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THE FLEAS OF EGYPT. HOPKINSIPSYLLA OCCULTA, A NEW GENUS AND SPECIES OF FLEA PARASITIZING JERBOAS
(SIPHONAPTERA: LEPTOPSYLLIDAE)

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The U. S. Naval Medical Research Unit No. 3, based at Cairo, Egypt, United Arab Republic, has been engaged in a broad research program on infectious diseases in Egypt, and a major aspect of this undertaking has been the study by the Department of Medical Zoology on potential vectors and reservoirs of disease. As a result, this Department, under the direction of Dr. Harry Hoogstraal, has collected and examined thousands of mammals and ectoparasites, and has contributed greatly to our knowledge of the medical ecology of the region. Among the fleas thus made available for investigation is a genus and species new to science, apparently chiefly parasitizing the four-toed jerboa, *Allactaga tetradactyla,* and herewith described in one of a series of articles on the Siphonaptera of Egypt.

Family LEPTOPSYLLIDAE
Subfamily AMPHIPSYLLINAE

Hopkinsipsylla, gen. nov.

Diagnosis.—Near *Ophthalmopsylla* Wagner and Ioff, 1926, and *Paradoxopsyllus* Miyajima and Koidzumi, 1909, but readily separable from both by the following characters: 1) Eye (fig. 1, E.) deeply and broadly excised ventrally, the resulting sinus conspicuous; with the ventral margin weakly sclerotized, inapparent; double in appearance in that it is divided into a larger, anterior and dorsal portion which is lightly sclerotized, and a ventro-posterior darker portion somewhat reniform in shape; the demarcation between the two areas not clearly delineated. In *Ophthalmopsylla* the ventral margin of the eye is convex or biconvex, not broadly excised, and the pale anterodorsal portion is clearly demarcated in sharp

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contrast to the darker ventroposterior area, which is pyriform in shape. In *Paradoxopsyllus* the eye is not double in appearance, and is not so deeply excised and/or there is a sclerotized ridge delineating the ventral margin. 2) Male eighth tergum (fig. 6, 8 T.) reduced so that dorsally it scarcely extends beyond base of the immovable process (P.), while ventrally it fails to reach below the ventral margin of P. In the other two genera, the eighth tergum is relatively much larger, extending caudad to level of acetabulum or beyond, and sufficiently ventrad so as to cover much of the aedeagus. 3) Male eighth sternum (fig. 6, 8 ST.) proportionately and relatively very large, extending both caudad and dorsad to extreme margins of acetabulum of clasper, overlapping 8 T., and extending to its midline; with many ($\pm$ 10) large non-marginal bristles, as large or larger than those of 8 T., and also with about an equal number of smaller bristles; essentially unmodified structurally. In *Paradoxopsyllus,* the 8 S. is proportionately and relatively smaller, normally not extending dorsad further than midline of body, generally in vicinity of the manubrium, and with the caudoventral angle no further posterior than level of apodemal strut; with only about four bristles and these ventral in caudomarginal region. While the 8 S. may be highly modified in *Ophthalmopsylla,* it is always smaller than in the new genus. 4) Male lacking acetabular bristles on process of clasper (fig. 13), whereas in the other two genera, there are typically one or two such bristles. 5) First pair of plantar bristles on fifth hind-tarsal segment (fig. 7) displaced mesad; the other plantar bristles much more lateral in position. In the other two genera, the plantar bristles are all lateral, their bases in line. 6) Bulga (head) of spermatheca (fig. 17, B.) shaped like a broad triangle with a rounded apex, instead of being gibbous or globate, or pyriform. 7) The homologue of the central tuber (trabecula centralis, T.C.) appearing as a large, lightly sclerotized, spherical structure lying above the eye, along the margin of the antennal groove, recalling *Peromyscopsylla* I. Fox, 1939, and *Cratynius* Jordan, 1933. The central tuber is distinct in *Ophthalmopsylla* and *Paradoxopsyllus,* much more sclerotized, smaller, and more ovate.

Generic Description.—Caput integrecipit (fig. 1, male and fig. 2, female). Eye broadly and deeply excised along ventral margin. Anterior arm of tentorium (T.A.) well-developed. Lacking a distinct sclerotized central tuber. Frontal tubercle (T.B.) distinct. Preantennal region with two rows of bristles and the first of these incomplete; at times with but one bristle representing an anterior third row. Second antennal segment (2 A.) with bristles short in both sexes. Antennal groove not extending onto propleuron. Postantennal region with only one complete row of bristles, that row caudomarginal. Labial palpi (L.P.) extending about four-fifths length of procoxae.

First vinculum or link-plate (VC. 1) received in distinct sinus of prosternosome. Pronotum narrower than length of spines of its combs with one row of bristles. Pronotal comb (P.C.) consisting of a total of about 18 narrow spines; near middle of comb, the spines are slightly longer than the breadth of pronotum at that level. Mesonotum (fig. 4, MSN.) with a total of about six or eight pseudosetae (PS.S.). Metanotum (MTN.) with a few apical spinelets. Mesepisternum (MPS.) and mesepimere (MPM.) clearly differentiated. Lateral metanotal area (L.M.) distinct. Pleural region of metasternosome fitting into a well-sclerotized pleural arch (PL.A.). Procoxa (fig. 1, 1 C.) with many lateral bristles. Meso- and metacoxae with a submarginal, vertical row of thin bristles. Metacoxae (fig. 11) lacking a

HOPKINSIPSYLLA OCCULTA GEN. & SP. NOV

Fig. 1, head and prothorax of male; fig. 2, head of female; fig. 3, immovable process and movable finger of clasper; fig. 4, meso- and metathorax; first abdominal tergum (male); fig. 5, distal arm of male ninth segment.

patch of mesal spiniform bristles, but with scattered, thin, marginal, mesal bristles. Profemora with some thin, scattered, lateral, non-marginal bristles. Dorsolateral bristles on posterior (outer) margin of tibiae (figs. 8 and 9) largely paired, tibial "combs" therefore lacking. First pair of tarsal plantar bristles displaced mesad but nevertheless proximad of second pair (fig. 7). Metanotum and some of typical abdominal terga with apical spinelets. Unmodified terga with two rows of bristles, but first row usually somewhat reduced in number. Representative abdominal spiracles subovate. Both sexes with three antesensiliary bristles per side, of which the middle one is the longest by far.

Male.—Eighth tergum (fig. 6, 8 T.) reduced, extending ventrad only to about level of seventh spiracular fossa (7 SPC.) and caudad not beyond level of proctiger. Eighth sternum (8 S.) large but relatively unmodified, about twice as broad (high) as long. Manubrium (fig. 13, MB.) long and narrow. Immovable process of clasper (figs. 3 and 13, P.) relatively unspecialized; higher than long; apex a broadly rounded triangle; the process directed dorsocaudad. Acetabular bristles absent. Clasper with movable finger or digitoid (F.) in shape of an inverted triangle with a broad apex and dorsocaudal angle rounded; lacking spiniform bristles. Tergal apodeme of ninth segment (T.AP.9) about 1½ times as long as broad at midpoint; apically about twice as broad as proximally. Distal arm of ninth sternum (figs. 5 and 13, D.A.9) relatively simple in structure; elongate, scarcely broader than proximal arm (P.A.9), which is subequal in length; lacking spiniform bristles. Apodemal rod or tendon of ninth segment (AP.R.9) well-developed, following cephalic course of penis rods for most their length. Aedeagus (figs. 14 and 15) relatively unspecialized; apodeme relatively long and narrow; apical appendage absent; proximal spur present; wall of aedeagal pouch (P.W.) weakly sclerotized; the bay in the apodeme (B.L.PT.) due to a convexity in the lateral plates (L.PT.), not the middle plate of apodeme (M.PT.); sclerotized inner tube (S.I.T.) short, straight and relatively unarmored; with a conspicuous apicomedian sclerite (A.M.S.); crochets (CR.) much longer than sclerotized inner tube, conspicuous; penis rods (tendons of phallosome) (P.R.) partially coiled anteriorly.

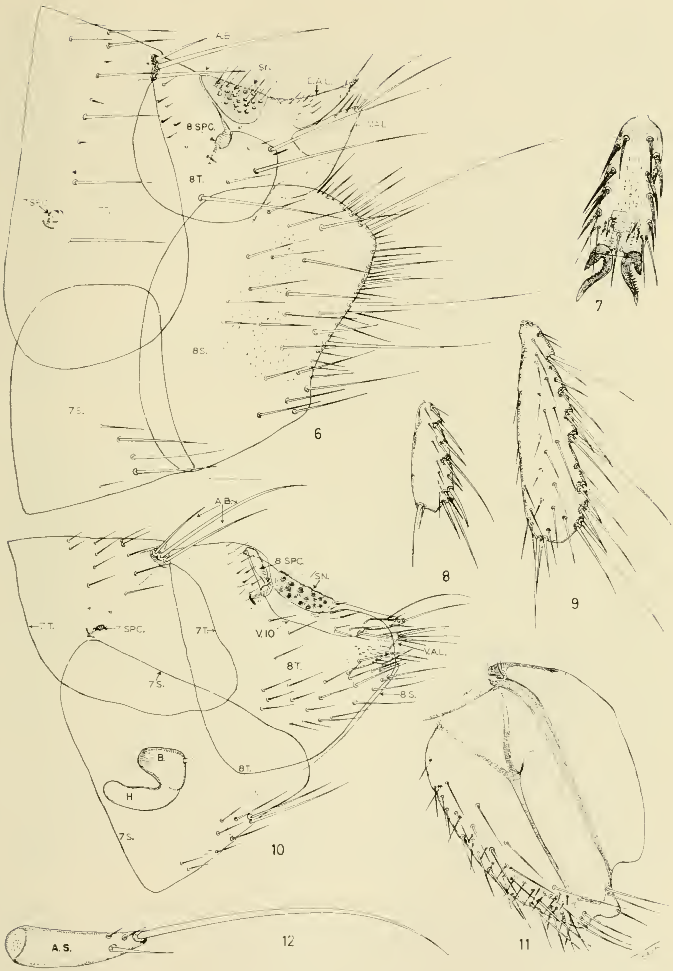
Female.—Spermatheca (figs. 10 and 17) with hilla (tail) (H.) much longer than bulga (B.), but its diameter only about half the height of hilla. Anal stylet (fig. 12, A.S.) slightly upcurved; more than 2½ times as long as broad. Stout bristles on ventral anal lobe (figs. 16 and 17, V.A.L.) relatively straight.

