sept. 1954, from potatoes, by J. Medina; and at Pasto, Nar., 12 April 1954, from beans, by M. Benavides.

The name of the species is derived from the colloquial Spanish word *papa*.

Empoasca scinda n. sp.

In general appearance this species closely resembles both *prona* and *papae*, but the coloration is slightly different and the male genital features are distinct.

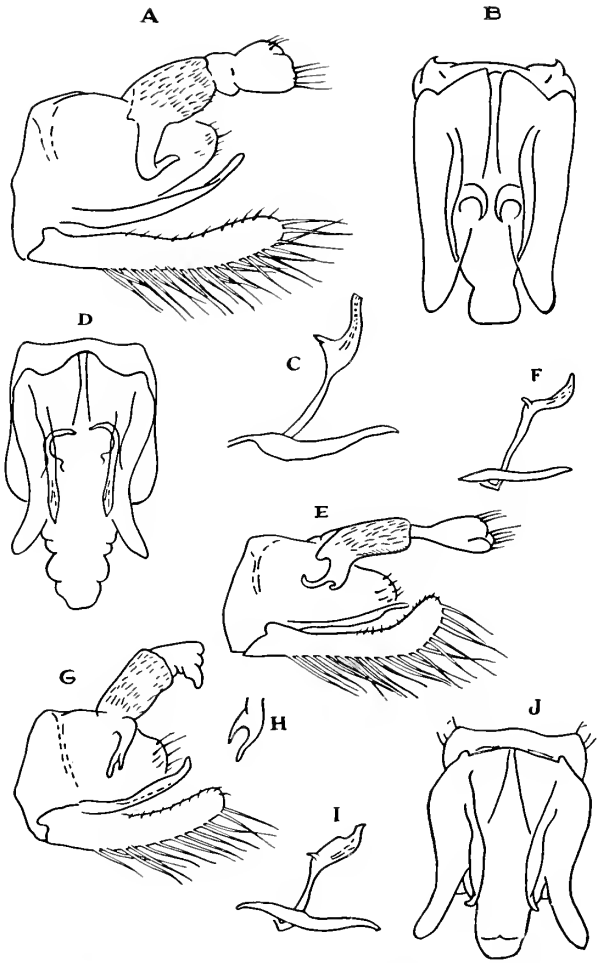
Length. Males, 3.63 mm.; females, 3.84 mm.

Color. The disk of the crown is green, the anterior margin bordered with tan. The ocelli are conspicuously margined with white. The pronotum is light green with its anterior margin spotted with white. The scutellum is light green with its basal angles outlined in white. The wings are light green, hyaline. The face is a uniform yellow-green with a small, white spot near each eye.

Male genitalia. The genital capsule is similar to that of *fabae*. The ventral processes of the pygofers are long, bent slightly dorsad near their proximal third, and their apices are pointed and bent sharply dorsolaterally. The anal hooks are bifurcate with their lateral lobes broader and shorter than their mesal lobes. The dorsal margin of the phallicata is roundly notched on its distal third and its apex is prolonged into a sharp point.

This species is common on the Sabana de Bogotá and is described from series collected from corn near Bogotá, Cun., 4 Aug. 1954, by M. Revelo, and from beans and "weeds" near Bogotá,

BULL. B. E. S. VOL. LI PLATE VIII



Empoasca antioquinae—A. genital capsule, lateral view; B. genital causule, ventral view; C. aedeagus and styles, lateral view. *E. papae*—D. genital capsule, ventral view; E. genital capsule, lateral view; F. aedeagus and styles, lateral view. *E. scinda*—G. genital capsule, lateral view; H. left pygofer hook, caudal view; I. aedeagus and styles, lateral view; J. genital capsule, ventral view.

Cun., 9 Sept. 1954, by M. Revelo.

The name used is descriptive of the characteristically notched phallicata.

Empoasca antioquinae n. sp.

This is a large dark green species with unique male genitalia. To date, no females can be definitely associated with the male specimens, so that the following description is based on the male.

Length. Males, 4.00 mm.

Color. The crown is pale green with the ocelli brown. The pronotum is green with the anterior margin orange-tan. The scutellum is green with the basal angles orange-tan. The wings are green, hyaline. Orange stripes extend along the commisural suture, the claval suture, and the proximal portion of the costal margin of the wing. The face is tan with lora and clypellus green and with a white spot beneath each ocellus.

Male genitalia. The genital capsule is similar to the others described in this paper. The ventral processes of the pygofers curve slightly dorsad and, in ventral view, are slightly S-shaped. The anal hooks are large, bent sharply meso-caudally near their middles, and their apices are sharply pointed. The phallicata is recurved and tapers gradually to a truncate apex.

This species is described from a series of male specimens collected from *Crotalaria juncea* near La Ceja, Ant., 18 Jan. 1955, by E. Cardona, and from Imperial grass at Rionegro, Ant. (elev. 2,300 m.), 19 Aug. 1955, by C. Carmona.

Empoasca bispinata Dav. and DeL.

This species, described from the State of Chiapas, Mexico (Davidson and DeLong, 1943), has been collected from peas and corn near Bogotá, Cund., and from a light at Bello, Ant.

Length. Males, 3.77 mm.; females, 3.86 mm.

Color. The vertex is golden with a pair of round, green spots on its disk. The pronotum and scutellum are golden with the basal angles of the scutellum outlined in white. The wings are translucent, golden. The face is pale golden-tan with the cypellus green.

Male genitalia. The genital capsule is similar to that of *fabae*. The ventral processes of the pygofers are slender, sharply pointed, and curve gently dorso-caudad. The anal hooks are broad and their apices are divided in small anterior and posterior processes. A pair of sharply-pointed spines which curve meso-caudad are located on the base of the aedeagus near the phallicata. The phalli-

cata is slender and curves dorsad.

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THE LIFE HISTORY AND BIOLOGY OF THE GENUS FRENESIA (TRICHOPTERA: LIMNEPHILIDAE).[1]

By Oliver S. Flint, Jr.,[2] Ithaca, New York[3]

The order Trichoptera, or the caddis flies, is one of the commonest orders of insects met with in any limnological survey. Yet no one has attempted to treat any species or genus morphologically and biologically throughout all its stages. The genus *Frenesia* Betten and Mosely was chosen for this study as its life cycle was, in certain respects very different from that of most caddis flies and presents several interesting adaptations. The genus contains two species, *difficilis* (Wlk.) and *missa* (Milne), which are often found flying together in the fall and early winter months in the north eastern United States.

The study was done at the state fish hatchery in Sunderland, Massachusetts, from the fall of 1953 to the spring of 1955. The fish hatchery is situated at the base of a gravel delta, deposited shortly after the last Pleistocene glaciation. A stream, which flows out onto the delta, sinks into the gravel about a mile east of the hatchery. The waters reappear at the hatchery as many springs along the margin of the delta. The water where it leaves the ground is very pure and of uniform flow and temperature (46–47° F.) throughout the year.

Life History

Taxonomy. Francis Walker described *difficilis* in 1852 from a specimen taken in Nova Scotia, but *missa* was not described until 1935 from a series taken in Massachusetts. The names *pallida* (Banks) and *coagulata* (Prov.) are undoubtedly synonyms of *difficilis*. Considerable confusion arose at one time over the name

[1] This paper is modified from a thesis submitted to the University of Massachusetts in partial fulfillment for the requirements of the degree of master of science, and is published with the aid of a grant from the Guy Chester Crampton research fund of the University of Massachusetts.

[2] I wish to express my thanks to Dr. Marion E. Smith, of the University of Massachusetts, under whose guidance the study was made, and to Dr. H. H. Ross of the Illinois Natural History Survey, Dr. P. J. Darlington of the M.C.Z., and Dr. Henry Dietrich of Cornell University for the loan of material.

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coagulata as Hagen (*in* Lintner 1878) and Betten (1934) applied it to *missa*, but Provancher's description in 1877 was undoubtedly of *difficilis*, so the name was not available for this species.

The adult stage. Excellent descriptions with drawings of the two species are given by Schmid (1952) and Betten (1934), of *difficilis* by Betten and Mosely (1940), and of *missa* by Ross (1944).

The range of the genus seems to cover most of the north east. Adults of *difficilis* have been recorded from Nova Scotia, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, District of Columbia, and Virginia; *missa* is recorded from Maine, New Hampshire, Massachusetts, New York, Pennsylvania, Maryland, District of Columbia, Virginia, Illinois, Michigan, and Minnesota. It would seem that the only major difference in distribution is the westward extension of *missa*.

The larval stage. Lloyd (1921) has given a fairly complete description of the larva of *difficilis*, and Ross (1944) has described some of the salient points of *missa*. A more complete description of *difficilis* follows.

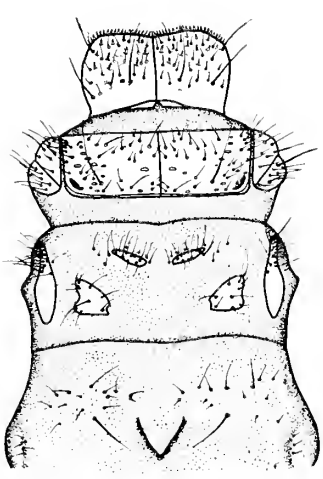
Length of mature larvae 14 mm., width 2.5 mm.; general shape eruciform; abdomen widest at the first segment, tapering slightly caudad; head and thoracic sclerites deep brown, legs pale brown, abdomen nearly white.

Head: broadly oval in frontal aspect; front rugose; with many very short, downward pointing setae; long dark setae arranged as in fig. 4. Many inconspicuous pale muscle insertion marks on posterior half; a circular group of 6–8 marks at apex of frontoclypeus. Labrum light brown, rounded laterally; anterior margin emarginate medially. Six pairs of setae on dorsum: 3 on anterolateral margin, inner pair very short and broad; 2 in transverse row across center of labrum; one midway between marginal and central rows. Three pale spots or pits on dorsum; 1 median just anterior to transverse row of bristles; one caudad to each seta of the pair midway between the marginal and transverse rows. A brush of hairs on the margin mostly between the two posterior marginal setae. Mandibles heavy, dark brown, slightly asymmetrical. Two hairs near base of outer surface; brush of hairs on inner

Explanation of Plate IX

Fig. 1. Thorax and first abdominal segment, dorsal. Fig. 2. Anal prolegs, ventral. Fig. 3. Maxillae and labium, ventral. Fig. 4. Head, anterior. Fig. 5. Legs, posterior: A. fore leg, B. Middle leg, C. Hind Leg.

BULL. B. E. S. VOL. LI PLATE IX



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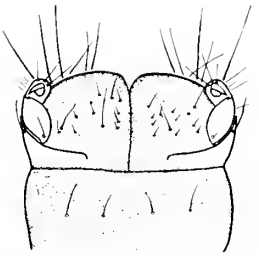

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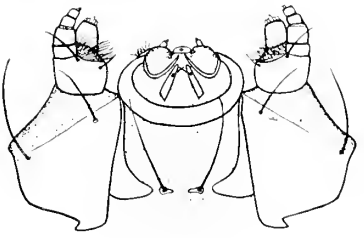

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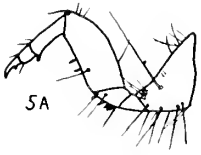
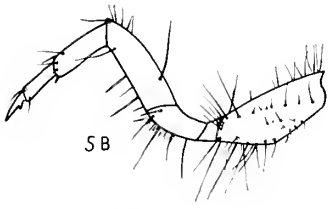
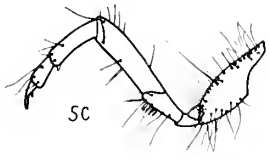
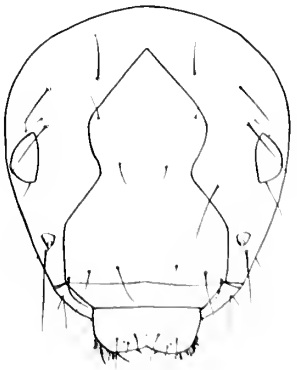








4

FRENESIA MISSA (MILNE)

surface of each mandible. Maxillae and labium with sclerotized parts light brown. Maxillary palpi 4-segmented (not 3 as shown in Lloyd (1921) fig. 109). Patch of fine hairs at base of maxillary lobe; its tip with numerous peg-like projections. Labial palpi 2-segmented.