The type species of the new genus is *Hopkinsipsylla occulta* sp. n., described below.

The genus is named for G. H. E. Hopkins, of the Zoological Museum, Tring, Herts., England.

Hopkinsipsylla occulta, sp. n.

Types.—Holotype male and allotype female (B-50761-1) ex *Allactaga tetradactyla,* the four-toed jerboa; Egypt: Western Desert Governorate, 35 km. West of Mersa Matruh, 18 Feb., 1960, collector, H. Hoogstraal, for U. S. Naval Medical Research Unit No. 3 (Cairo). Paratypes as follows: 32 males and 34 females with same date *or* from nest of this particular individual jerboa; four males and two



HOPKINSIPSYLLA OCCULTA GEN. & SP. NOV.

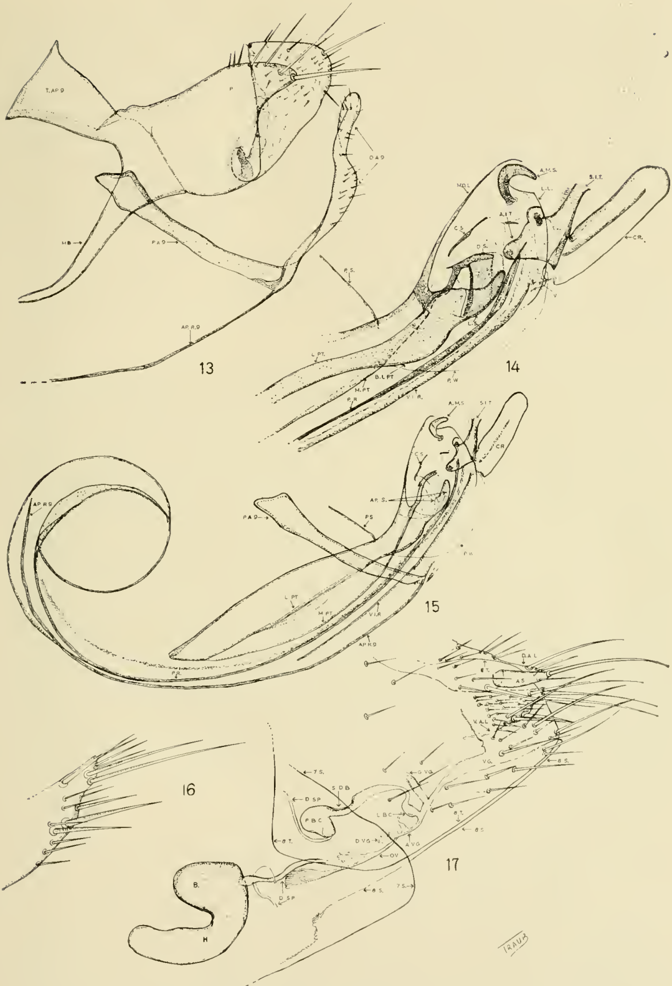
Fig. 6, seventh, eighth and tenth segments of male; fig. 7, metatarsus (male); fig. 8, protibia (male); fig. 9, metatibia (male); fig. 10, modified abdominal segments of female; fig. 11, metacoxa (male); fig. 12, anal stylet.

females (B-50766), ibid. but 19 Feb., 1960 one male and five females (B-50771) reared at NAMRU-3 Laboratory, on 23 Feb., 1960 from same nest as B-50761; three males and 13 females (B-50773), ibid. but reared 25 Feb., 1960; two females (B-50782) ibid. but reared 14 March, 1960; three males and 11 females (B-50763) ex a nest containing *Jaculus orientalis orientalis*, the greater Egyptian jerboa, otherwise with same data as holotype; one female (B-50765), same data as B-50763; two females (B-50764) ex nest of *Pachyuromys duprasi natronensis*, otherwise with same data as holotype; three females (B-10049), ex *Allactaga tetradactyla*, Egypt: Western Desert Governorate, Mersa Matruh, 2 May, 1952, collector H. Hoogstraal; four females (B-22334) ex *Allactaga tetradactyla*, Egypt; Western Desert Governorate, 5 mi. East of Sidi Barrani, 24 April, 1954, collector, H. Hoogstraal.

Holotype and allotype and two pairs of paratypes deposited in the collection of the U. S. National Museum, Washington, D. C. Paratypes deposited in the British Museum of Natural History (Tring, Herts.), the Chicago Natural History Museum, and in other institutions, as well as in the author's collection.

Head.—(fig. 1, male and fig. 2, female). Frontal tubercle (TB.) acute, median, conspicuous. Preantennal region with a row of two large bristles well anterior to eye; with a row of about four fairly small bristles at level of internal portions of stylets, uppermost of these bristles, bordering antennal groove, very small. Eye (E.) slightly more than twice as long as broad at midpoint; the ventral incision extending for a distance equal to about one fourth breadth of eye. Genal process quite broad and subtruncate apically. Maxillary lobe in shape of an acute elongate triangle, extending to approximate level of apex of third segment of maxillary palpus. Labial palpi (L.P.) 5-segmented, extending about four-fifths length of procoxae (1 C.); penultimate segment slightly more than one-half length of apical one, third segment slightly smaller than fourth. Maxillary palpi (M.P.) with third segment about one-half length of fourth. Scape of antenna with a few scattered, thin, apico- and dorso-marginal bristles. Second antennal segment (2 A.) with bristles shorter than width of segment. Club (A.C.) broadly ovate in outline. Postantennal region with longest bristle near ventrocaudal angle, slightly out of line with row; another large bristle submedian below midline; generally with two small thin bristles above the submedian large bristle and forming an equilateral triangle with it as an apex, directed ventrad; with one or two small bristles along antennal groove near midpoint and two or three more posterior in position. First vinculum or link-plate (VC. 1) elongate, cylindrical.

Thorax.—Pronotum with breadth from margin to base of spines of pronotal comb (P.C.) about two-thirds of length of spines of comb, as measured at middle level; bristles subequal in length to spines of comb, except for ventralmost, which is stout and very long nearly twice the length of the others. Pronotal comb consisting of a total of about 18 spines, whose bases form a shallow arc in outline, the arc facing cephalad; the middle spines about 4½ or five times as long as broad at midpoint; these slightly concave; spines generally with emarginate bases. Second vinculum (VC. 2) with portion distad of center of spiracular plate sub-



HOPKINSIPSYLLA OCCULTA GEN. & SP NOV

Fig. 13, male ninth sternum and clasper; fig. 14, apex of aedeagus; fig. 15, aedeagus; fig. 16, ventral anal lobe of female proctiger; fig. 17, female modified abdominal segments (enlarged).

equal in length to that of pronotum, as measured above. Mensonotum (fig. 4, MSN.) with two distinct rows of bristles; with a broad flange, about three-fifths breadth of mesonotum proper. Mesonotal flange with four pseudosetae (PS.S.). Mesepisternum (MPS.) with about four bristles in ventrocaudal region, of which the uppermost is median, but near the sclerotization separáting MPS. from the mesepimere (MPM.); with three very thin bristles near anterodorsal angle. Mesepimere (MPM.) with eight or nine bristles, of which generally three are ventromarginal. Metanotum (MTN.), together with its flange, about subequal in length to MSN., with two rows of bristles; the anterior row dorsally preceded by one or two dorsal bristles. Metanotal flange with three apical teeth per side, the teeth in recessed sinuses so that their apices are virtually in line with margin of flange. Lateral metanotal area (L.M.) broader (higher) than long. Metepisternum (MTS.) with one large bristle in posterodorsal region; squamulum (SQ.) relatively elongate. Metepimere (MTM.) generally with seven or eight bristles, frequently arranged 3(4)-3-1. Spiracular fossa of metepimere ovate, oblate, slightly longer than broad.

Legs.—Metacoxa (fig. 11) with about 11-14 thin submarginal and submedial lateral bristles; with about 13-17 small, thin, submarginal mesal bristles, mainly on apical half. Profemur with about eight or nine small, thin, scattered, nonmarginal lateral bristles. Meso- and metafemur with two submarginal lateral bristles, subventral in position; these segments also with two subapical bristles on ventral margin. Protibia (fig. 8) with five pairs of stout dorsomarginal bristles in notches; the basal bristle single, and with another single bristle between third and fourth pair; at times (especially in female) with an additional single stout bristle between first and second pair. Mesotibia with seven pairs of stout dorsomarginal bristles (excluding most proximal pair, which consists of one stout and one thin bristle); at times (especially in female) with additional single dorsomarginal bristles as follows: one between first and second pairs and one between fourth and fifth, chaetotaxy thereby agreeing in this respect with metatibia (fig. 9). Meso- and metatarsi with one distomarginal bristle on third segment extending beyond apex of fourth segment. Metatarsus with at least one apical bristle of second segment extending beyond apex of third. The displaced first pair of plantar bristles on last tarsal segment virtually subequal in size to the four lateral plantar bristles but straight, not somewhat convex, as shown for metatarsus in fig. 7. Measurements (in microns) of tibiae and segments of tarsi (petiolate base deleted) of holotype:

		Tarsal Segments				
Leg	Tibia	I	II	III	IV	V
Pro	198	72	75	51	39	93
Meso	315	129	114	75	39	102
Meta	396	306	186	111	57	120

Abdomen.—First tergum (fig. 4, 1 T.), including anterior phragma and caudal flange slightly longer than metanota including its phragma and flange; with two rows of bristles and an apical, recessed spinelet per side. Basal sternum with about three well-separated ventromarginal bristles, the caudalmost large; with one or two submedian bristles. Terga 1, 2, and, in male especially, sometimes 3, with one apical spinelet per side. Unmodified terga in both sexes with two rows of bristles; the posterior row of long bristles, extending slightly below level of subovate spiracular fossa (fig. 6, 7 SPC.), the anterior row short, of one to three smaller bristles and extending much less than half way down to spiracle. Typical sterna in male, on each side, with a vertical row of about three (or four) approximated large bristles, the lowest ventromarginal, preceded by one or two submarginal smaller ones; in female the row generally consists of four large bristles preceded by two groups of two smaller ventromarginal ones. Antesensiliary bristles in each sex (figs. 6 and 10, A.B.) consisting of three bristles of which the middle one is somewhat more than twice the length of the upper one and slightly less than twice that of the lower one; in female the lowest bristle somewhat longer than in male.

Modified Abdominal Segments—Male.—Eight tergum (fig. 6, 8 T.) with about six to seven small thin bristles on dorsal anterior third of segment; with three long bristles in a row as follows: one median, subventral; one at dorso-caudal angle and the third between these; with one smaller bristle between ventral two long ones and one dorsomarginal small bristle immediately preceding and, at times, also caudad to the dorsalmost long one. Eighth spiracular fossa (8 SPC.) small, subovate, thin (especially the portion extending dorsad). Eighth sternum (8 S.) with a conspicuous fringe-like row of dorsocaudal, marginal, small bristles and three long caudomarginal bristles of which one is at dorsocaudal angle, one median and one subventral; with a submarginal row of four or five small bristles along lower half of caudal margin and a row of seven to eight such bristles on posterior fourth, and a group of about seven to ten bristles in two irregular rows, largely submedian, above midline and ranging to near caudal margin. Eighth sternum spiculose submedially; caudal margin convex above and becoming somewhat convex subventrally.

Immovable process of clasper (figs. 3 and 13, P.) produced into a snout-like projection with a broad base; its height (measured from transverse suture above base of manubrium) greater than its morphological length—about twice as high as broad at midpoint; its snout bearing three long dorsal or subdorsal bristles and one subapical ventromarginal bristle. Clasper with movable process or finger (F.) roughly ham-shaped; about 2½ times as long as broad at midpoint; with cephalic and dorsal margins quite straight for most their lengths; margin broadly rounded dorsocaudally; with a fairly long bristle at junction of dorsal and caudal margins; this preceded by a small marginal bristle and with a small dorsomarginal bristle near cephalodorsal angle; with four to six small bristles on distal third of caudal margin; with many small, thin bristles, scattered over mesal surface. Manubrium (fig. 13, MB.) about 10½ times as long (measured from suture on P. to apex) as broad at midpoint, its margins relatively straight and tapering, but curving caudad subapically. Ninth sternum with proximal arm (P.A. 9) narrow, about 12 times as long as broad at midpoint; margins subparallel except for expansion near apical end, which is produced in the shape of an equilateral triangle with rounded angles, whose base is more than twice the breadth of P.A. 9. Distal arm of ninth segment (D.A. 9 and fig. 5) long and narrow; biconvex caudally, due to a deep, broad sinus at apical fourth; apical portion with a row of about six small, thin cephalomarginal bristles, the uppermost at dorsal margin;

with one caudomarginal bristle near midpoint of apical lobe; with one to three such bristles in region of sinus, proximal portion with about 12 small, thin, scattered bristles, about half of which are non-marginal.

Aedeagus (figs. 14 and 15) with lateral plates (L.PT.) beyond apodemal strut (AP.S.) more than six times as long as broad at midpoint. Proximal spur (P.S.) fairly straight, about one fourth the length of lateral plates. Crescent sclerite relatively straight and thin. Sclerotized inner tube (S.I.T.) about twice as broad near base as near apex; abruptly narrowed near midpoint; distal half with sides subparallel. Armature of inner tube (A.I.T.) represented primarily only as a bulge at dorsobasal region. Apicomedian sclerite (A.M.S.) distinctive as a broad crescentic or semicircular structure. Crochets (CR.) conspicuous as a pair of long oblong lobes with rounded apices, extending well beyond end-chamber; about four times as long as broad; with sclerotized submedian ridge extending most of the length. Ventral intramural rod (V.I.R.) terminating in a weakly-developed vesicle (V.). One of penis rods (tendons of phallosome) (P.R.) typically making a compl(te cephalic loop, the other a partial one.

Sensilium or pygidium (fig. 6, SN.) very flat dorsally, longer than broad; with about 18-21 sensory pits per side. Dorsal anal lobe of proctiger (D.A.L.) conical, with a patch of about 8-12 small proximal and submedian bristles and four to six distal ones, of which one or two near apex are the longest. Ventral lobe of proctiger (V.A.L.) with four to six dorsomarginal bristles, and one or two long apical ones; ventral margin rather well-sclerotized.

Female.—(figs. 10 and 17). Seventh sternum (7 S.) with apical margin quite straight and subvertical; caudal margin mainly at an angle of about 45° with horizontal axis, essentially straight except for a slight subventral sinus; caudoventral angle broadly rounded, lacking submedian or caudal bristles; with two virtually contiguous ventromarginal long bristles near apical third, preceded by a smaller slightly more dorsal bristle; with three or four small ventromarginal bristles on proximal two-thirds, and three or four submarginal small bristles. Eighth tergum (8 T.) with many small bristles preceding eighth spiracular fossa (8 SPC.); two subdorsal ones near ventral margin of tenth segment (V. 10); with about 18-20 submedian bristles scattered over surface, some below ventral anal lobe (V.A.L.); in addition with four somewhat longer ventromarginal ones near caudal margin; with a patch of about 14 small, thin, mesal bristles anterior and laterad to ventral anal lobe. Tenth segment with about seven small subdorsal and submedian bristles caudad to sensilium; its ventral margin (V. 10) with one long bristle at ventrocaudal angle, immediately next to base of anal stylet (A.S.); this bristle preceded by a fairly long, submarginal one and two smaller ones in a vertical row. Dorsal anal lobe of proctiger (D.A.L.) with a group of four or five subapical bristles, of which one is very long. Anal stylet (A.S. and fig. 12) slightly more than thrice as long as broad at midpoint; with a very long, apical bristle, a subapical bristle near ventral margin and two very small dorsal ones. Ventral anal lobe (V.A.L. and fig. 16) with a conspicuous sinus subapically, flanked anteriorly by a pair of stout contiguous bristles and apically by a pair of long ones of which one is mesal; with three thin apical bristles and one long dorsal one; the margin of the sinus bearing one fairly stout mesal bristle and one thin bristle; proximal portion of ventral margin generally with three bristles; with three submarginal bristles, one near ventral large pair and two near sinus.

Spermatheca (figs. 10 and 17) with bulga (head) (B.) somewhat orbiculate, but oblate, with ventral margin flat, and much broader than the rounded dorsal margin; about 1.6 times as high as broad at midline. Hilla (tail) (H.) of spermatheca long and broad; more than twice as long as broad, and more than 1.5 times as long as bulga is high; apex broadly rounded; lacking an apical papilla; fairly well delineated from bulga. The sclerotized duct of the bursa copulatrix (fig. 17, S.D.B.) the most conspicuous part of this organ, appearing as annulated crescent. The dilated portion of the bursa copulatrix, herein called the perula (P.B.C.) weakly sclerotized, apically somewhat biconvex above the point of entry of the duct of the spermatheca (D.SP.). The portion of the bursa copulatrix entering the vagina, herein designated the lura (L.B.C.), somewhat dilated.

Remarks.—The specific name of this species was suggested by the fact that intensive search over a period of years was required before the males were discovered and an adequate number of specimens collected for description. The first specimens taken in 1952 by Harry Hoogstraal were four females from the four-toed jerboa, *Allactaga tetradactyla*. He obligingly returned to seek more material upon being notified that these specimens undoubtedly represented an undescribed genus of flea, and although *Allactaga* are difficult to collect in Egypt, he and his colleagues managed to examine more than 200 during the next eight years without collecting any *Hopkinsipsylla*. The author also failed to get additional material during a short collecting trip kindly arranged by the Division of Medical Zoology of NAMRU-3.

The long series ultimately collected in 1960, cited above as types, indicate that this species of flea may be a nidicolous form, perhaps most prevalent during the winter months, and even then primarily in nests. In this connection it may be noteworthy that the only species of host to be infested with this flea was the four-toed jerboa, *Allactaga*, and that even though Dr. Hoogstraal and his associates examined over 500 specimens of *Jaculus jaculus*, the lesser Egyptian jerboa, and 500 *Jaculus orientalis orientalis*, the greater Egyptian jerboa, no specimens were taken from any of these animals (Hoogstraal and Traub, in preparation). The only records of *Hopkinsipsylla* from sources other than *Allactaga* or their nests were 14 specimens from a nest containing *Jaculus* and two from the nest of *Pachyuromys*, in the type locality, and it is possible that these nests may once have harbored *Allactaga*. It also seems significant that many of the above mentioned *Jaculus* were from other areas, even from the well-studied Giza district, and that many nests of *Jaculus*, as well as many other rodents, were carefully examined without finding any *Hopkinsipsylla*. It therefore appears that *Allactaga* is the true host of *Hopkinsipsylla*.

This new genus of flea is apparently most closely allied to *Ophthalmopsylla*, a genus which has been found thus far only in the desert and semi-desert regions of Europe and Asia, where it parasitizes *Allactaga* and related rodents. It would be premature to postulate, on the basis of available evidence, that *Hopkinsipsylla* may have replaced or was evolved from *Ophthalmopsylla* in the North African habitats of jerboas, because too little is known of the Siphonapteran fauna of that part of the world. It may be that *Ophthalmopsylla* occurs in Tunis or Algeria and yet be absent from Egypt. If so, it would parallel the discontinuous distribution of another genus of flea infesting desert rodents in the Mediterranean-Siberian region, *Coptopsylla* Jordan and Rothschild, 1908, which, as shown by Hopkins and Rothschild (1956), is known both from regions west of Egypt and in Turkestan, etc., but has not been found in Egypt itelf, despite the intensive collecting of Harry Hoogstraal's unit.

Summary

Hopkinsipsylla occulta, a new genus and species of flea from *Allactaga tetradactyla* and from the nests of *Allactaga* and other jerboas in the Mersa Matruh-Sidi Barrani area of the Western Desert Governorate of Egypt, is described and figured. *Hopkinsipsylla* is close to *Ophthalmopsylla* and *Paradoxopsyllus*, but is separable in that the eye is ventrally broadly and deeply excised, not convex or biconvex; the eighth tergum is greatly reduced so that dorsally it scarcely extends beyond the movable process; the male lacks acetabular bristles on the process of the clasper, among other differences. The collection-data suggests that this flea is nidicolous and perhaps seasonal (late winter and early spring) in nature.