Thorax: Pronotum with anterior margin shallowly emarginate; groove arising at point of articulation with leg and extending weakly over dorsum along posterior margin. Numerous short blade-like setae on notum, principally along anterior margin; a few longer setae scattered among them. Prosternal spine short, not extending beyond apices of front coxae. Mesonotum rectangular; low ridge extending around posterior margin and forward halfway on lateral margin; linear dark spot on postero-lateral angle. A few pale muscle attachment scars obliquely across middle; long dark setae scattered irregularly over surface. Metathorax with 3 pairs of small sclerites on dorsum: small ovate pair in antero-medial area, with 7–9 setae; larger roughly triangular pair posterior and laterad to first, with 8–9 setae; third pair on lateral margin, elongate, widened posteriorly, anteriorly with numerous setae. Legs paler than thorax; fuscus at articulation of femur and tibia, and coxa and trochanter. Fore legs shortest with femora considerably broadened; middle legs slightly longer than hind legs. Fore femora with 2 clear sword-like setae on ventral margin, these setae dark on other legs. All legs with brush of fine hairs on ventral apical portion of trochanters, a row of very short flattened setae along ventral margin of femora, and numerous long black setae on coxae and femora.

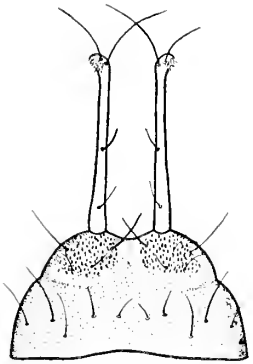
Abdomen: Fringe line present from third to eighth segments. Spacing humps of first segment small and flattened. Gills arranged as in fig. 10. First segment with a group of 6–10 setae on each side of dorsal hump; another group of 5 on upper surface of lateral hump; about 50 setae scattered over sternum. Mature larva with oval sclerotized rings on sternites 3–7. Posterior margin of eighth tergite with 20–25 setae. Ninth segment with 2–3 setae laterad of dorsal chitin plate.

The larva of *missa* is very similar to that of *difficilis* differing in the following ways.

Explanation of Plate X

Fig. 6. Labrum, dorsal. Fig. 7. Caudal extremities, dorsal. Fig. 8. Mandible, dorsal. Fig. 9. Pupa, dorsal. Fig. 10. Larval tracheal gill diagram. Fig. 11. Caudal extremities, dorsal. Fig. 12. Hook plates, dorsal (A—anterior, P—posterior).

BULL. B. E. S. VOL. LI PLATE X



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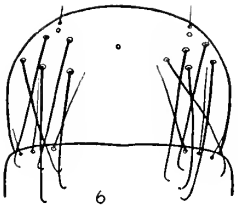

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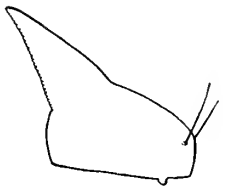

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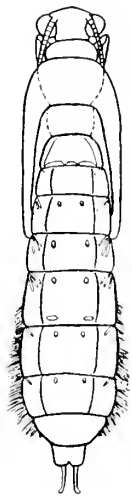

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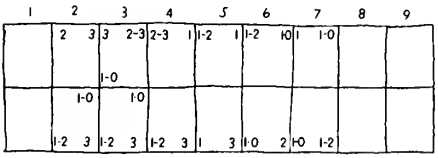
FRENESIA DIFFICILIS (WALK.)



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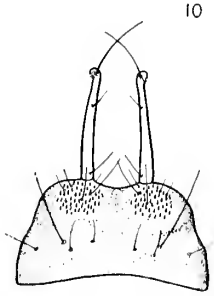

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FRENESIA MISSA (MILNE)

Length of mature larva 11–12 mm., as opposed to 14–15 mm. Head (fig. 4) and mouthparts (fig. 3) morphologically identical, differing only in being smaller.

All thoracic sclerites (fig. 1) in general more hairy. At least 3 major setae laterad of anterior plates of metathorax. The long sword-like setae on posterior margin of femora clear yellowish on all legs (fig. 5).

First abdominal segment (fig. 1) more hairy; about 15 setae on each side of dorsal hump; venter with approximately 100 setae. Commonly with fewer gills but extremes exhibiting considerable overlap. An irregular row of 8–10 setae laterad of chitinous plate on dorsum of ninth segment. Each anal proleg with 10–12 setae on membranous ventral portion (fig. 2).

A possible relationship with *Glyphopsyche missouri* Ross, the only other described species in the *Chilostigma* group of genera, is suggested by the common character of short blade-like setae on the prothorax. The character of the setae on the ventral portion of the anal prolegs, used by Ross (1944) for separation of the genus *Frenesia*, is a specific character of *missa* only. Ross' key may be corrected by substituting the following for couplets 5 and 6.

5. Pronotum with numerous short blade-like setae, especially along anterior margin 6
   Pronotum lacking these setae 7
6. Legs banded with red and black ..... *Glyphopsyche*
   Legs not banded with red and black ..... *Frenesia*

The pupal stage. The pupa of *difficilis* has been superficially described by Lloyd (1921); that of *missa*, not at all. The following is a description of *difficilis*.

Length 13–15 mm., width 2–2.5 mm. Color creamy white, turning golden brown near time of ecdysis.

Head: Labrum (fig. 6) semicircular. Each distal bristle group of 5 long, stout, hooked setae; each proximal group of 3 slender setae. A very short seta on each side of labrum anterior to distal bristle group. Three pale spots: one posterior to each short seta, the third median. Mandible (fig. 8) inflated at base; apex thin, blade-like, with numerous serrations on the inner margin. A pair of black setae on outer surface near base. Front and vertex with 4 pairs of long black setae: first posterior to proximal bristle group of labrum; second antero-laterad of these; third between bases of antennae; last pair on vertex. Another pair of setae on epicranium near eyes; these may be accompanied by 1–2 short setae. Antennae extending posteriorly to caudal margin of seventh or eighth abdom-

inal segment; second antennal segment with tuft of 8–10 setae, longest seta about as long as segment.

Thorax: Pronotum with widely separated pair of setae. Meso- and metanotum each with a seta on each side near anterior margin; two setae on each side about midway to posterior margin. Coxae of fore legs with a group of 2–6 setae on lower surface; coxae of middle legs with 2 setae on ventral surface, one proximal, the other distal. A fringe of hairs on each side of tarsi of middle and hind legs. Wing pads extending caudally to anterior margin of fourth abdominal segment.

Abdomen: Segments 2–8 with 2 pairs of sclerotized rods: one pair dorsal, running from anterior to posterior margin of the segment (each rod overlies lateral margin of tergite of adult); second pair ventral, in a similar position. Strong lateral fringe beginning in posterior half of fifth segment, extending to caudal margin of eighth segment, curving ventrally there and ending near mid line. Gills present from anterior margin of second segment to anterior margin of seventh segment; arising either singly or in tufts of 2–3, about as long as segment which bears them. Hook plates present in anterior half of segments 3–7, number of hooks varying from 2–5, but usually 3 or 4; hook plate posteriorly on segment 5 with 8–11 hooks. Ninth segment with transverse row of 9–10 setae dorsally about mid-way of segment. Scabrous patch dorsally on ninth segment near base of anal processes with interspersed short hairs. Ninth sternum with 3 large, often flattened and twisted hairs near caudal margin. Anal processes (fig. 7) slender, rod-like, curved apically; almost 1½ times the length of ninth segment, cluster of short scabrous setae and two long hairs at apex; third hair near middle; a fourth in basal third.

The pupa of *missa* is the same as *difficilis* in structure, but shorter (12–13 mm.) and with shorter anal processes.

Anal processes (fig. 11) are subequal in length to the ninth segment. One long black seta at apex of each process. The two setae along the side of each process exhibit considerable variation in placement, often one or the other lacking.

Although many pupae have been described from this family, most descriptions are not sufficient to allow a separation of the genera. At present it is not possible to separate pupae of the genera *Limnephilus*, *Glyphopsyche*, and *Frenesia*.

Biology[1]

[1] Unless otherwise stated the remarks apply equally well to both species.

The adult stage

Flight period. The time of emergence of the adults of this genus is very unusual, as no other caddis fly in the east flies so late in the year. Morse (personal correspondence) records the earliest date for *difficilis*, October 3, at Lee, New Hampshire. One of the paratype series at the MCZ in Harvard bears the earliest date found for *missa*, October 17, Ithaca, New York. In Sunderland, Mass. they become numerous in early November, declining in numbers late in the month. During December they are hard to find, though on warm days they may appear in numbers again. The latest date for *difficilis* is December 27, in Sunderland, Mass., and for *missa* it is February 2, in Michigan.

There are three known records of *difficilis* appearing in the spring: Morse & Blickle (1954), VI-24-46, Durham, N. H.; a specimen at the MCZ, VI-21, Glen Carlyn, Va.; and a specimen in the Univ. of Mass. collection, VI-23-54, Amherst, Mass. One record of a spring occurrence of *missa* is known: Leonard & Leonard (1949), VI-29, East Fish Lake, Mich. These individuals may represent small broods of these species which normally emerge in the spring, or, more likely, individuals that developed slowly and were prevented from emerging in the fall by cold weather.

The insects fly mainly during the daytime, but Morse & Blickle (1949) record taking several specimens of *difficilis* in a light trap. When not flying, they are found on grasses and herbs, which, being dead and brown in the fall of the year, render the protectively colored caddis flies very inconspicuous. When disturbed, the insects fall from their resting places and feign death, but if annoyed further they right themselves and attempt to escape by running or flying.

Temperature relations. Flight starts when the temperature rises to 45–55° F. Only the males were taken at these temperatures, the females preferring temperatures about 10° higher.

The ability to withstand low temperatures is remarkable. Some individuals were left outdoors overnight in a bottle when the temperature dropped to about 20° F. In the morning they could hardly move, yet when taken indoors and warmed they were soon moving around normally. They may be found outdoors long after freezing has occurred, and in one instance an adult *difficilis* was seen walking over frozen ground.

Length of life. A series of experiments was performed in the laboratory to determine the length of life at room temperature (about 73° F.). Since no reared specimens of a known age were available, adults collected in the field were used. They were

placed in stender dishes with dried grass and a one-inch square of blotter moistened with water. Under these conditions 27 adults of *difficilis* lived an average of 7.5 days, one surviving 10 days. Seven adults of *missa* similarly confined lived an average of 6.1 days, one surviving 9 days.

Feeding. The specimens confined in the stender dishes were often seen to go through feeding motions on pieces of grass. An individual would move slowly across the grass, lapping or cleaning it with the haustellum in a manner similar to that of a fly. What they were obtaining, if anything, from the surface is not known.

In order to ascertain if supplementary nutrients would prolong their life, another series of experiments was performed using a sugar solution (33% sugar by volume) instead of water to moisten the blotter. With the sugar solution available 16 *difficilis* adults lived an average of 11.6, one surviving for 14 days. Five *missa* adults averaged 8.6 days, two surviving for 10 days. These results indicate an average increase of survival time of 4 days in *difficilis* and 2.5 days in *missa*, indicating they are able to utilize nutrients. Under natural conditions of low temperature and normal food, they may well live at least another several weeks.