Acknowledgements

I am indebted to Dr. Harry Hoogstraal of NAMRU-3 for making it possible to study this genus of flea as well as the many other fine Egyptian Siphonaptera which have become available largely through his sustained efforts. My thanks are extended to Dr. G. H. E. Hopkins and Dr. F. G. A. M. Smit of the British Museum (Natural History) at Tring, Herts., for verifying the status of this flea, and to Dr. V. E. Tiflov, of the Parasitological Laboratory, Stavropol, Caucasus, U.S.S.R., for supplying specimens of *Ophthalmopsylla* for comparison.

List of Abbreviations

A.B., Antesensiliary bristle; **A.C.**, Club of antenna; **A.I.T.**, Armature of sclerotized inner tube; **A.M.S.**, Apicomedian sclerite of aedeagus; **AP.R.9**, Apodemal rod of ninth sternum; **AP.S.**, Apodemal strut of aedeagus; **A.S.**, Anal stylet; **B.**, Bulga (head) of spermatheca; **B.L.PT.**, Bay or ventral convexity of lateral plate of aedeagal apodeme; **CR.**, Crochet of aedeagus; **D.A.L.**, Dorsal anal lobe of proctiger; **D.A.9**, Distal arm of male ninth sternum; **D.SP.** Duct of spermatheca; **E.**, Eye; **F.**, Movable finger or digitoid of clasper; **H.**, Hilla (tail) of spermatheca; **L.B.C.**, Lura of bursa copulatrix; **L.M.**, Lateral metanotal area of metathorax; **L.P.**, Labial palpus; **L.PT.**, Lateral plate of aedeagal apodeme; **M.P.**, Maxillary palpus, **M.PT.**, Middle plate of aedeagal apodeme; **MB.**, Manubrium; **MPM.**, Mesepimere; **MPS.**, Mesepisternum; **MSN.**, Mesonotum; **MTM.**, Metepimere; **MTN.**, Metanotum, **MTS.**, Metepisternum; **P.**, Immovable process of clasper; **P.A.9**, Proximal arm of male ninth sternum; **P.B.C.**, Perula—dilated portion of bursa copulatrix; **P.C.**, Pronotal comb; **P.R.**, Penis rod; **P.S.**, Proximal spur of aedeagus; **P.W.**, Wall of aedeagal pouch; **PL.A.**, Pleural arch of metathorax; **PS.S.**, Pseudosetae; **S.D.B.**, Sclerotized duct of bursa copulatrix; **S.I.T.**, Sclerotized inner tube of aedeagus; **SN.**, Sensilium; **SQ.**, Squamulum; **T.A.**, Arm of tentorium; **T.AP.9**, Tergal apodeme of ninth segment; **T.C.**, Trabecula centralis; **TB.**, Frontal tubercle; **V.**, Vesicle of aedeagus; **V.A.L.**, Ventral anal lobe of proctiger; **V.I.R.**, Ventral intramural rod of aedeagus; **V.10**, Ventral margin of female tenth segment; **VC. 1**, First vinculum; **VC. 2**, Second vinculum; **1 C.**, Procoxa; **1 T.**, First tergum; **2 A.**, Second antennal segment; **7 S.**, Seventh sternum; **7 SPC.**, Spiracle (fossa) of seventh segment; **8 S.**, Eighth sternum; **8 SPC.**, Spiracle (fossa) of eighth segment; **8 ST.**, Eighth sternum; **8 T.**, Eighth tergum.

References

Hoogstraal, H. and R. Traub. The Fleas (Siphonaptera) of Egypt. Host-Parasite Relationships. (In preparation).

Hopkins, G. H. E. and M. Rothschild. 1956. An Illustrated Catalogue of the Rothschild Collection of Fleas (Siphonaptera) in the British Museum (Natural History). Coptopsyllidae, Vermipsyllidae, Stephanocircidae, Ischnopsyllidae, Hypsophthalmidae and Xiphiopsyllidae. Vol. II, xi + 445 pp., figs. 1-707, 32 pls.

BOOK REVIEW

THE INSECT FACTOR IN WOOD DECAY, by Norman E. Hickin, 1963, 336 pages, 263 figures, 2 col. pls. Hutchinson & Co., London and New York. Price: £2 S10.

Dr. N. E. Hickin, a distinguished British entomologist, has written a general account of insects as factors in wood destruction, particularly to timber indoors. Insects are by far the most important animal group causing deterioration. One of the results of the great upsurge of the use of imported softwoods into Britain after the first World War was the increase in damage to buildings by the anobiid beetle *Anobium punctatum*, or wood worm. Control work is costing the public £10 million annually. Of course this anobiid has world-wide distribution. Details are given on its appearance and habits. Dr. Hickin is an authority on this beetle.

Other species of British anobiids are discussed, particularly the "death-watch beetle" *Xestobium rufovillosum*, which is also injurious in the U. S. Its sex noise, or rapping on wood, was supposed to predict death.

Lyctidae and Bostrichidae, also injurious powder-post beetles, the habits and damage by various species are given in detail.

Buprestid beetles, the wharf borer and certain wood-boring weevils, which cause damage to wooden structures in both Britain and the U.S. are briefly described and their habits given.

Next to the anobiid beetles, the cerambycids are given a great deal of attention, with description and keys. *Hylotrupes bajulus*, called the old house borer in the U. S. where it is very injurious, is as yet only local in Britain. Britain has 64 species of cerambycid beetles.

Termites do not occur in Britain, but have been accidentally introduced several times, and Dr. Hickin has investigated existing legislation to prevent importation in bringing live termites for study to the remarkable Rentokil laboratory in Sussex from France.

Wood-boring wasps, bees, ants and moths which occasionally damage structures are briefly noted as being injurious elsewhere.

To summarize Jan.-Dec. 1961 the comparative importance of wood-boring insects in Britain: woodworm 77.4%, death-watch 5.0%, *Lyctus* 1.2, weevils 4.1, cerambycids 0.5, number of surveys 18,015.

Control, after sanitation, is the application of an insecticide proven affective in the laboratory for each type of borer.—Thomas E. Snyder, *U. S. National Museum, Washington, D. C.*

EIGHT NEW CHRYSOMELID BEETLES FROM THE WEST INDIES (Coleoptera)

Doris H. Blake, *Smithsonian Institution, Washington, D. C.*

The present paper is concerned with a miscellaneous lot of beetles from the West Indies that have been accumulating in the collection of the United States National Museum. There are also three sent from Jamaica by T. H. Farr and two other closely related ones sent me by John A. Wilcox, who had picked them out from the collection of the Museum of Comparative Zoology.

Chthoneis insularis (Harold)
(Fig. 7)

Exora insularis Harold, Col. Heft., vol. XIII, 1875, p. 93.

About 7 mm. in length, elongate oblong oval, somewhat shiny, finely punctate, dirty yellowish brown with three piceous elytral fasciae, the apical one not extending to lateral margin.

Head with interocular space about one-third width of head, occiput finely punctate, especially over frontal tubercles which are well marked, a short distinct carina down lower front; head dusky yellowish brown with piceous mouthparts. Antennae with the third joint shorter than fourth, the rest a little shorter and about equal, piceous, hairy. Prothorax almost twice as broad as long with rounded sides a broad tooth at apical angle and a smaller one at basal, surface a little humpy, finely and rather rensely punctate, somewhat shiny and dirty yellowish brown. Scutellum dark. Elytra elongate, moderately convex, with traces of lateral costae, densely and distinctly punctate, a dirty yellowish brown with broad dark brown or piceous fasciae, the suture dark, a fascia before and one after the middle, and a smaller one near apex, the apical one not reaching margin. Body beneath and femora dirty yellowish brown, deeper on the breast, tibiae and tarsi deep brown. Anterior coxal cavities open, claws appendiculate. Length 6.2-7 mm.; width 3 mm.

Type.—Whereabouts unknown, collected in Cuba.

Remarks.—A single female specimen in the U.S. National Museum collection from Vista Alegre, Santiago, Cuba, collected 3 May 1940 by C. T. Ramsden, and two specimens sent me by J. A. Wilcox who picked them out of the collection at the Museum of Comparative Zoology, from Soledad, Cienfuegos Province, Cuba, collected on 28 November 1926 by P. J. Darlington Jr., correspond, as J. A. Wilcox has pointed out to me, with Harold's description of *Exora insularis*, described from Cuba. Wilcox does not believe that any of these that I have described under the genus *Chthoneis* really belong there, but to an undescribed genus from the West Indies that is endemic there.

Chthoneis ferruginea, n. sp.
(Fig. 9)

About 7 mm. in length, elongate oblong oval, shining, finely punctate, the head, prothorax, undersurface and femora yellowish brown, the elytra reddish brown, antennae, tibiae and tarsi piceous.

Head with interocular space half width of head, frontal tubercles a little swollen, occiput finely punctate, a row of coarse punctures on each side near eye; carina short, lower front short, head entirely yellowish brown. Antennae barely reaching the middle of the elytra, deep reddish brown almost piceous. Prothorax twice as broad as long, with rounded sides, finely and densely punctate, the surface a little humpy, rather flat. Scutellum yellowish brown. Elytra elongate, with faint costae, finely and moderately densely punctate, shining reddish brown, in the one specimen known faint traces of paler fasciae near the middle, possibly these only an irregular fading of color in that area. Body beneath entirely pale yellowish brown, femora yellowish brown, tibiae and tarsi deep brown or piceous, anterior coxal cavities open, claws appendiculate. Length 7 mm.; width 3.3 mm.

Type.—Female, Museum of Comparative Zoology Type No. 30404 from Port-au-Prince and vicinity, Haiti, collected 2 October 1934 by P. J. Darlington, Jr.

Remarks.—Only one specimen, female, is known, which J. A. Wilcox has sent me to describe after picking it out of the collection at the Museum of Comparative Zoology. In size and general coloration it is not unlike *C. insularis* (Harold) from Cuba. Whether the faint pale traces of fasciae on the elytra are merely irregular fading of color or are traces of real fasciae cannot be determined from one specimen alone.

Nyctiplanctus, new genus
(*νυκτίπλαγκτος*—roaming by night.)

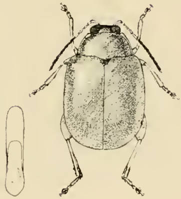
Slender beetles between 4 and 8 mm. in length, with antennae not as long as the body, with short broad prothorax and long elytra and long slender legs.