Mating. Many times specimens were observed mating in a pint sized jar in which they were placed for transport to the laboratory. The process was never observed in nature but is doubtless the same as that described here.

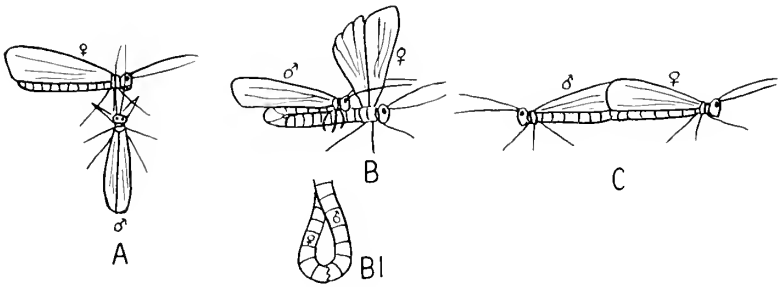
The male, when in proximity to the female, becomes very excited, running rapidly over the grass and bottle. Upon meeting the female he tries to grasp her with his front legs. If successful, he holds her at the bases of her front legs, usually from the right side, between the femora and tibia of his own front legs (fig. A). The body of the male is thus at about right angles to that of the female. The male possesses a row of spines on the inner surface of the femora and tibiae of the front legs. Apparently they allow him to grasp the female more securely. The head of the male is very close to the legs of the female, and sometimes he seems to be stroking the bases of her legs with his mouthparts. Next the female raises her wings and the male crawls onto the dorsum of her abdomen, facing the same direction as she (fig. B). At this point copulation takes place, the male's right side being attached to the female's left (fig. B1). The pair stays in this position for about one minute, whereupon the male crawls off on the side from which he mounted. They now assume the normal position, attached by their genitalia, and facing opposite directions (fig. C).

Often the male does not grasp the legs of the female as he should,

and she continues to move while he tries to correct his hold. Sometimes he succeeds, but often he does not and is dragged around for some time before he is brushed off. On some occasions the female fails to raise her wings and the male is shaken off despite all efforts.

It was noted several times that a male of one species would try to mate with the female of the other. In no instance were they able to copulate. Either the female would not raise her wings, or if she did and the male attempted to mate, they could not do so and soon separated. In one instance a male of *missa* was observed on the back of a male *difficilis* apparently trying to mate.

In the laboratory, duration of copulation may vary considerably, the pair generally remaining in copula for from one to one and one half days. A single case of extreme length of time was noted. A pair of *missa* mated on November 6th and remained in copula until November 23rd, when the female was found dead and slightly



Figs. A–C. The mating positions of *Frenesia*. For explanation see text.

mouldy, still being dragged around by the male. In this case the pair must have been unable to separate, as it required considerable force to separate them.

One pair of *difficilis* was observed to mate twice. A mating pair was put into a container; a day later they separated. Four days afterward they were found in copula again and continued so for about 30 hours. No eggs were laid after either mating.

The egg stage

Oviposition. Oviposition was never observed, either in the field or in the laboratory. Only once was an egg mass laid in any culture. In this case a dozen adults of *difficilis* were confined in a screen cage 8-inches in diameter by 12-inches in height. A large clump of grass was placed on the bottom of the cage, and the whole cage placed in an aquarium with an inch of water on the bottom.

On the fifth day an egg mass was found on one side of the sod.

Appearance. The eggs are deposited in masses of 100–200, embedded in a gelatinous matrix. The masses when laid are about 2 mm. in diameter, spherical, yellow in color, with the eggs contiguous. As the gelatin absorbs water, the mass swells until it is about 20 mm. in diameter, remaining roughly spherical in shape, and varying in color from almost clear to light yellowish. The eggs are now separated by the gelatin by distances 2–3 times their diameters.

Habitat. The egg masses are deposited out of water, on soil or vegetation, as is typical for the family. A representative site was on grass roots and moss the overhung boards forming the sides of a pool. The eggs were three feet above water, and often occurred in groups of 4–6 masses in a small pocket, possibly where a pebble had fallen out. In other instances they were found partially covered by vegetation on dead grass and leaves an inch above water line. Large clumps of *Juncus effusus* L. growing in some of the pools were commonly used as oviposition sites. The masses were placed on the leaves about an inch above the water. The eggs were moist in all these situations, being either in seepage areas or on moist substrata.

Duration. Oviposition occurs during late November and December, but hatching is delayed until the following spring. The egg masses are often frozen solid during the winter, sometimes even having an ice cap. The exact time of hatching varies considerably depending on the season. It occurred in mid-March in 1954, but not until a month later in 1955. In 1955 the spice bush (*Lindera Benzoin* Blume) was coming into full bloom at the time of hatching, and it may well be a good indicator of when hatching will take place.

In order to determine how long the egg stage lasts under different conditions, egg masses were put into slender dishes with a little water to prevent desiccation. The dishes were then covered and kept at different temperatures. One series was kept at 23° C., a second at 16.5°, and a third at 5°; these required 13, 22, and 35 days respectively to hatch.

The eggs do not undergo a true diapause during the winter. This fact was proven when a female *difficilis* laid an egg mass in the laboratory; this egg mass, which was never subjected to freezing temperatures, hatched in 22 days. It is thus cold and not a diapause which retards development and prevents hatching in the fall.

Hatching. The egg masses remain in a semi-solid state even if

submerged in water or alcohol for several months. They liquefy only when the emerging larvae start crawling through the mass. The eggs cease development and die if the mass is submerged in water for more than a day, and after a week the eggs are commonly surrounded by a halo of mold. Several masses that were hatching were placed in water. The larvae already hatched and the eggs containing larvae ready to hatch lived, but the rest of the eggs ceased development and soon died.

The larvae stay in or on the mass for a day or so after hatching. In no case were they observed to start building a case while in the jelly. The young larvae may be washed into the water by heavy dews or rains, as recorded by Wesenberg-Lund (1908) for the genus *Glyphotaelius*. However, some were seen crawling around in a dry petri dish several days after hatching. This observation suggests that the larvae may leave the egg mass and start searching for water.

The larval stage

Case-making. The first case made by the larva of *difficilis* consists of fine organic debris. The larva starts by scraping up a mass of debris with its legs. The mass is then cemented by the larva rolling it around with its front legs and mouthparts, spinning silk over it. When the condition of the mass is suitable the larva curls into a "C" shape, and by spinning silk over the debris attaches the mass around the middle of its abdomen. The larva is still uncovered at both ends, but more debris is attached to the first band, eventually completing the case. If another larva happens by, the first is not averse to collecting some material from the newcomer's case for its own. The process of casemaking is rapid, the first case being completed in about 15 minutes.

Within several days, larger pieces of plant material are added to the case increasing its rigidity. These pieces of plant material are attached at irregular angles, so that a case has a rather ragged appearance. These smallest cases consist almost completely of organic material: pieces of wood, leaves, seeds, and bark; one larva had even added a beetle elytron to form one side of the case. By the end of the first stadium sand grains are being added, and at maturity the case is in a large part mineral matter, with pieces of plant material here and there.

The larva of *missa* constructs its case from sand grains normally, not plant material, and may continue to do so throughout its life. For this reason the two species can often be told apart by the type of case. However, on certain occasions *missa* will make a case

like that of *difficilis*. At maturity the cases can often be separated as the larvae of *missa* utilize a preponderance of small equidimensional sand grains, while those of *difficilis* use larger, often flattened pieces of rock in its cases.

Habitat. Available records indicate that larvae develop in clean unpolluted water only. Lloyd (1921) reported *difficilis* in a small stream flowing out of a sphagnum bog. Ross (1944) records *missa* as occurring in a seepage area as well as in a stream nearby. Both species occur at the fish hatchery in streams and pools that are spring-fed and unpolluted.

The larvae of *missa* seem to prefer the streams and seepage areas. Ross (1944) states ". . . the larvae were congregated in a little seepage area near the bank and were thriving in water scarcely deep enough to cover their cases. Many individuals were feeding on leaves and twigs so that most of the insect and its case was actually out of water. Later we found that odd specimens would live in the stream itself; and, since the seepage areas frequently dried up, it is possible that the reservoir in the stream is chiefly responsible for the preservation of the species in this area." At the fish hatchery, the larvae of *missa* were not observed in large enough numbers in the streams to sustain the adult populations found in the same area. Even though it is likely that larvae develop in some of the many seepage areas present at the fish hatchery, no specimens were found in such locations by this investigator.

The records for *difficilis* indicate that the larvae always occur under water and not in seepage areas. Lloyd (1921) recorded larvae in certain portions of a small brook only. They were numerous in certain pools and in most of the brooks at the fish hatchery.

Food. The food of the larvae seems to be mostly dead organic matter. Ross (1944) records *missa* as feeding on leaves and twigs. On the basis of stomach examinations Lloyd (1921) stated that *difficilis* fed on leaves and decaying wood. All observations and dissections of specimens from the fish hatchery by the author corroborated these statements.

Duration. The larvae are first found in the spring from mid-March through April; the exact date depends on the season. Development proceeds rapidly during the summer, and the larvae mature in September and October. Based on measurements of head capsules, five larval instars are recognizable. The species are not separable until the third instar when the setae develop on the prolegs.

The pupal stage

Pupation. When ready for pupation, the larva attaches the an-

terior end of its case by silken threads to a rock, root, stick, or other vegetation. The ends of the case are then closed with sand grains, and a silken web woven over the inside. Ten or a dozen small openings are left at each end between the grains; these allow the water to circulate through the case.

Habitat. The larvae of *difficilis* which developed in a small pool seemed to favor the submerged bases of clumps of *Juncus effusus* L. for pupation. Dozens of pupae may be found attached at all angles to the leaves and roots at the base of such a plant. Often the larvae burrow beneath small stones and the resulting pupae may be found attached under such stones.

The larvae which develop in streams commonly attach to stones; however, one mass of roots, covered by their cases, was discovered in one of the brooks. Lloyd (1921) described a very similar instance.

The pupae of *missa* are found in conjunction with those of *difficilis* in the streams. They were also observed attached to corners and crevices in the boards along the sides of some pools where they might be three feet above water. In some cases water was trickling over them, but in others they were simply on very moist substrata.

Duration. Pupation does not occur immediately after attachment of the case by the larva. A brief prepupal stage of 1–2 weeks intervenes; the prepupae may be found in late September or early October.

The pupal stage itself lasts 3–4 weeks; pupae may be found in October and November.

Emergence. The pupa leaves its case by cutting away the anterior end, though at times it may emerge laterally. A few strands of silk are often left holding the end so that a "door" swings back into place after the pupa has left. It then swims to some emergent object where it crawls out of the water a distance varying from a quarter of an inch to a foot or so. Next, it attaches itself to some irregularity in the substratum by its front tarsal claws. When the time for ecdysis comes, which may be either immediately or 15–20 minutes later, pumping motions begin in the abdomen and sweep forward. The whole body moves forward slowly until the front legs hold the body from further forward movement. The pupal integument splits along the mid-dorsal line of the thorax, and the adult emerges rapidly. The front legs are the first to emerge, followed rapidly by the antennae and middle legs; the hind legs, wings, and abdomen are freed last. The wings as they emerge from the pupal skin are fully expanded, although not yet fully colored and hardened. The process of ecdysis takes only 4–5 minutes if nothing

unusual happens; however, the pupa may fall back into the water if it is not attached securely.

When large numbers of individuals are emerging, the exuvia may form a line on an object suitable for emergence. On the boards forming the dam of a pool where *difficilis* bred such a line was evident just above and parallel to, the water's edge, while other exuvia were scattered intermittently farther up.

Summary

Descriptions with illustrations are given of the larvae and pupae of the two species of *Frenesia*. The winter period of the life cycle is passed in the egg stage, the larvae hatching in April or March and pupating in September or October. The adults are on the wing in late October through December, and rarely into January or February. Other aspects of the biology of the adult, egg, larval, and pupal stages are presented.

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THE SPECIES OF CHRYSEIDA (HYMENOPTERA, EURYTOMIDAE).

By Barnard D. Burks[1], Washington, D. C.

The genus *Chryseida* Spinola includes several species of relatively large eurytomids in all of which the body has brilliant metallic coloration. As all other species in the family Eurytomidae have dull yellow, brown, or black coloration, this metallic color alone will serve to distinguish the species of *Chryseida* generically from the others. *Chryseida* is not, however, an artificial group characterized only by this one rather superficial attribute. This genus has a large number of significant generic characters which are summarized below.

Most of the species of *Chryseida* are restricted to the Neotropical region, but two of them are found as far north as southern Texas. Two species of this genus have been reared from bruchids, and it is possible that all the species have this habit. There is, however, a somewhat questionable record of one species having been reared from a cerambycid.

This paper contains a key to the eight previously known species, and, in addition, two new species are described. I have studied the types of *inopinata* Brues, *aeneiventris* Ashmead, and *aurata* Ashmead, which are deposited in the U. S. National Museum collection. Ashmead redescribed *cyanea* (Fabricius), and I am following his identification. His material of it is preserved in the National Museum collection. Mr. G. J. Kerrich, Commonwealth Institute of Entomology, British Museum (Natural History), has kindly sent me descriptions of the types of *aequalis* (Walker) and *amazonica* Westwood. I have not seen the types of *superciliosa* Spinola, *pachymeri* Schrottky, or *claritarsis* Strand. The disposition of the types of these species has been taken from Horn and Kahle (1935–37, Ent. Beihefte, v. 2–4, 536 p.), and these have been placed in my key from their descriptions.

Genus *Chryseida* Spinola

Chryseida Spinola *in* Guérin-Méneville, 1840, Revue Zool., 3:18; Spinola, 1840, Mag. de Zool, 10 (Ins., 41—43): 8; Westwood, 1874, Thesaurus Ent. Oxon., p. 140; Ashmead, 1894, Amer. Ent. Soc. Trans., 21: 323; Ashmead, 1895, Ent. Soc. Washing-

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ton Proc., 3: 106; Dalla Torre, 1898, Cat. Hym., v. 5, p. 352; Ashmead, 1904, Carnegie Mus. Mem., 1: 261, 262, 370, 461; Brues, 1907, Wisc. Nat. Hist. Soc. Bull., 5: 104; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 134, 135, 136; Gahan and Fagan, 1923, U. S. Natl. Museum Bull. 124, p. 33; Peck *in* Muesebeck and others, 1951, U. S. Dept. Agr. Monog. 2., p. 574. Type: *Chrysceida superciliosa* Spinola; monotypic.

The following combination of characters will distinguish the members of this genus from all other members of the family Eurytomidae:

Head and thoracic notum with umbilicate punctation; body metallic blue, blue-green, or green, often marked with red, copper, bronze, or brassy color; a pair of carinae or low laminae on frons running parallel with and close to inner eye margins; anterior ocellus located in scrobe cavity; cheeks carinate laterally; antennal funicle with 5 segments, club composed of 3 almost completely fused segments. Each anterior coxa with a deep, oblique channel on its anterior face for the reception of the ventral margin of the head; parapsidal furrows complete; submarginal vein 3 to 6 times as long as marginal vein, postmarginal and marginal veins usually equal in length, postmarginal sometimes the longer, stigmal slightly shorter or equal to marginal. Surface of propodeum lying at angles of from 70° to 85° to longitudinal axis of thorax; petiole of female varying from as long as wide to twice as long as wide, male petiole twice or more as long as wide; gaster more or less compressed, more strongly so in the male than in the female, and approximately as long as the thorax; ovipositor directed straight posteriorly and not markedly exserted.

Key to Species

1. Thorax and abdomen uniformly dark metallic blue or blue-green ..... *cyanea* (Fabricius)
   Thorax and abdomen uniformily metallic green or particolored, or thorax blue-green and gaster the same color with bronzy or brassy cross-stripes 2
2. Fore wing partly or completely infumate with brown or yellow 3
   Fore wing hyaline 4
3. Fore wing shaded with brown on disc posterior to stigmal and postmarginal veins; hind femur uniformly bright, brownish red ..... *inopinata* Brues
   Fore wing completely shaded with light yellow, this color

slightly more intense just posterior to marginal and postmarginal veins; hind femur purplish bronze, red-brown at apex ..... *aequalis* (Walker)

4. Pronotum and scutellum metallic blue-green, praescutum and scapulae brassy red or copper colored 5
   Entire thoracic notum metallic blue-green or green 6
5. Praescutum and scapulae brassy red .... *superciliosa* Spinola
   Praescutum and scapulae copper colored .....
   ..... *pachymeri* Schrottky
6. Thoracic notum metallic blue-green 7
   Thoracic notum metallic green 8
7. Length less than 5 mm.; femora and tibiae red .....
   ..... *claritarsis* Strand
   Length over 6 mm.; femora and tibiae tan .....
   ..... *aeneiventris* Ashmead
8. Marginal vein slender; scrobe cavity wide apically, one and one-half times as wide as parascrobal space *aurata* Ashmead
   Marginal vein thickened; scrobe cavity narrowed apically, three-quarters to four-fifths as wide as parascrobal space .. 9
9. Propodeum with a vertical carina located in a median, smooth space ..... *gramma* n. sp.
   Propodeum strongly rugulose medially, lacking a vertical carina
   ..... *bennetti* n. sp.

Chryscida cyanea (Fabricius)

Chalcis cyanea Fabricius, 1805, Syst. Piez., p. 164.

Chryscida cyanea (Fabricius) Ashmead, 1894, Amer. Ent. Soc. Trans., 21: 323; Ashmead, 1895, Ent. Soc. Washington Proc., 3: 106; Dalla Torre, 1898, Cat. Hym., v. 5, p. 352; Ashmead, 1904, Carnegie Mus. Mem., 1: 461; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 137.

Type.—Location of type unknown; I follow Ashmead's identification of this species.

Type locality.—South America.

Distribution.—Brazil.

Chryscida inopinata Brues

Chryscida inopinata Brues, 1907, Wisc. Nat. Hist. Soc. Bull., 5: 103; Crawford, 1913, U. S. Natl. Mus. Proc., 46: 345; Peck *in* Muesebeck and others, 1951, U. S. Dept. Agr. Monog. 2, p. 574.

Type.—U.S.N.M. no. 42706; originally deposited in the Brooklyn Museum.

Type locality.—Brownsville, Texas.

Distribution.—Texas, northern Mexico.

Host.—Crawford (1913, loc. cit.) published a note that this species had been reared from the cerambycid *Oncideres putator* Thom., at Brownsville, Texas, under Chittenden no. 1921. This host (probably a misidentification of *C. pustulata* Lec.—*putator* is a Brazilian species) evidently developed in woody legumes such as *Acacia, Leucaena,* and *Mimosa.* It has not, unfortunately, been possible to find in the National Museum collection the host material associated with the parasites. It may be that the specimens of *inopinata* actually emerged from bruchids infesting the seeds of the legumes in which the *Oncideres* developed, rather than from the *Oncideres* themselves.

Chrysocida aequalis (Walker), new combination

Epistenia aequalis Walker, 1862, Ent. Soc. London Trans., ser. 3, 1: 392; Dalla Torre, 1898, Cat. Hym., v. 5, p. 177; Ashmead, 1904, Carnegie Mus. Mem., 1: 485; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 159.

Chrysocida amazonica Westwood, 1874, Thesaurus Ent. Oxon., p. 140; Dalla Torre, 1898, Cat. Hym., v. 5, p. 352; Ashmead, 1904, Carnegie Mus. Mem., 1: 461; Schmeideknecht, 1909, Gen. Ins., fasc. 97, p. 137. ***New synonymy.***

I am indebted to Mr. E. F. Riek, C. S. I. R. O., Canberra, Australia for the information that *Epistenia aequalis* Walker, long listed in the Cleonymidae, is actually a species of *Chrysocida* and is the same species as *Chrysocida amazonica* Westwood.

Type:—British Museum (Natural History), 5.902.

Type locality.—São Paulo, Brazil.

Distribution.—States of Amazonas and São Paulo, Brazil.

Chrysocida superciliosa Spinola

Chrysocida superciliosa Spinola *in* Guérin-Méneville, 1840, Revue Zool., 3: 18; Spinola, 1840, Mag. de Zool., 10 (Ins., 41–43): 12; Westwood 1874, Thesaurus Ent. Oxon., p. 140; Ashmead, 1894, Amer. Ent. Soc. Trans., 21: 323; Dalla Torre, 1898, Cat. Hym., v. 5, p. 352; Ashmead, 1904, Carnegie Mus. Mem., 1: 261, 462; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 137.

Type.—Possibly in the Turin University Zoological Museum.

Type locality.—French Guiana, interior.

Distribution.—French Guiana; Ashmead (1904) recorded this species from British Guiana, but that apparently was an error.

Chryseida pachymeri Schrottky

Chryseida pachymeri Schrottky, 1906, Zeitschr. für wiss. Insektenbiol., 2: 101.

Type.—Destroyed.

Type locality.—Paraguay.

Distribution.—Paraguay.

Host.—*Gibbobruchus polycoccus* (Föhr).

Chryseida claritarsis Strand

Chryseida claritarsis Strand, 1911, Fauna Exotica, Jahrgang 1, nos. 2–3, p. 14.

Type.—Probably in the Deutsches Entomologisches Institut, East Berlin, Germany.

Type locality.—Pachitea River, Perú.

Distribution.—Perú.

Chryseida aeneiventris Ashmead

Chryseida aeneiventris Ashmead, 1909, Carnegie Mus. Mem., 1: 462, pl. 33, fig. 4; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 137.

In the figures accompanying the original descriptions of this species and *Bephrata striatipes* Ashmead, the legends for the two were reversed; the figure given as *B. striatipes* actually is a drawing of *aeneiventris*. This figure, however, shows the abdominal petiole as being considerably larger than it is in the type specimen of *aeneiventris*.

Type.—U.S.N.M. no. 25513; originally deposited in the Carnegie Museum, Pittsburgh.

Type locality.—Santarem, Brazil.

Distribution.—Santarem and Chapada, Brazil.

Chryseida aurata Ashmead

Chryseida aurata Ashmead, 1894, Linn. Soc. London, Zool., Jour., 25: 150; Dalla Torre, 1898, Cat. Hym., v. 5, p. 352; Schmiedeknecht, 1909, Gen. Ins., fasc. 97, p. 137.

Type.—U.S.N.M. no. 2429.

Type locality.—Leeward Side, St. Vincent, British West Indies.

Distribution.—St. Vincent, British West Indies.

Chryseida gramma n. sp.

Female.—Length, 3.5 mm. Head dark metallic green with a faint, polished brassy cast, antennal scape tan at base, shading to very dark brown apically, pedical and funicle dark brown, almost black, club lighter brown; thorax, propodeum, and all coxae dark metallic green, femora red-brown with dark metallic green shading in the middle, apices yellow; tibiae with bases and apices yellow, median area of each red-brown and a minute black area at middle of outer surface of fore and mid tibia; tarsi yellow; tegulae black; wings hyaline with tan venation; petiole and gaster black, shining.

Head and thorax sparsely clothed with short, decumbent, silvery pubescence; each posterior coxa with dense, stout pubescence along dorso-lateral and posterior margins, femora with finer pubescence, tibiae with denser, stout pubescence; propodeum with dense, stout pubescence laterally, hair becoming finer toward meson, median groove bare; exposed portions of gastral tergites 5–7 densely covered with short, flattened hair; other gastral tergites bare.