Elongate oblong oval, the head smoothly rounded over occiput, with well-marked frontal tubercles, a short, broad and rather flat carina between antennal sockets ending in a ridge extending on either side slantwise below the antennal sockets to beneath eyes; lower front short, eyes large, entire, with interocular space less than half width of head. Antennae not extending much below middle of elytra, third joint a little longer than second, fourth more than twice as long as third and longest, fifth a little shorter, the rest gradually diminishing a little in length. Prothorax about twice as broad as long at widest, widest anteriorly and with a broad tooth at anterior angle and a smaller one at basal angle; the sides curved inwards towards base; disk rather flat, with a faint trace of lateral humpiness. Elytra about four times as long as the prothorax, moderately convex, with a trace of costae, a narrow explanate margin, epipleura disappearing at apical curve. Body beneath with the anterior coxal cavities open, legs long and slender, neither the anterior tibiae nor the first tarsal joint in males noticeably enlarged, claws appendiculate.

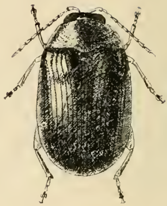
Type of genus.—*Nyctiplanctus farri*, n. sp.

T. H. Farr, who has collected both species, writes that he found *N. jamaicensis* on *Cordia globosa*, which is also the food plant of *Chthoneis insulana* Blake from Cuba, and feeding only at night. These two Jamaican species are closely related to the Cuban and Haitian species that I have described under the genus *Chthoneis*. They are probably not of that genus but a closely related one that is endemic in the West

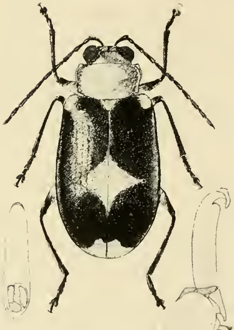
1. Apraea jamaicensis



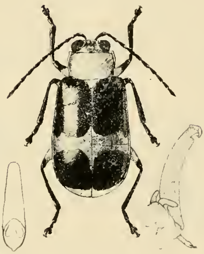
2. Heikertingerella darlingtoni



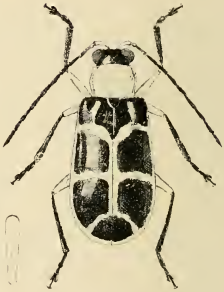
3 Apraea fulgens



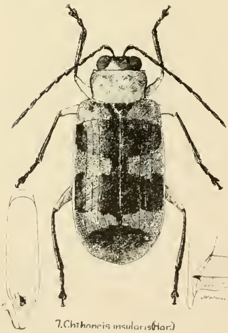
4 Nyctiplanctus farri



5. Nyctiplanctus jamaicensis

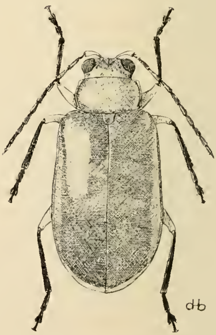


6 Diabrotica hispaniolae



7. Chthoneis insularis (Har.)

8. Lactica grenadensis



9. Chthoneis ferruginea

Indies. Whether they are all even congeneric is problematic. The two Jamaican species are stouter and more robust than the others and the aedeagi are somewhat different. John A. Wilcox has managed to inflate the internal sac and made drawings of these which he has sent me and which I am including in my plate together with the figure of an internal sac of *Chthoncis insularis* (Harold) which he also inflated. The species of *Nyctiplanctus* differ from species of *Chthoncis* from Central and South America in having shorter antennae and differently formed aedeagi.

Nyctiplanctus jamaicensis, *n. sp*
(Fig. 5)

Between 4 and 5 mm. in length, elongate oblong oval, somewhat shiny, finely punctate, the elytra with faint traces of costae in some specimens; a reddish brown fascia in lower half of dark piceous elytra, and the apex also reddish brown.

Head with interocular space less than half width of head, occiput smooth, nearly impunctate, a short median line above frontal tubercles, carina short, broad and flattish; yellowish brown. Antennae with third joint shorter than fourth, remainder subequal, hairy, piceous and not extending much below the middle of the elytra. Prothorax twice as broad as long, widest anteriorly, with rounded sides, a broad tooth at apical and a smaller one at basal angle, surface shining, finely punctate, yellowish brown. Scutellum yellowish brown. Elytra piceous with a reddish brown fascia slightly below the middle, shining, very finely punctate. Body beneath yellowish brown to dark brown, femora pale with the apex dark, tibiae and tarsi dark. Anterior coxal cavities open, claws appendiculate. Length 4-5.3 mm.; width 2-2.7 mm.

Types.—Male, and 10 paratypes, U.S.N.M. Type No. 65927, 12 paratypes in Institute of Jamaica, Kingston, Jamaica, collected at Trelawny, 3 miles south of Falmouth, 20 July 1960 by T. H. Farr, on *Cordia globosa*, feeding at night.

Remarks.—This species was collected on the same foodplant as *Chthoncis insulana* Blake of Cuba. It is somewhat similar in coloration although it has, unlike the Cuban species a pale fascia across the elytra.

Nyctiplanctus farri, n. sp.
(Fig. 4)

Between 5 and 7.5 mm. in length, elongate oblong oval, shining, very finely punctate, the elytra faintly costate, reddish brown with piceous elytra, tibiae and tarsi, the elytra having a reddish brown spot on the humerus, a reddish brown band not extending to the margin below the middle, and the apex also reddish brown.

Head with interocular space a little less than half width of head, occiput smooth, shining, minutely punctate, a median line above the well marked frontal tubercles, carina short, broad and flattish, entirely reddish brown. Antennae with the third joint approximately half as long as the fourth, which is longest, the rest a little shorter and subequal, hairy, piceous, with the terminal joints tending to be brownish. Prothorax twice as broad as long, widest anteriorly, with rounded sides, a broad tooth at apical angle, and a smaller one at base, surface a little humpy, finely punctate, shining, reddish or yellowish brown. Scutellum reddish or yellowish brown. Elytra shining, rather densely and finely punctate, with faint traces of costae, piceous with a reddish or yellowish brown spot on humerus, a pale fascia widest at suture below the middle and not reaching the lateral margin, and the apex pale. Body beneath entirely reddish or yellowish brown, femora pale with the apex dark, tibiae and tarsi dark. Anterior coxal cavities open, claws appendiculate. Length 5.3-7.5 mm.; width 2.7-3.5 mm.

Types.—Male and 4 paratypes U.S.N.M. Type No. 65928, 3 other paratypes in the Institute of Jamaica, Kingston, Jamaica, all but one collected at St. Thomas, Morant Bay Road, 14 miles east of Kingston on 20 Jan. and 12 March 1961. One collected at Clarendon, Portland Ridge, north side, on the 23 July 1958 by T. H. Farr, who beat them from dead palm fronds.

Remarks.—The beetles strongly resemble *N. jamaicensis* but are larger and have a little different elytral marking, with a spot on the humerus and a fascia that is wider at the suture and does not extend all the way across elytra. The aedeagus also is a little different. I take pleasure in naming this after its collector, Thomas H. Farr.

Diabrotica hispaniolae, n. sp.

(Fig. 6)

Between 5 and 7 mm. in length, elongate oblong oval, shining, very finely punctate, black, with pale yellow prothorax, femora and basal joints of antennae, the elytra with a pale margin and part of the suture pale and three transverse pale elytral fasciae and a short pale median vitta at base of each elytron.

Head with interocular space about one-third width of head, eyes large, occiput smooth, impunctate, a median depression over frontal tubercles, a broad carina running down lower front; entirely black and shining. Antennae with first three basal joints yellowish brown, remainder dark brown, three terminal joints sometimes a little paler brown. Prothorax a little wider than long, with curved sides and flattish smooth disk, finely punctate, shining, pale yellow. Scutellum black. Elytra somewhat wider in apical half, smooth, very finely punctate, shining, deep brown or black with pale yellow margin and three pale yellow fasciae and a short pale vitta in the middle of base of each elytron. Body beneath piceous with pale femora, the tibiae and tarsi dark. Length 5.5-7 mm.; width 2.8-3.4 mm.

Type.—Male, and 4 paratypes U.S.N.M. Type No. 65929 from Valle del Rio, Province La Vega, Dominican Republic, collected 26 Dec. 1955 by J. Maldonado Capriles.

Other localities.—Dominican Republic: San Francisco Mts., collected in April 1915 by August Busck; Haiti: Port-au-Prince, Mariana, Sept. 26, 1924, Attelye, Oct. 21, 1925, Rio Friode, Jan. 28, 1925, all collected by W. A. Hoffman: Carrefour, May 1908, collected by Dr. M. Cameron.

Remarks.—The elytral color pattern of this species is similar to that of some species of *Cerotoma*, such as *C. atrofasciata* Jac. but the front of the head in the male is not excavate nor the male antennae modified as in *Cerotoma*. Dr. B. J. Selman has sent me two specimens of this from the British Museum with the note that it is an undescribed species.

Heikertingerella darlingtoni, n. sp.
(Fig. 2)

About 2 mm. in length, ovate, shiny, yellow brown, very finely punctate.

Head with interocular space less than half width of head, eyes large, front and occiput very finely punctate, carina short and knoblike, entirely brown except mouthparts which are darker. Antennae with the outer joints deeper brown. Prothorax entirely pale yellowish brown, shining, minutely and densely punctate. Scutellum, dark reddish brown. Elytra shining, yellow brown, minutely and rather densely punctate. Body beneath and legs yellow brown, hind tibiae grooved and with an outer tooth before the apex and a spur at apex. Length 2.4 mm.; width 1.5 mm.

Type.—Male, Museum of Comparative Zoology Type No. 30405 from Mt. Diego de Ocampo, Dominican Republic, 3-4000 ft. collected in July 1938 by P. J. Darlington, Jr.

Remarks.—Only one specimen of this small species of *Heikertingerella* is known. It is shorter and less distinctly punctate than *H. krugi* Weise or *H. minima* (Suffrian), and the aedeagus has a more rounded tip.

Lactica grenadensis, n. sp.
(Fig. 8)

About 5 mm. in length, oblong oval, shining, pale yellow with the antennae, except for the basal joint, black and black lower half of tibiae and tarsal joints.