Head in anterior aspect, measured across eyes, one and one-third times as wide as high, in dorsal aspect one and one-eighth times as wide as thorax across tegulae; height of compound eye twice as great as width of malar space; an obscure carina paralleling eye on ventral half of outer margin and extending the entire length of the inner margin, terminating beside lateral ocellus; antennal pedicel short, only one-third as long as first funicle segment, second through fourth funicle segments equal in length and each four-fifths as long as the first, fifth segment slightly wider than others and five-sixths as long as fourth, club one and one-half times as long as fourth segment. Prepectus sub-triangular, its surface smooth dorsally, minutely shagreened ventrad; tegula smooth; femoral furrow of mesepisternum with numerous very obscure, parallel rugae formed by coalescence of punctures; submarginal vein three and one-third times as long as marginal vein, postmarginal and marginal veins equal in length, stigmal vein four-fifths as long as marginal; median lobe of metanotum with a pair of oblique rugae extending ventrad from meson of anterior margin. Propodeum with a smooth median area, this with a vertical carina on meson, lateral areas umbilicate-punctate; surface of propodeum lying at a 75° angle to longitudinal axis of thorax; petiole with dorsal surface flat, minutely shagreened, petiole three-fifths as long as posterior coxa; gaster slightly longer than thorax and propodeum combined, fourth gastral tergite as long as three basal tergites

combined.

Male.—Unknown.

Type.—American Museum of Natural History.

Type locality.—Grand Bahama Isl.

Described from one specimen collected on Pine Ridge, Grand Bahama Isl., May 13, 1953. Van Voast—A.M.N.H. Bahama Island Expedition, E. B. Hayden.

Chryseida bennetti, n. sp.

Female.—Length 2.5–4.0 mm. Head dark metallic green, some specimens darkened on vertex, antennal scape with basal two-thirds to four-fifths tan, apex dark brown, pedicel and flagellum dark brown; thorax, propodeum and all coxae metallic green, median area of thoracic dorsum in some specimens darkened; femora and tibiae red-brown shading to yellow apically (in some specimens femora dark brown medially), tarsi yellow; tegulae tan to brown; wings hyaline with tan venation; petiole and gaster black, shining.

Pubescence as in *gramma*, except that gastral pubescence is slightly less dense.

Head in anterior aspect one and two-fifths times as wide as high, in dorsal aspect as wide as thorax across tegulae; height of compound eye twice as great as width of malar space; a moderately strong carina paralleling eye on ventral half of outer margin and extending the entire length of the inner margin, terminating at lateral ocellus; antennal pedicel one-half as long as first funicle segment, second through fourth segments equal in length and each five-sixths as long as first, fifth nine-tenths as long as fourth, club one and one-half times as long as fourth funicle segment. Prepectus subtriangular, almost entirely smooth, only small area near ventral angle shagreened, median area of prepectus depressed; tegula faintly reticulated, almost smooth, femoral furrow with parallel rugae more strongly developed than in *gramma*; submarginal vein five times as long as marginal, stigmal and marginal equal in length, postmarginal one and one-half times as long as marginal; median lobe of metanotum with a single arcuate ruga originating at one postero-lateral angle, extending to or nearly to anterior margin and continuing to other postero-lateral angle. Propodeum with entire surface umbilicate-punctate, punctures in median area slightly irregular; surface of propodeum lying at or very near a 90° angle to longitudinal axis of thorax, petiole with dorsal surface flat, minutely shagreened, length of petiole equal to

that of hind coxa; gaster as long as thorax; third and fourth gastral tergites sub-equal in length and each approximately as long as first and second tergites combined.

Male.—Unknown.

Type.—U.S.N.M. no. 62904.

Type locality.—Paradise Mt., Trinidad, B.W.I.

Described from 26 female specimens as follows: Holotype, Paradise Mt., Trinidad, B.W.I., March 1952, reared from *Bruchus* sp. in pigeon peas, no. 241, F. D. Bennett; 3 paratypes intercepted at the D. C. Inspection Station in seeds of *Rhynchosia* from Mexico, May 20, 1953, H. Y. Gouldman; 22 paratypes, Brownsville, Texas, March 1921, reared from seeds of *Havardia brevifolia* infested with *Merobruchus* sp., J. C. Bridwell.

GEOGRAPHIC VARIATION IN THE BLISTER BEETLE LYTTA BIGUTTATA (COLEOPTERA, MELOIDAE).[1]

By Richard B. Selander,[2] Urbana, Illinois

Lytta biguttata is one of the most abundant and widely distributed species of the genus *Lytta* in North America. As has been long recognized, the color pattern of the species is highly variable, but no comprehensive study of this variation has been made previously. When analyzed this variation is found to consist of a wide range of individual variation superimposed on an even wider range of geographic variation.

The present paper is being published prior to my revision of the North American species of *Lytta* in order that the included information as well as the name of one of the subspecies will be available to others now engaged in a project involving *biguttata*. A description of the structural features of the species, together with additional synonymy, host plant information, and more detailed locality data for the subspecies will appear in my revision.

Lytta biguttata LeConte

In all races the ground color of the pronotum and elytra is yellow-orange, the elytra being paler; the tarsi are black or brown.

[1] Field work contributing to this study was supported by grants from the Sigma Xi-RESA Research Fund and the Penrose Fund of the American Philosophical Society.

[2] Illinois Natural History Survey.

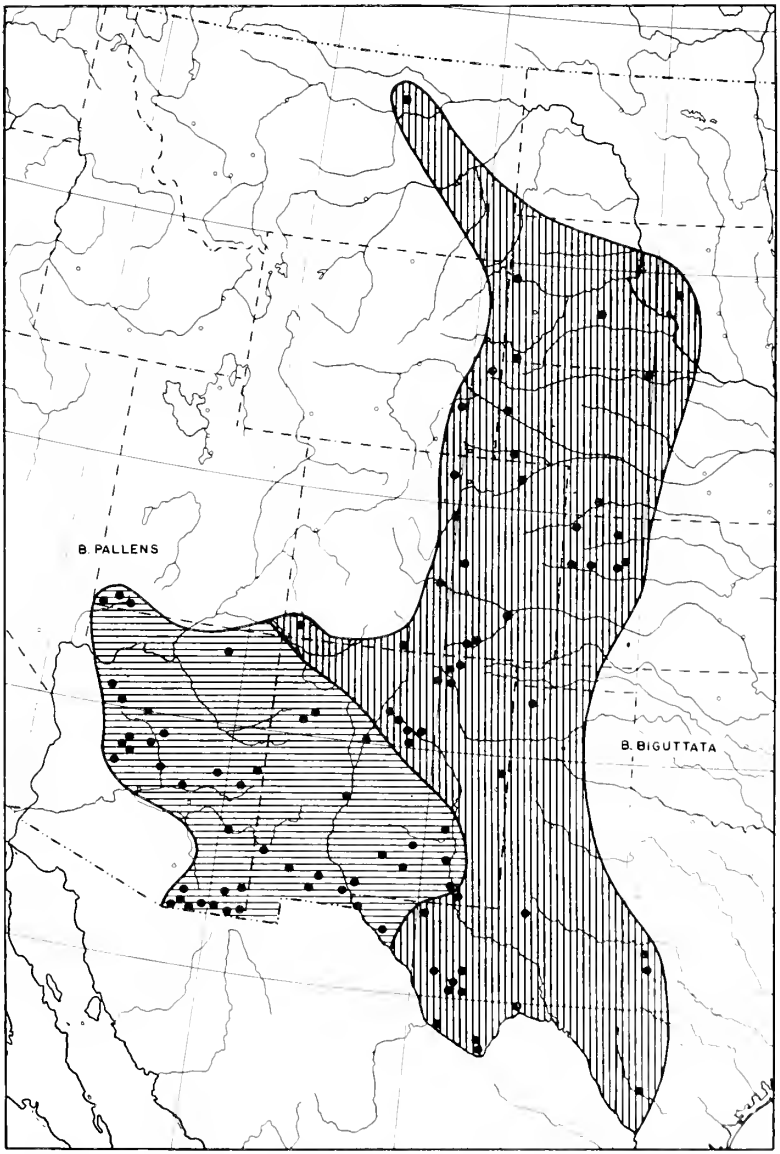

Fig. 1. Distribution of *Lytta biguttata* in the United States. Literature records are included.

Distribution: Northern Montana and central South Dakota to western Texas and eastern New Mexico; thence westward through southern Colorado and New Mexico to Arizona (exclusive of the Sonoran Desert) and southwestern Utah, extending southward on

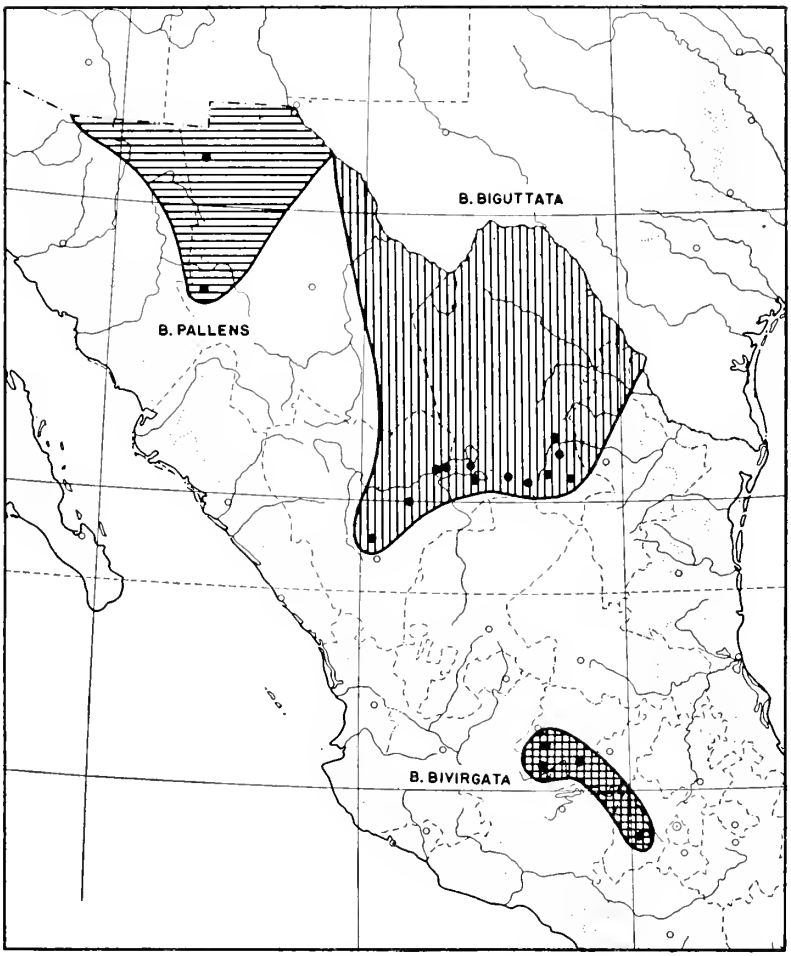

Fig. 2. Distribution of *Lytta biguttata* in México. Literature records are included.

the Mexican plateau to the state of México. See figures 1–2.

The species occurs commonly on Compositae and is probably a pollen feeder. Three well-marked subspecies may be recognized,

series of which are distinguishable by use of the following key:

Key to the Subspecies of *biguttata*

1. Head and under surface orange, or at least predominantly of this color ..... *b. pallens*
   Head and under surface black, or at least predominantly of this color 2
2. Elytra each with a dark subapical spot or short vitta .... *b. biguttata*
   Elytra each with a pair of submarginal dark vittae .... *b. bivirgata*

Lytta biguttata **pallens** n. subsp.

Head, femora, and under surface, except frequently a part of the thorax, orange or yellow-orange. Upper surface immaculate or with a pair of black spots on the pronotum and/or a black or brown spot distally on each elytron (fig. 4A). Elytral suture entirely pale or finely bordered with black or brown for basal half or less. Tibiae in both sexes and basal antennal segments in male black or orange. Antennal segments less elongate than in *b. bivirgata*. Elytral pubescence moderately long, sufficiently dense to be conspicuous under magnification, as on head and pronotum.

Distribution: Valley of the Virgin River in southwestern Utah (Washington County) through Arizona, exclusive of the Sonoran Desert, to central western Chihuahua, extreme western Texas (Hudspeth County), and southeastern New Mexico. See figures 1–2.

Variation and Intergradation: The femora are sometimes finely tipped with black. Within the range of typical *b. pallens* the under surface of the thorax is entirely orange in approximately 61 per cent of the specimens examined, partially black in about 39 per cent. The area covered by the black thoracic markings varies from a fine margin of the side pieces to all but the middle of the metasternum. Five specimens with well-developed thoracic markings have some black on the first to first three visible abdominal sternites. In two of these (Senator Mine and Douglas, Arizona) and in one specimen with a typical abdomen (Douglas) the head is suffused with brown or black on the vertex. The pronotal and elytral markings are, on the average, less extensive in *b. pallens* than in *b. biguttata* and are more frequently absent. As in *b. biguttata* there is some correlation between the extent of the dark markings on the body and legs and the extent and intensity of those on the elytra.

Contact with *b. biguttata* results in increased variability in series of *b. pallens* from northwestern and southeastern New Mexico and extreme western Texas, with some influence of *b. biguttata* apparent in central eastern Arizona also. Although almost every conceivable transitional stage between *b. pallens* and *b. biguttata* coloration is represented among material from intergradational localities, it has been found convenient in analyzing variation within these races to assign specimens to one of three types, according to whether the color pattern is 1) typical or nearly typical of *b. pallens*, 2) typical or nearly typical of *b. biguttata*, or 3) more or less intermediate between the two.

Intergradation between *b. pallens* and *b. biguttata* is shown graphically in figure 3 by the use of pie graphs indicating the relative frequency of the three color pattern types in material from various localities. It should be noted that in order to minimize error associated with extremely small samples, most series consisting of less than three specimens have been lumped with adjacent series. All specimens from the range of *b. biguttata* outside the limits of the map shown in figure 3 are assignable to the *b. biguttata* type.

A specimen of *b. pallens* from the Santa Rita Mountains, Arizona, is indistinguishable from typical *b. biguttata*, but eight other specimens from the Nogales region are typical of *b. pallens*. Although the Santa Rita specimen may indicate that the influence of *b. biguttata* on *b. pallens* extends as far south as southern Arizona, it is perhaps equally likely that it represents an extreme expression of the range of individual variation of *b. pallens*. A series of eight specimens from the Sierra Ancha Mountains of eastern central Arizona includes two specimens of the intermediate type and one typical of *b. biguttata* and is clearly intergradational. To the east a specimen from Springerville, Arizona, is typical of *b. biguttata*. Two other samples from the general region consist of one specimen each of typical *b. pallens*. Northward *b. pallens* ranges into southwestern Utah and northeastern Arizona (northern Mojave County) in typical form.

In series of nine specimens from 18 miles east of Gallup, New Mexico, and three from Albuquerque, *b. pallens* and the intermediate type occur in the proportion of two to one. A decrease in the influence of *b. pallens* to the north is suggested by a series of specimens from Montezuma County, Colorado, consisting of two *b. biguttata*, two intermediate, and one *b. pallens* types and referable, therefore, to *b. biguttata*. An abrupt transition between *b. pallens* and *b. biguttata* in northern central New Mexico is

indicated by the fact that a series of 17 specimens from Santa Fe and San Miguel counties shows no influence of *b. pallens*.

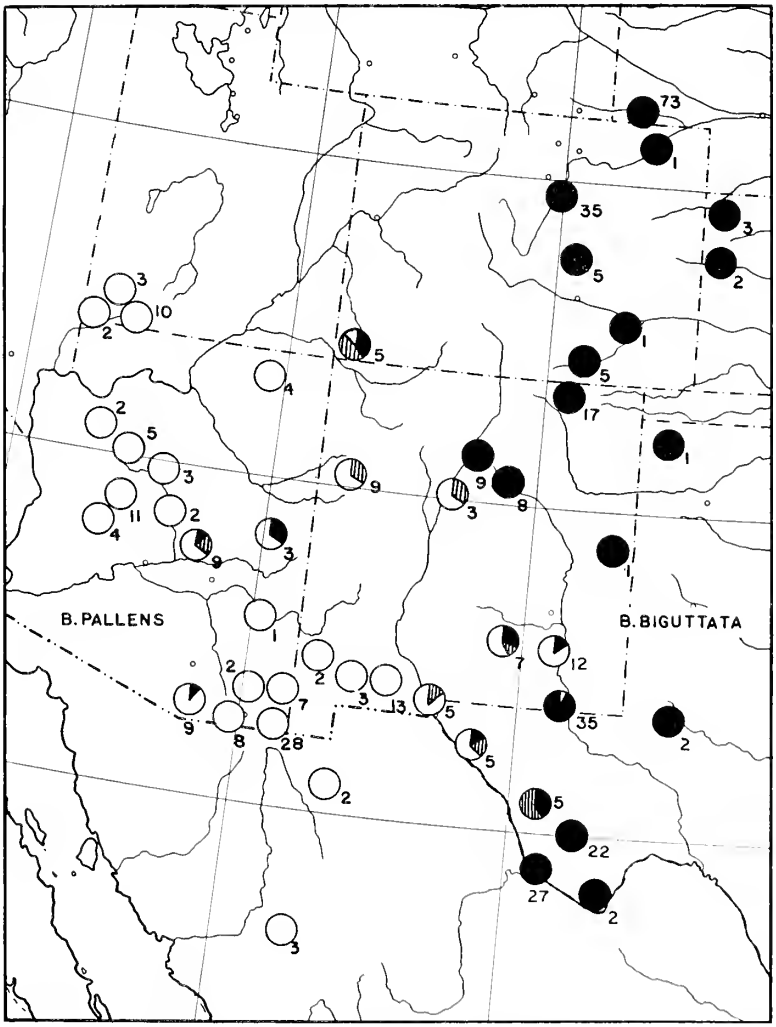

Fig. 3. Intergradation of *Lytta b. biguttata* and *b. pallens*. Relative frequency of the *b. biguttata*, *b. pallens*, and intermediate color pattern types in each sample is indicated by the size of the black, white, and lined sectors, respectively, of the pie graphs.

Variation of *b. pallens* toward *b. biguttata* is somewhat less abrupt in southeastern New Mexico. Seven specimens from

northern Otero County give the ratio of four *b. pallens*, one intermediate, and two *b. biguttata* types. Twelve specimens from Artesia, northern Eddy County, show even stronger influence of *b. pallens* than the Otero County material, consisting of 10 *b. pallens* and two *b. biguttata* individuals. One of two specimens from Carlsbad, central Eddy County, represents *b. pallens*, the other *b. biguttata*. Taken together this pair is perhaps closer to *b. pallens* than to *b. biguttata;* it has been assigned to *b. pallens* but has been lumped with the Loving series in figure 3. Sixteen miles to the southeast of Carlsbad the effect of *b. biguttata* is dominant, a series from Loving consisting of 30 *b. biguttata* and two *b. pallens* types.

A gradual cline of color variation is evident in central southern New Mexico and extreme southwestern Texas. Pure *b. pallens* extends into southern New Mexico as far east as western Dona Ana County. Three specimens from Las Cruces in central Dona Ana County are typical of *b. pallens*, as is a single specimen from adjacent El Paso County, Texas. A specimen from 10 miles east of Las Cruces is of the intermediate type, although closer to *b. pallens* than to *b. biguttata*. To the southeast, three specimens from McNary, Hudspeth County, Texas, represents *b. pallens*, one the intermediate type, and one *b. biguttata*. Finally, a series from 11 miles north of Valentine, Jeff Davis County, consists of three intermediate and two *b. biguttata* types and is assignable to *b. biguttata*.

The relationship of the two subspecies in central New Mexico is unknown. The high degree of variability in central eastern Arizona samples may indicate that the influence of *b. biguttata* is greater through central New Mexico than to the north and south. The species *biguttata* has been recorded from Socorro, New Mexico, but no information as to the character of the population there is available. Contact and intergradation of *b. pallens* and *b. biguttata* undoubtedly occur in northern México, but the range of the species in México is so poorly known that no information on this subject is available at the present time.

Remarks: Holotype male and allotype female from Douglas, Arizona, September 15, 1933, W. W. Jones, in the collection of the University of California at Berkeley. The majority of other specimens of *b. pallens* studied have been designated as paratypes. Speciments examined: 168.

Lytta biguttata biguttata LeConte

Lytta biguttata LeConte, 1853, Proc. Acad. Nat. Sci. Philadel-

phia, 6: 332.

Cantharis alemani Dugès, 1889, An. Mus. Michoacano, 2: 106. *New synonymy.*

Head, antennae, tibiae, and under surface, except commonly the last two visible abdominal segments and a small patch at the sides of some of the preceding sternites, black. Femora black or, less commonly, orange broadly tipped with black. Pronotum usually with a pair of black discal spots, sometimes with a black dot on each side anterior to these. Elytra usually each with a black spot or elongate streak distally (fig. 4B), occasionally immaculate. Elytral

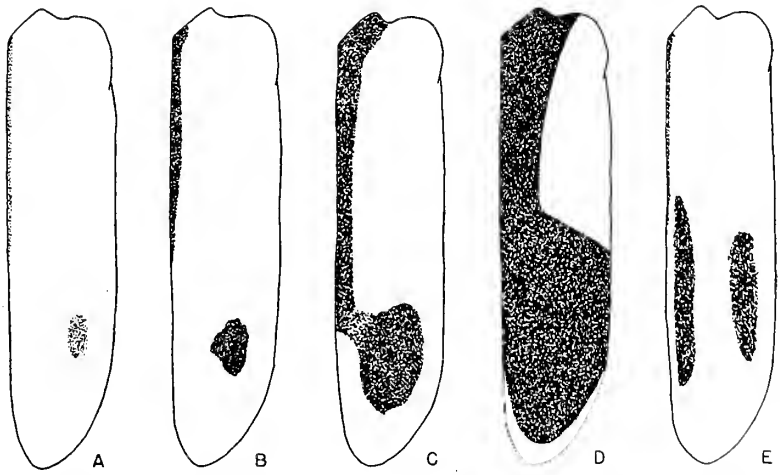

Fig. 4. Variation in the elytral color pattern of *Lytta biguttata*. A. *b. pallens*, Zion National Park, Utah; B. and C. *b. biguttata*, Santa Fe, New Mexico; D. *b. biguttata*, Ciudad Lerdo, Durango (after Champion, 1893, Biol. Centr.-Amer., Col. 4(2), pl. 21, fig. 23); E. *b. bivirgata*, 1 mile east of Villagrán, Guanajuato.

suture usually finely bordered with black for basal half. Antennae and elytral pubescence as in *b. pallens*.

Distribution: Northeastern Montana and central South Dakota through the Great Plains regions of Wyoming, Nebraska, Kansas, Colorado, and northern Texas to extreme southwestern Colorado (Montezuma County) and northern and eastern New Mexico; thence through southwestern Texas (east of Hudspeth County) to southeastern Coahuila and central Durango. See figures 1, 2.