Head with interocular space less than half width of head, occiput smooth, nearly impunctate, carina somewhat produced, lower front narrow, pale yellow with somewhat darker mouthparts. Antennae except for the pale basal joint entirely piceous, not extending to middle of the elytra. Prothorax with slightly curved sides, widest at base, a broad basal sulcus with limiting ends, pale yellow, shining, nearly impunctate. Scutellum pale. Elytra entirely pale yellow, shining, nearly impunctate; body beneath pale, lightly pubescent, the femora pale, the tibiae with the lower part, lower half in two anterior pairs, piceous, tarsal joints piceous. Length 5 mm; width 2.7 mm.

Type.—Female, U.S.N.M. Type No. 65930 from Grenada, B.W.I., collected in 1936 by Sebastian Gates.

Remarks.—This strongly resembles all the other pale species of *Lactica* from the West Indies but differs slightly in coloration, having apical parts of the tibiae and all the tarsal joints dark. It is perhaps closest to *Lactica dominicae* Baly in which species only the tips of the tibiae are dark as well as the tarsal joints, but in *L. dominicae* the apex of the femora is dark.

Apraea jamaicensis, n. sp.
(Fig. 1)

About 3 mm. in length, oval, shining, the elytra rather irregularly striate punctate with costae between, piceous with a bronzy lustre, legs, antennae and undersurface yellowish brown.

Head with interocular space not one-third width of head, eyes large, antennal sockets closely set with a very short knob-like carina between, frontal tubercles not well defined, occiput shining, finely punctate. Antennae with the third joint a little shorter than fourth, rest subequal, yellowish brown. Prothorax broad and somewhat convex, widest at base with the base sinuate over the scutellum, disk shining, rugosely punctate with groups of coarse punctures on sides anteriorly and in middle of base, between these rough places finer punctures. Scutellum small, shiny bronze. Elytra convex, costate with strong somewhat irregular striate punctation and scattered finer punctures, all this tending to produce a rugose surface, shining with a bronzy lustre. Undersurface shining, yellowish brown, hind tibiae with a short channel near apex and with a spur at end, tarsal joint of hind tibiae somewhat longer than in many species of *Apraea*. Length 3 mm.; width 1.8 mm.

Type.—Male, U.S.N.M. Type No. 65931 from St. Ann Parish, Dry Harbour, Jamaica, B.W.I., collected 14 July 1959 by T. H. Farr.

Remarks.—This species has the coloring of *A. pyritosa* (Suffrian) from Cuba, but has a much rougher surface with more irregular and coarser elytral punctation and costae. It is also more costate than *A. jansoni* Baly, also from Jamaica, and has a differently shaped aedeagus.

Apraea fulgens, n. sp.

(Fig. 3)

About 3 mm. in length, oval, shining, the pronotum distinctly but not coarsely punctate in places with fined punctures intermixed, the elytra with small striate punctures and in the intervals finer punctures, deep brown with a bronzy lustre, antennae, legs and undersurface reddish brown.

Head with interocular space about one-third width of head, eyes very large, a depressed groove near them, the narrow front finely punctate, carina and lower front short; entirely deep brown. Antennae reddish brown. Prothorax widest at base, with the basal margin sinuate over the scutellum, covered with fine punctures with groups of larger punctures scattered on sides and along base, entirely brown with a bronze lustre. Scutellum brown. Elytra elongate, moderately convex, with a faint transverse depression about one-third the way down; ten rows of dense striate punctures with finer punctures scattered in the intervals between the striate punctures, the striate punctures not coarse but distinct, towards apex and on sides the intervals becoming a little costate; shining with a bronzy lustre. Body beneath and legs reddish brown, middle and hind tibiae sulcate, a short spur on hind ones, claws appendiculate. Length 3.1-3.5 mm.; width 1.7-1.9 mm.

Type.—Female, U.S.N.M. Type No. 65932 and one female paratype from Port-au-Prince, Haiti, R. J. Crew collector from the Wickham collection.

Remarks.—This Haitian species resembles *A. pyritosa* (Suffrian) from Cuba, *A. jamaicensis* Blake and *A. jansoni* Baly from Jamaica in being bronzy brown in color, but whereas *A. jamaicensis* is more rugose than *pyritosa*, this species is smoother with finer punctures than any of them.

THE AMERICAN GENUS MYCOTROGUS: A SYNOPSIS, A NEW SPECIES FROM CUBA, AND A NOTE ON A LARVA

(COLEOPTERA: TENEBRIONIDAE)

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Many beetles of importance to stored products in North America are contained in the Ulomini, and those species have been discussed very often in the literature. But other species and genera of the tribe have been seriously neglected. Sixty years have passed since an American taxonomic paper was published on the tribe, except for the description of new species; and except for determination keys to genera, the relationships of ulomine genera have not been discussed in the last 90 years. One of the first steps toward adequate knowledge of intratribal relationships is a study of each genus and its members *Mycotrogus* is one of the least known ulomine genera.

Most specimens used in this study are in the collection of the United States National Museum. The others, indicated below by (CAS), are in the California Academy of Sciences. The latter specimens were kindly lent by Hugh B. Leech, and to him I tender my thanks. Also I thank J. A. G. Rehn for courtesies during my visit to the Academy of Natural Sciences of Philadelphia to examine the lectotype of *Mycotrogus angustus* Horn.

Mycotrogus Horn

Mycotrogus Horn, 1870. Trans. American Philos. Soc. (new series) 14: 364, 367.

Description.—Shape elongate, subparallel-sided, width of pronotum subequal to width of elytra, lateral borders of pronotum almost continuous with lateral borders of combined elytra. Head with anterior border of epistoma straight or almost so; male with protuberance above each eye; female without protuberance, evenly rounded. Eye strongly emarginate, dorsal and ventral lobes large. Antenna slender, gradually enlarged apically; distal segments subtriangular and loosely fitting. Maxillary palpus with terminal segment strongly or weakly divergent distally. Labium of same shape in male and female, with mentum small, very strongly convex, not bordered with minute setae; surface with long, golden, erect setae which curve medially; in male with a coarse central puncture which contains a short bristlelike seta. Pronotum in dorsal view wider than long; anterior angles distinct; posterior angles approximately right-angled; lateral border with a distinct carina and sulcus; posterior border strongly sinuate; dorsal surface either with punctures of approximately the same small size or with punctures of two obviously different sizes, large laterally and small over whole surface. Prosternum with intercoxal process narrow, elongate, almost flat, acute apically. Mesosternum with a strong V-shaped notch to receive prosternal process, walls of notch very thick. Procoxal cavity circular in ventral view. Protibia weakly compressed anteroposteriorly, gradually expanded dorsally, convex on both anterior and posterior surfaces; dorsal border entire, with a single row of very short, very coarse setae; ventral border with a very narrow row of fine, depressed, dense setae; posterior surface with elongate punctures and a dull microsculpture; apex with relatively long spurs. Protarsus with basal segments asymmetrical, the ventroanterior, apical angle projecting. Metafemur either subelliptical in both sexes, or strongly sinuate ventrally in the male and weakly sinuate in the female. Elytra in dorsal view with lateral borders straight throughout most of their lengths and weakly converging posteriorly, apex evenly rounded; pseudopleural carina completely visible in dorsal view; pseudopleuron relatively wide and attaining apex of elytra; striae very weakly sulcate and composed of small punctures; intervals almost flat, not carinate, with very fine punctures. Metathoracic wings complete. Abdomen with intercoxal process of first visible sternum broad and weakly rounded apically; last visible sternum not sulcate. Male genitalia with the paramere either lightly sclerotized and subcylindrical or strongly sclerotized and depressed and sinuate apically. Posterior digestive tract with circular or sinuous rectal valve.

Type species.—*Mycotrogus piceus* Horn, 1870. Subsequent designation by Gebien (1940, Mitt. Münchner Ent. Ges. 30(2) : 768(575)).

In current catalogues *Mycotrogus* is placed near *Alegoria*, but the two genera actually have little in common. *Mycotrogus* is better placed near the end of the Ulomini with *Ulosonia* and *Phayllus*. These three genera are similar in the following characteristics: The asymmetrical protarsal segments, the pseudopleuron extending to the elytral apex, the simple mentum, a prominence above the eye in the male, and a prolonged intercoxal process of the prosternum. In addition, *Ulosonia* has a pronotum with punctures of two sizes.

The species of *Mycotrogus* separate into two groups: In the first, *paripunctatus*, with approximately uniform pronotal punctures, sexual dimorphism in the metafemur, and a heavily sclerotized, sinuate paramere; and in the second group, *mentalis*, *angustus*, and *piceus*, with the pronotal punctures being of two sizes, the metafemur being alike in the sexes, and with a lightly sclerotized, rather straight paramere. The differences in the metafemur and genitalia prompted me to isolate *paripunctatus* in a new genus, but I finally became convinced that it is better at present to put this species in *Mycotrogus*. Two alternatives in the eventual solution of this problem should be considered, either the splitting of *Mycotrogus* into two genera, or the uniting of *Mycotrogus*, *Phayllus*, and possibly *Ulosonia* into one genus. The morphological gap previously existing between *Mycotrogus* and *Phayllus* will probably be closed by the new species *Mycotrogus paripunctatus*. I am not prepared to solve the problem now, and I think that our knowledge of the Ulomini is not sufficient to allow solution. By keeping *paripunctatus* within *Mycotrogus* we can at least avoid another generic name, and also have what appear to be closely related species together.

Key to the Known Species of Mycotrogus
(**Mycotrogus piceus** is not included)

1. Pronotum on dorsal surface with punctures small, of approximately uniform size .... **paripunctatus**, new species

   Pronotum on dorsal surface with punctures both small and very large 2

2. Pronotum in dorsal view with lateral borders almost straight in posterior two-thirds and moderately convex in anterior one-third .... **angustus** Horn
Pronotum in dorsal view with lateral borders weakly convex in posterior three-fourths and strongly convex in anterior one-fourth ... **mentalis** Blaisdell

Mycotrogus paripunctatus new species

This species is easily distinguished from other members of the genus by its approximately uniform pronotal punctures, hence the specific name. It is larger than the others, the shape of the pronotum in dorsal view is different, and the shape of the metafemur is sexually dimorphic. The paramere of the male genitalia is very different.