Variation and Intergradation: Except at intergradational localities (see below) the head, antennae, and under surface of the

thorax are consistently black in *b. biguttata.* The abdomen and legs show some variety with respect to the extent of dark markings but are more extensively marked than in *b. pallens.*

Variation in the extent and intensity of the elytral markings covers an unusually wide range. From the typical pattern (fig. 4B) the elytra vary imperceptibly to an entirely immaculate extreme which is represented sporadically and at low level throughout the range of the subspecies. In rare instances loss of the elytral spots is accompanied by absence of the sutural borders. Variation in the other direction is almost as continuous and sporadic. The elytral spots vary in form from nearly round to elongate-oval, in some cases becoming quite vittate in appearance. On the basis of a relatively small sample the tendency for elongation of the spots seems to be stronger in northern México than elsewhere within the range of the subspecies. Pronounced enlargement of the spots is accompanied by an increase in extent of the sutural borders of the elytra. In three especially well-marked specimens from Santa Fe, New Mexico, the borders extend to and narrowly fuse with the spots, as in figure 4C. The elytral color pattern of a specimen examined from Ciudad Lerdo, Durango, is similar, but the borders and spots are narrowly separated. The extreme of variation in this direction is represented by a female from Ciudad Lerdo figured by Champion (1893, Biol. Centr.-Amer., Col. 4(2), pl. 21, fig. 23) in which the spots cover all but the apical margin of the distal half of the elytra (fig. 4D).

One of four specimens from Cottonwood, South Dakota, has unicolorous, dark brown elytra. The other specimens are typically colored. It appears to me that the Cottonwood variant represents an anomaly rather than an extreme of normal color pattern variation.

Except possibly with respect to the shape of the elytral spots, color variation in non-intergradational populations of *b. biguttata* seems to show no significant correlation with geographic distribution. As might be expected, some correlation is evident between the extent of the markings on the body and legs and the extent and intensity of the markings on the elytra. This relationship can be expressed only on the basis of averages, however, as the elytral markings vary within wide limits among otherwise identically marked specimens; moreover, in some of the palest specimens the elytra are heavily marked, while in some of the darkest they are immaculate. In some of the more heavily marked specimens the pronotal spots may extend to the basal margin.

A specimen from the Chisos Mountains, Big Bend National

Park, Texas, is exceptional in that the abdomen is largely orange. Although this specimen possibly reflects the influence of intergradation between *b. biguttata* and *b. pallens* to the north, I am more inclined to believe that it represents an extreme of normal color variation. Series of specimens from Cortez, Colorado; Loving, New Mexico; and 11 miles north of Valentine, Texas, although assignable to *b. biguttata* show definite intergradation with *b. pallens* and have been discussed under that subspecies.

Remarks: The type locality of *biguttata* is Santa Fe, New Mexico. *Cantharis alemani* was described by Dugès on the basis of a single female specimen from Ciudad Lerda, Durango. Champion (1892, Biol. Centr.-Amer., Col. 4(2): 440) placed *alemani* as a questionable junior synonym of *quadrimaculata,* but it seems more likely that it was based on a specimen of *biguttata.* The type locality of *alemani* is within the range of the present subspecies. Several specimens of *b. biguttata* studied from the United States fit Dugès' description of *alemani* in all details. Specimens examined: 321.

Lytta biguttata bivirgata (Dugès), *new status*

Cantharis bivirgata Dugès, 1881, La Naturaleza, 5: 140, pl. 4, fig. 2.

Cantharis alfredi Dugès, 1889, An. Mus. Michoacano, *2*: 98.

Head, antennae, and under surface, except the last two visible abdominal segments and a small patch at the sides of some of the preceding sternites, black. Femora and tibiae orange, finely tipped with black. Pronotum with a pair of black discal spots and a small black dot on each side anterior to these. Usual distal spot replaced on each elytron by a pair of black, submarginal vittae (fig. 4E). Elytral suture finely bordered with black for basal half. Antennal segments perceptibly more elongate in form than in *b. biguttata* and *b. palleus.* Elytral pubescence short, bristle-like, very sparse.

Distribution: Meseta Central of the states of Guanajuato and México. See figure 2. At present the known range of *b. bivirgata* is isolated from the main range of *biguttata* by a distance of more than 300 miles. Collecting in central México, however, has not been sufficiently intensive to establish if this hiatus in distribution is an actuality in nature. The subspecies *b. bivirgata* undoubtedly has a larger range than shown. Records obtained in 1955, the first in 67 years, more than doubled its known range.

The established southern limits of range of *b. biguttata* correspond roughly with the southern border of the Mapimí Province as defined by Smith (1949, Ann. Assoc. Amer. Geogr., 39: 231, fig. 1) but even more closely parallel Mexican highways 31 and 60 connecting Durango City and Monterrey.

Variation and Intergradation: The description of structural characters is drawn from three specimens which I examined. As far as color pattern is concerned, the description applies to the typical form as described by Dugès on the basis of material from southwestern Guanajuato. Dugès did not mention the lateral orange patches of the abdominal sternites, but these could have been easily overlooked by him. That the extent of color pattern variation in *b. bivirgata* is comparable to that of the other subspecies of *biguttata* is shown by the list of color varieties given by Dugès, but, unfortunately, the relative frequency of neither the typical form nor any of the color varieties was indicated by him.

In Dugès' variety A the vertex of the head, except for a stripe on the midline and a broad border around the eyes, is yellow. Varieties B through F are based on various degrees of development of the pronotal spots. In lightly marked specimens the discal pair, which are typically rather large, are reduced to dots and the antero-lateral dots are absent. In heavily marked individuals the discal spots extend to the posterior margin of the pronotum and exhibit a greater or lesser degree of fusion. All pronotal variation described for *b. bivirgata* is duplicated in *b. biguttata*.

Progressive steps in extension of the elytral markings form the basis for varieties G through J of Dugès. In variety G the vittae of each elytron are wider than in the typical form but still separate; in variety H they contact one another; in variety I they fuse to form a single large spot which reaches the sutural margin; and in variety J the sutural border of each elytron is broadened and fused with the spot. As Champion noted, this last elytral color pattern is the same as that in his heavily marked specimen of *b. biguttata* from Durango.

One of two specimens of *b. bivirgata* studied from 1 mile east of Villagrán, Guanajuato, is typical. In the other specimen the head has the color pattern of Dugès' variety A and there is, in addition, a large pale area on the under surface of the thorax. A single male from 14 miles west of Toluca, México, is typical except that the vittae of each elytron contact each other, corresponding to the condition in Dugès' variety H, and the first and fourth to sixth antennal segments are partially orange.

Although *b. bivirgata* appears to be geographically isolated from

b. biguttata and *b. pallens* and is perhaps an incipient species, it is not regarded as specifically distinct at the present time because it 1) possesses no more than minor structural differentiation and 2) differs in color from *b. biguttata* to a lesser degree than does the definitely subspecific *b. pallens*. Furthermore, the possibility that *b. bivirgata* and at least *b. biguttata* are connected by a continuous interbreeding population has by no means been eliminated.

Remarks: *Cantharis alfredi* may be regarded as an objective junior synonym of *bivirgata* as it was proposed, in effect, merely as a new name for the latter. In describing *bivirgata* in 1881 Eugenio Dugès credited the name to his brother, Alfredo. In redescribing the same form in 1889 Eugenio Dugès was apparently under the impression that he had used the name *alfredi* in his earlier paper as he cited his original description under that name and cited "*C. bivirgata* Alf. Dug." in synonymy as a manuscript name.

The type locality of *b. bivirgata* is Silao, Guanajuato. Dugès also recorded the subspecies from Tupátaro, Guanajuato. Specimens examined: 3.

ON THE RENDERING OF CHARLES De GEER'S SURNAME.

By Ashley B. Gurney,* Washington, D. C.

One of the outstanding pioneer entomologists of the 18th century was Charles De Geer (1720–1778), whose name appears almost daily as the describer of the red-legged grasshopper, *Melanoplus femur-rubrum* (De G.), and numerous other common insects. Unfortunately, writers are not consistent in rendering De Geer's surname, so that DeGeer, Degeer, de Geer, Geer, and other forms are used. An example of varying usage among North American entomologists is found in the official list of Common Names of Insects.[1] The abbreviation DeG. was used in the 1908, 1925, and 1931 editions of the list, and Deg. in 1937, 1942, 1946, and 1950. The current 1956 list (Bull. Ent. Soc. Amer., vol. 1, no. 4, pp. 1–34) returns to DeG. An important minority group of writers uses Degeer, and they are convinced that this form is in accordance with

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[1] The lists were issued by the American Association of Economic Entomologists, in the Journal of Economic Entomology, prior to 1956.

De Geer's own wishes, according to the statement of the German entomologist Johann A. E. Goeze[2] (1731–1793) who translated from the French and edited the German edition of De Geer's famous work, "Memoirs pour servir a l'histoire des Insectes." While the lack of uniformity in rendering the surname may seem trivial, the exactness which we try to achieve in the scientific names of animals warrants this attempt to determine the correct spelling. As a result of this study, it is concluded that De Geer is the correct rendering of the surname.

Since most usage of the Degeer form is based on one or both of the two statements published by Goeze, it is desirable to quote them here, followed by translations which have been prepared by Miss Ruth Ericson of the Entomology Research Branch, U. S. Department of Agriculture.

"Den Namen des Herrn von Geer hab 'ich in dem Werke selbst *von Geer, de Geer, von Geerisch,* unrecht geschrieben, indem es *Degeer, Degeerisch* heissen muss, weil mir dieser berühmte Naturforscher selbst gemeldet hat, dass das *de* in seinem Namen nicht der Deutschen *von* sey; sondern wesentlich zu demselben gehöre." —Goeze (1777, p. xiv)

Translation—In the Work (or volume or article) itself I have incorrectly written the name of Herr von Geer as *von Geer, de Geer, von Geerisch,* while it must be called *Degeer, Degeerisch,* because this famous naturalist himself informed me that the *de* in his name is not the German *von*; but it is essentially part of the same [i. e., the name].

"'*Nachricht.*—Der im verwichenen Jahre im Herrn entschlafene Verfasser, bezeigte mir schriftliche seine Zufriedenheit uber meine Uebersetzung des Insektenwerkes, zugleich aber ersuchte er mich, seinem Namen künstig nicht mehr von Geer zu schreiben, oder ein neues Insekt von Geerisch zu nennen, sondern alleseit Degeer, degeerisch zu schreiben, weil diese De nicht der Teutschen von sey, sondern wesentlich zu seinem Namen gehöre, welches ich hierdurch, wie billig, dem Publikum anzeigen wollen.—Göze.'" —Goeze, in De Geer (1779).[3]

[2] Written Göze in the volume by De Geer (1779).

[3] Coe (1943) referred to the statement by Goeze (in De Geer, 1779) and said that it appears "in the form of a notice preceding the text, i. e., following title-page and general index." A copy of the work belonging to the University of Minnesota Library has been borrowed, but no such statement appears in it. In response to an inquiry concerning the exact place where the statement occurs, Mr. Coe has replied that in the copy examined by him the Goeze statement appears on the right hand side of a sheet which

Translation—*Note*—The author who went to sleep in the Lord [died] last year, notified me in writing (or by letter) of his satisfaction with my translation of the Volume on Insects (or Insect Work), but at the same time he requested me not to write his name von Geer any more in the future, or to name a new insect von Geerisch, but always to write Degeer, degeerisch, because this De is not the German von but rather is essentially a part of his name, which I, as is proper, hereby want to make known to the public.—Göze.