Holotype, male.—Black with a brownish hue, shiny; elongate; subparallel-sided, lateral borders of pronotum and elytra almost continuous. *Head.* Epistoma with anterior border straight medially, then evenly convex to region above antennal insertion; with surface convex and having a shallow longitudinal depression; epistomal sulcus relatively deep; a weak protuberance above each eye, the area between protuberances concave; dorsal surface with punctures fine on epistoma, coarse between and posterior to eyes. Eye strongly emarginate on anterior border, ventral area obviously larger than dorsal area. Antenna with segments 2-5 nearly cylindrical, each very gradually wider at apex; segments 6-11 obviously wider than 2-5, progressively becoming weakly compressed, broadly triangular, and gradually wider; segment 6 with width of 0.15 mm., segment 10 with width of 0.19 mm.; segments with following lengths, in millimeters: 2—0.10, 3—0.15, 4—0.15, 5—0.15, 6—0.15, 7—0.15, 8—0.15, 9—0.15, 10—0.125, 11—0.175; segments covered with golden setae of moderate length and density. Maxillary palpus with apical segment (fig. 1) strongly divergent distally. Mentum with surface convex; laterally with long setae curving medialy, center with a coarse puncture which contains a short bristle.

Thorax.—Pronotum in dorsal view (fig. 2) wider than long; anterior border strongly, evenly concave, with fine sulcus on lateral third; anterior angles obtuse, though definite; lateral border almost straight on posterior half, thence strongly convex on anterior half, strongly carinate; posterior angles weakly acute; posterior border strongly bisinuate, finely carinate; surface strongly convex transversely on lateral thirds, weakly convex on medial third, weakly convex longitudinally, with weak longitudinal depression extending a short distance from near posterior border at approximately one-third of width from posterior angle; with fine punctures of approximately uniform size except becoming slightly finer toward borders, without coarse punctures. Pronotal hypomeron finely, sparsely punctured, weakly wrinkled. Prosternum with dense, small punctures; intercoxal process simple, apex acute but without nodule. Mesothoracic and metathoracic sterna and pleura finely punctured, punctures denser laterally.

Legs.—Profemur strongly narrowed basally, in anterior view the ventral border sinuate. Protibia (fig. 3) slightly more slender and dorsal border slightly straighter than in other species; posterior surface dull, with elongate coarse punctures apically, punctures becoming smaller toward base, with dense golden setae subapically on ventral surface. Protarsus (fig. 3) slender, slightly longer than in other species; first segment strongly projecting on anterodistal corner of ventral surface, other segments gradually less strongly projecting at same corner. (Note that figure 3 is a ventral view of tarsus, not a lateral view.) Mesofemur in anterior view with dorsal border sinuate basally. Mesotibia slightly enlarged toward apex. Mesotarsus normal, without ventral projections on segments. Metafemur in anterior view (fig. 6) with dorsal border evenly convex; ventral border strongly sinuate. Metatibia slightly enlarged toward apex. Metatarsus normal, without ventral projections on segments.

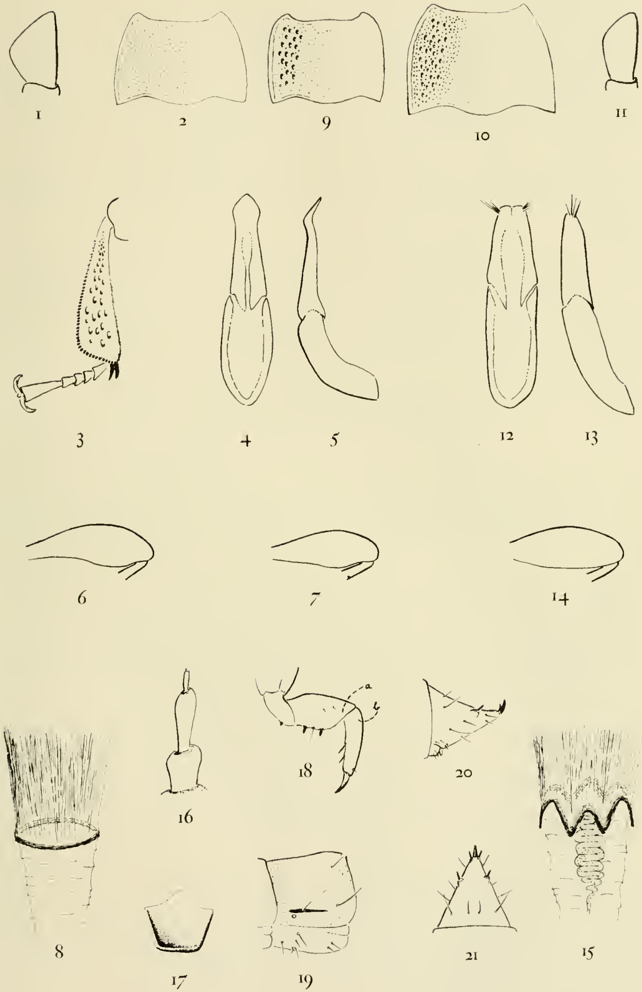
Elytra with lateral borders very weakly narrowed posteriorly on basal two-thirds, then strongly convex to apex which is weakly emarginate at posterior end of suture; with transverse convexity strong laterally; striae composed of coarse, round punctures, connected by a shallow sulcus, depth and coarseness of striae becoming slightly greater laterally; intervals weakly convex near suture, becoming more convex laterally, eighth interval not more convex than adjacent intervals, all intervals with very fine punctures.

Abdomen finely, densely punctate on first three visible sterna, very finely, densely punctate on last two visible sterna. Genitalia not examined.

Allotype, female.—Head without protuberance above each eye, the area between eyes therefore convex. Maxillary palpus with apical segment slightly narrower than in holotype. Mentum without central seta, but with other setae as in holotype. Protarsus with first segment having ventral projection on anterodistal corner smaller than in holotype; projection on second segment very small; other segments without projections. Metafemur in anterior view (fig. 7) with ventral border weakly sinuate. Antenna slightly shorter than in holotype.

Variation.—Paratypes, males. No variations from holotype, except in size, are noticeable. The following structures were not dissected in the holotype. Male genitalia with tegmen (figs. 4, 5) heavily sclerotized, dark; pars basalis elongate, troughlike membranous ventrally; paramere in dorsal view with lateral borders gradually converging posteriorly, then strongly sinuate to form angular apex; paramere in lateral view slender, sinuate; penis small, membranous, difficult to delimit. Posterior digestive tract (fig. 8) with a simple, circular rectal valve (see Appendix I).

Mycotrogus paripunctatus new species (figs. 1-8). Fig. 1, Apical segment of maxillary palpus; fig. 2, Pronotum, dorsal view; fig. 3, Left protibia, posterior view, and left protarsus, ventral view; fig. 4, Tegmen of male genitalia, ventral view; fig. 5, Tegmen of male genitalia, lateral view; fig. 6, Metafemur of male, anterior view; fig. 7, Metafemur of female, anterior view; fig. 8, Part of posterior digestive tract. **Mycotrogus mentalis** Blaisdell. Fig. 9, Pronotum, dorsal view. **Mycotrogus angustus** Horn (figs. 10-15). Fig. 10, Pronotum, dorsal view; fig. 11, Apical segment of maxillary palpus; fig. 12, Tegmen of male genitalia, ventral view; fig. 13, Tegmen of male genitalia, lateral view; fig. 14, Metafemur of male and female, anterior view; fig. 15, Part of posterior digestive tract. **Larva, possibly Mycotrogus angustus** Horn (figs. 16-21). Fig. 16, Antenna; fig. 17, Hypopharyngeal sclerome of labium, adoral view; fig. 18, Right prothoracic leg, posterior view; "a", the position of a seta on mesofemur; "b", the position of a seta on mesotibia; fig. 19, First abdominal segment, lateral view; fig. 20, Ninth abdominal segment, lateral view; fig. 21, Ninth abdominal segment, dorsal view.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Measurements.—The following order is maintained in each measurement: First, holotype male; second, paratype male; third, paratype male; and fourth, allotype female. Millimeters are the units of measure. Approximate total length: 5.9, 5.7, 5.6, 5.3. Medial length of head, from anterior epistomal border to imaginary line between posterior borders of eyes: 0.65, 0.55, 0.60, 0.55. Medial length of pronotum: 1.5, 1.4, 1.2, 1.3. Maximum length of elytra: 4.0, 4.0, 3.8, 3.6. Maximum width, at elytral humeri: 2.4, 2.2, 2.2, 2.1.

Specimens studied.—Holotype male (USNM Type No. 65950), Cayamas, Cuba; 14-1, E. A. Schwarz collector, in *Ceiba*. Allotype female, and two paratypes males, all with the same data as on holotype.

The name Cayamas is used for at least two populated localities in Cuba. The Cayamas at which Schwarz collected is at Latitude 22° 15″ N., Longitude 80° 48″ W., in Las Villas Province (formerly called Santa Clara Province). For Schwarz's description of the Cayamas region, see Sherman (1929, Jour. New York Ent. Soc. 37(3): 330-359).

Mycotrogus angustus Horn

Mycotrogus angustus Horn, 1870. Trans. American Philos. Soc. (new series) 14: 368.

The species *angustus* is relatively common. It is externally distinct in the shape of the pronotum, the moderate convexity, the shiny luster, and the relatively moderate size of the large pronotal punctures.

Diagnosis. Reddish brown, shiny. Head in dorsal view with anterior border of epistoma weakly concave; in male with protuberance above eye relatively weak; in female without protuberance, evenly convex. Maxillary palpus with apical segment (fig. 11) weakly divergent distally. Pronotum in dorsal view (fig. 10) with lateral borders almost straight in posterior two-thirds, then moderately convex in anterior one-third; surface moderately convex, with very large punctures laterally and fine punctures over whole surface. Metafemur elliptical, in anterior view (fig. 14) with ventral border convex in both sexes. Male genitalia with tegmen (figs. 12, 13) lightly sclerotized; paramere subcylindrical, with borders evenly arcuate, not sinuate. Posterior digestive tract (fig. 15) with a sinuous rectal valve (see Appendix I). Measurements: Approximate total length, 3.9-4.8 mm.

Specimens examined.—*Arizona*: Ft. Yuma, 27-1, Hubbard and Schwarz Collection, 2 specimens; Sabino Canyon, 3-29-1919, in dead *Cercidium torreyanum*, G. Hofer collector, 1 specimen; Santa Catalina Mts., 16-5, Hubbard and Schwarz Collection, 2 specimens. *California*: Painted Canyon, near Indio, 1-2-39, Van Dyke Collection (CAS), 4 specimens; Palm Springs, 5-3, Hubbard and Schwarz Collection, 15 specimens.