Prior to his death in 1778, De Geer evidently saw Volume I of the German edition of his "Memoirs," first published in 1776, as translated and edited by Goeze, who wrote the name as "von Geer" and "de Geer." Since Goeze apparently had supposed the *de* to be merely a nobiliary particle equivalent to the German *von*, he used *von* in some instances. In the same manner he had referred to "Herr von Reaumur." Contrary to this interpretation, De Geer and others of his family have traditionally considered the *De* as part of the surname, though usually a space is shown between *De* and *Geer*. Therefore, De Geer wrote to Goeze, and the 1777 Goeze statement suggests that De Geer said only that the *De* was not the equivalent of *von* and that it was an essential part of the name. It is uncertain whether De Geer elaborated his preferences further, but Goeze (1777) *inferred* that the Degeer form was correct, while in 1779 he *stated* that this was part of the *author's request*. It seems quite possible that Goeze, sincerely wishing to avoid the use of *de* in the sense of a nobiliary particle, and unaccustomed to a capital letter in the middle of German surnames, wrote his own interpretation into the 1779 statement as part of De Geer's specific request. My discussion will be devoted mainly to a review of the situation[4] and

immediately follows a sheet presenting the table of contents (Verzeichniss). On the right hand side of the Verzeichniss sheet, near the bottom of the unnumbered page, is a sketch of a bee-hive with three bees flying away. The Minnesota copy lacks the sheet following the "bee-hive" page, and there is no indication that a sheet has been removed. A further sign that individual copies of the Goeze translation may have varied is the statement by Schmidt-Gobel (1876, p. 149) that he was told that some colored examples existed, though he himself had not seen them.

[4] The cooperation of the various individuals whose assistance is mentioned throughout the paper is gratefully acknowledged. The benefit of their assistance and judgment has been very helpful. A copy of this manuscript was sent to Mr. R. L. Coe, and he agreed (*in litt.*, June 27, 1956) that Goeze's statements are not entirely reliable.

the evidence pointing to the likelihood that Goeze's own interpretation entered strongly into the 1779 statement.

Writers referring to one or both of the Goeze statements in support of the Degeer form include Schmidt-Gobel (1876, p. 149), Schulz (1906, p. 237), Dimmock (1906, footnote p. 322), Clément (1910), Wheeler (1931, footnote p. 31), Balfour-Browne (1938, footnote p. 6), and Coe (1943). Other references of a similar nature may have escaped my attention. All of the above writers except Coe referred to Goeze briefly. Balfour-Browne stated "Goerze (sic!), Ent. Beytrage, 1777, *I*, xiv, states that Degeer himself told him that this is the correct spelling of his name instead of 'De Geer'," when, in fact, Goeze did not make that exact statement. It was Dr. Joseph Bequaert who invited Wheeler's attention to the Clément reference, which in turn was responsible for Wheeler's adoption of the Degeer form. Coe's explanation is much the fullest, though still lacking the support of Swedish sources, such as genealogies, the examination of which Coe suggested might be helpful. It appears that the adoption of Deg. in the 1937, 1942, 1946, and 1950 lists of the Common Names of Insects is traceable to an acquaintance with Dimmock's note, on the part of coleopterists at the U. S. National Museum, and a consequent acceptance of the views expressed by Goeze (1777).

Horn (1926, p. 50) treated the surname as Geer, perhaps reflecting the opinion that *de* was fully comparable to *von*. Horn and Schenkling (1928–1929, *1*: 247; *2*: 403) adopted Degeer, probably a sign that Goeze's views were accepted, and Horn and Kahle (1935, pp. 4, 52, pl. 14) continued the use of Degeer.

In De Geer's principal work (1752–1778), published in Stockholm, the full name CHARLES DE GEER appears on the title page. Spacing occurs in the surname, but due to the use of capital letters no further preference in the rendering of the name is evident. Concerning other De Geer works, his paper on the "worm-lion" (De Geer, 1752), published in Stockholm, has been seen in the original. The author's name appears as CARL DE GEER, and it also is given in the same way in a list of members at the front of the volume. A paper on a cranefly by De Geer (1773), published at Upsala 5 years before the entomologist's death, has been consulted in the original. Presumably it reflects De Geer's usage during his later years, and it doubtless was not subject to faulty typesetting by foreign printers unfamiliar with the author's name. The latinized form CAROLO DE GEER appears on the paper, and in the list of authors represented in the volume CAROL. DE GEER is used. Dr. K. Princis of Lund, Sweden, the well known student of

cockroaches, has written (*in litt.*, April 4, 1954), "There is no doubt that De Geer himself used the form De Geer and so do also all the Swedish entomologists without exception. The form Degeer appeared for the first time in the German translation by Goeze, although there is a clear space between De and Geer in the original edition." This evidence should more than counterbalance the inference by Coe (1943) that the printed form of De Geer's name appearing with his work is not a basis for opinion due to the fact that he did not always see proof of papers published outside of Sweden.

Through the kind cooperation of Dr. Felix Bryk of Stockholm, and of the Swedish Academy of Science, I have obtained a photocopy of a letter written by De Geer to the Swedish Academy in 1742. The closing portion of the letter, clearly showing a capital D and a capital G., is reproduced in fig. 1. In this specimen of De

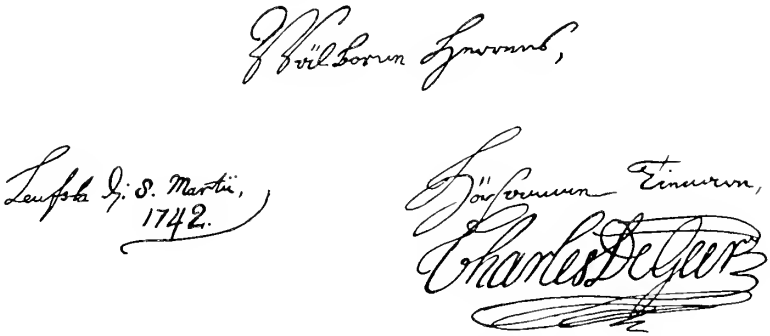

Fig. 1. Closing portion of a letter written by Charles De Geer, the entomologist, belonging to the Swedish Academy of Science. Traced by the author from a photocopy furnished by Dr. Felix Bryk. A free translation is as follows: "Leufsta the 8th March 1742. The obedient servant of the honorable gentlemen."

Geer's handwriting no spacing occurs between parts of the name, including the given name, but spacing is amply evident from the title page of his work and from usage of his friends Reaumur and Linnaeus, as well as that of present-day descendants of his line (Leufsta) of the De Geer family.

During De Geer's life he was rather close to the great French naturalist, Reaumur, and considerable correspondence passed between them, though Caullery (1955, p. 42) reports the failure to learn that any letters from Reaumur to De Geer are preserved in the De Geer family archives. However, in his paper on the "worm-

lion," Reaumur (1753) twice referred to his friend as "M. de Geer," evidently demonstrating that Reaumur was accustomed to present the parts of the surname separately. Probably the French influence was responsible for the use of a small *d*. Linnaeus, a fellow-countryman and friend, used the form De Geer in the 10th Edition of the Systema Naturae, 1758.

The Baroness Ebba-Hult De Geer, of Stockholm, a member of the Leufsta branch, which began with the famous entomologist, has shown in correspondence with me that the correct form of the surname includes spacing, though in handwriting or typing it is not always observed. She has most kindly furnished a copy of the signature of De Geer's son (fig. 2), which clearly shows that in 1788

Fig. 2. Copy of a signature of Charles De Geer, son of the entomologist, made from a tracing presented to the U. S. National Museum by the Baroness Ebba-Hult De Geer.

he capitalized both D and G. Presumably the practice was followed by the family during his father's life.

It is true that some variation in the use of the surname has occurred. Dr. Bryk has consulted the minutes of the Swedish Academy of Science, and reports that during the early years (1739–1741) of De Geer's association with the Academy his name was variously recorded as Degér, Deger, Degeer, and DeGeer [Secretary's records, not De Geer signatures]. Later, De Geer apparently was used consistently in the Academy records. Mr. Sven Lundgren, a consultant on Swedish biography in the Library of Congress, has explained to me that the use of a small *d*, in such names, is a privilege accorded nobility in Sweden. I have been informed by the Baroness that in the Leufsta branch of the family there has privately been some use of the small *d*, but in the peerage the name was entered with the capital *D* until 1947.

The non-Swedish influence or attitude toward the name is shown by Caullery (1955) who uses the name Charles de Geer, clearly

following the French custom, as also shown in such names as "de Lanux" and "de Custine." Perhaps the French custom influenced Duncan (1848, pp. 59–66), in his rather noteworthy "Memoir of DE GEER," to refer to him as Charles de Geer and Baron De Geer, apparently using a capital *D* only when the surname was not combined with a first or "given" name. Among French entomologists the use of "de" in De Geer's name is not uniform, however. Bonnet (1952) has pointed out that forms of the name other than De Geer, including the form Degeer in the German translation of the "Memoirs," are erroneous. Dr. Lucien Chopard uses De Geer regularly in his papers. Dr. René Malaise of Stockholm has pointed out (*in litt.*, Dec. 18, 1952) that non-Swedish families with names like "de Jongh" and "de Grade," who have recently arrived in Sweden, are inclined to use that form, in contrast with Swedish De Geers. He has cited the Stockholm telephone register as demonstrating these distinctions.

Although most differences in the rendering of De Geer's name involve the way "de" is combined with "Geer," the "De" sometimes has been eliminated entirely by later entomologists. As an example, Kevan (1952, p. 169) states that the name was Charles Geer, and he cites Willemse (1917) in support of that view. Willemse (1917, p. 17) had commented "Gewoonlijk wordt DE Geer of Degeer geschreven. Dit is echter minder juist. Zijn naam was Geer." (Ordinarily DE Geer or Degeer was written. However, this is less exact. His name was Geer.—Translation by Miss Ericson.) In the light of all the evidence here presented, the omission of "De" is unwarranted. The Baroness De Geer has commented to me that members of the families of von Rosen, af Ugglas, etc., may be referred to as Count Rosen, Count Ugglas, or Baron Essen, but never a Baron Geer, instead always De Geer, so tightly does the prefix constitute an essential part of the name.

Dr. Felix Bryk, who has made a detailed study of De Geer, has written (*in litt.*, March 2, 1956) that he considers Goeze's rendering of the name wrong. It seems quite probable that Goeze was influenced by German customs. On page 6 and elsewhere of De Geer (1779), Goeze referred to Reaumur as "Herr von Reaumur," since the French entomologist often was called "de Reaumur," though "de" was not an essential part of the surname. In the same way Goeze sought to Germanize De Geer's name in the first volume of the translation, with the result that De Geer asked him not to write "von Geer." It may be noted that the requests ascribed to De Geer in the two Goeze statements do not agree entirely, and my inference is that Goeze added his own interpretation to the request. De Geer

probably did not go so far as to request that his name be written Degeer, as Goeze said in 1779, but did not say in 1777.

The authoritative Swedish genealogy by Elgenstierna (1926) consistently used the surname De Geer. Nordenskiöld (1920–24) gave the name as Charles De Geer, though the English translation[5] by Eyre (Nordenskiöld, 1928) used the surname "de Geer."

Specific and generic names originating as patronymics based on De Geer's name have appeared in numerous forms. Bonnet (1952) reported a survey of those forms, including the 22 different ways in which the specific name of one common spider had been written by different authors. Since the Rules provide for a single word consisting of small letters, including the initial one, *degeeri* is the correct specific patronymic. If the name of a person on whose name a patronymic is based contains a nobiliary particle, as "de Lessert," the specific name may be formed either with or without the particle (*delesserti* or *lesserti*). In the case of De Geer, the particle is not strictly a nobiliary one, but a definite part of the surname, so that *degeeri* is the result. Concerning generic names, a single word, of which the initial letter is capitalized, is the correct form, hence *Degeeria* and *Degeeriella*.

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[5] The 1928 translation is readily available, much more so in the United States than the original Swedish edition. I am indebted to Mr. Herman H. Henkle, Librarian of the John Crerar Library, of Chicago, for checking the form used by Nordenskiöld. This change during translation is an example of how misunderstandings have arisen with respect to De Geer's name.

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