In addition, I have examined a male specimen labeled "Ar." in the Horn Collection of the Academy of Natural Sciences of Philadelphia;

I hereby designate it Lectotype No. 3989 for the species *Mycotrogus angustus*. It contains the identification label of Horn. I cannot locate the other specimens Horn used in his original description. In that original description Horn says specimens found at "Camp Grant, Arizona, under Cottonwood bark." In the previous century authors commonly published more collecting data than they put on labels on specimens.

Schwarz wrote to Hubbard concerning the California specimens collected by the latter, "March 5, 1896 In dead palm bud, Palm Canyon—*Mycotrogus angustus* Horn (Tenebrionid). Two specimens were found by you before at Yuma under willow bark. . . ." The statements between quotation marks are from the collected letters published by Sherman (1929, Jour. New York Ent. Soc. 37(3): 266).

The locality Santa Catalina Mountains is my interpretation of the label "Catal Mts., Ariz." on specimens in the U. S. National Museum. Most of the Hubbard and Schwarz Collection labels did not include a year, but I did find in Hubbard's field notes in the archives of the National Museum that he was in Sabino Canyon of the Santa Catalina Mountains on May 16, 1897. I assume the label applies to that particular collecting trip, for I cannot find "Catal Mts." on a map or in a gazetteer.

One male specimen from 5 miles south of Miraflores, Baja California, Mexico, VII-10-1938, Michelbacher and Ross collectors (CAS), appears to be *angustus*, at first glance. However, Blaisdell had identified it as *mentalis*, according to an attached label. It resembles *angustus* in the shape of the lateral borders of the pronotum and by the moderate curvature of the dorsal surface of the pronotum, but it has the more pronounced male protuberance above the eye as in *mentalis*. It is intermediate in color between *angustus* and *mentalis*. The large punctures of the pronotum are even smaller than those of *angustus*. I prefer to identify it as "possibly *angustus*" until more specimens and more complete distributional data for both species are available.

Mycotrogus mentalis Blaisdell

Mycotrogus mentalis Blaisdell, 1923. Proc. California Acad. Sci. (4) 12 (12): 279.

The species *mentalis* is externally distinct in the shape of the pronotum, the strong convexity, the dull luster, and the relatively large size of the large pronotal punctures.

Diagnosis. Brownish black, with a dull luster. Head in dorsal view with anterior border of epistoma weakly concave; in male with protuberance above eye relatively strong; in female without protuberance, evenly convex. Maxillary palpus with apical segment weakly divergent distally, same as in *angustus* (fig. 11). Pronotum in dorsal view (fig. 9) with lateral borders weakly convex in posterior three-fourths, then strongly convex in anterior one-fourth; surface strongly convex, with very large punctures laterally and fine punctures over whole surface. Metafemur elliptical, in anterior view with ventral border convex in both sexes, same as in *angustus* (fig. 14). Male genitalia with tegmen more heavily sclerotized than in *angustus;* paramere subcylindrical, with borders evenly arcuate, not sinuate, same as in *angustus* (figs. 12, 13). Posterior digestive tract with a sinuous rectal valve, same as in *angustus* (fig. 15) (see Appendix I). Measurements: Approximate total length, 5.4-5.9 mm.

Specimens examined.—Baja California: Las Animas Bay, May 8, 1921, J. C. Chamberlin collector, 4 paratypes, male and female, (CAS). *Arizona*: Santa Catalina Mts., 16-5, Hubbard and Schwarz Collection, 1 specimen.

The holotype of *mentalis* is also from Las Animas Bay; it is in the California Academy of Sciences, but I have not examined it. Blaisdell (1943, Proc. California Acad. Sci. (4)24(7): 269) gave additional localities for this species; all are in the southern half of Baja California, the most northern being Santa Rosalia. The above addition of southeastern Arizona to the known distribution creates a large geographical gap. More specimens and localities should resolve this problem.

Species inquirenda

Mycotrogus piceus Horn

Mycotrogus piceus Horn, 1870. Trans. American Philos. Soc. (new series) 14: 367.

This species is unknown to me. The holotype and only specimen Horn used in his original description is not in the Academy of Natural Sciences of Philadelphia, the Museum of Comparative Zoology at Harvard, or the California Academy of Sciences. I assume Blaisdell never obtained specimens of *piceus* for there are none in the California Academy of Sciences; he must have used Horn's original description when making comparisons with his own new species.

Blaisdell's *mentalis* might eventually be synonymized with *piceus* Horn. Specimens of the former agree somewhat with the original description of the latter. In addition, the recording of *mentalis* from Arizona eliminates in part the previously recorded geographical gap between the two species. Even so, for the following reasons I prefer not to synonymize the two species: Horn's description is rather short; the distribution of *piceus* in California is not known (Horn listed only the State); the distribution of *mentalis* must be better known, especially in the United States, now that it is recorded from Arizona; and Horn's holotype might yet be found. The status of *inquirenda* is most unfortunate, for *piceus* is the type species of *Mycotrogus.*

Appendix I—Rectal Valves

The differences in the rectal valve mentioned above are very interesting. Every tenebrionid I had previously dissected possessed the circular type of rectal valve (fig. 8). Finding the sinuous type (fig. 15) was quite a surprise.

In tenebrionids the posterior digestive tract, the proctodaeum, suddenly turns to become directed anteriorly, then again suddenly turns to become directed posteriorly; this last straight section extends from approximately the base of the abdomen to the anus. In the basal three-fourths of this final straight section the cuticular layer (that layer remaining after treatment with KOH) is transparent and has small transverse wrinkles. Then a longitudinally wrinkled section extends to the anus. The transversely and longitudinally wrinkled sections are separated by a slender, heavily sclerotized ring embedded in the cuticle. This ring was called the rectal valve by El-Kifl (1953, Bull. Soc. Fouad Ent. 37: 223, figs. 54, 55). The Malpighian tubules lie on the outside of the transversely wrinkled section and terminate at the rectal valve. The typical position of the Malpighian tubules in *Tenebrio molitor* is given by Marcus (1930, Zeitsch. morph. okol. Tiere, Abt. A, 19(4): fig. 38) in his study of the tubules in beetles; their position in *Tribolium confusum* is given by El-Kifl (op. cit., p. 225, fig. 55).

Mycotrogus paripunctatus has a circular rectal valve (fig. 8), which is the usual type. In the dried specimen which I dissected, the Malpighian tubules were obscured, hence they are not shown on the illustration. The rectal valve of the other species is very odd. *Mycotrogus angustus* has a strongly sinuous rectal valve (fig. 15). The valve is a little closer to the anus than in *paripunctatus*, causing the longitudinally wrinkled section to be slightly shorter. The valve is composed of a comparatively broad, sclerotized band, with six deep sinuosities. The valve is attached to the transversely wrinkled section in such a manner that six pockets are formed along the anterior edge of the valve. Into each of these pockets is tucked the distal end of a sinuous Malpighian tubule.

Appendix II—A larva tentatively identified as Mycotrogus angustus

A larva was pasted on the cardboard point that held one of the adult specimens of *angustus* Horn. The accompanying label for both read: Painted Canyon, near Indio, California, January 2, 1939, Van Dyke Collection (CAS). I can assume only that the larva was collected with the adult. Only if the larva had been reared to adulthood could we be sure of the association of the two stages. However, because the larva is undescribed, because it is a ulomine, and because there is a very good chance that it is *angustus*, I am describing and identifying it as "possibly *Mycotrogus angustus*." When the true identity of the larva is known, a more exact name can be attached.

Head.—Dorsal surface with two long, slender setae anteriorly and one posteriorly on each side of midline. Labrum without transverse carina, with two slender setae on each side of midline on sclerotized area; membranous anteriorly. Clypeus with two slender setae on each side. Eyes very faintly evident. Antenna (fig. 16) slender, with segment 2 much slenderer than 1, segment 3 long and slender. Mandible stout; with blunt tooth or angulation on dorsal cutting edge at helf of distance from apex to molar area, with acute tooth forming apex and with one smaller subapical tooth ventrally; area opposite to cutting edge with two contiguous setae near dorsal articular fossa and one stiff seta near ventral articular process. Maxilla stout, palpus of moderate length, last segment slender; lacinia extending to half length of second palpal segment, medial border with long, stiff setae. Labium stout; palpus of moderate length; hypopharyngeal sclerome (fig. 17) with lateral borders converging from base, apical border angulate medially, concave on adoral surface, especially basally.

Legs.—Procoxa (fig. 18) long, projecting, with long, slender setae which are especially numerous on anterior surface. Protrochanter (fig. 18) stout, with a short, coarse, spinous seta on ventral surface at one-third of length from apical border. Profemur (fig. 18) stout, with two coarse, spinous setae of moderate length on ventral surface and with a long slender seta between them; posterior surface with two short slender setae on apical third. Protibia (fig. 18) slender, with two long setae of moderate coarseness on ventral surface on apical half of length; with a slender seta on dorsal surface near apex. Protarsungulus (fig. 18) slender, darkened apically. Mesothoracic and metathoracic legs subequal to prothoracic leg in length but more slender; both otherwise like prothoracic leg except as follows: mesofemur and metafemur with a coarse seta on posterior surface near apical border (at position "a" in figure 18), mesotibia and metatibia with only the more basal seta on ventral surface and with a coarse seta on the posterodorsal surface at approximately two-fifths of the length from the base (as position "b" in figure 18).

Thoracic and abdominal segments.—Terga of thoracic and anterior abdominal segments sclerotized or darkened on anterior half, those of posterior abdominal segments gradually becoming sclerotized over complete surface and much darker. Protergum with long, slender seta at anterolateral corner, one near posterolateral corner, one on anterior margin of sclerotized area on each side of midline, and one on the vague lateral line. Mesothorax and metathorax shorter than prothorax; each tergum with long, slender seta at posterolateral corner, one at lateral third on posterior border, one near midline on posterior border, and one on vague lateral line. Abdominal segments 1 (fig. 19) and 2 having tergum with long, slender seta at posterolateral corner, one near midline on posterior border, and one on lateral line. Abdominal segments 3-8 having each tergum with long, slender seta at posterolateral corner, and one near midline on posterior border. Lateral line on abdominal segments 1-8 distinct, though not dark. Spiracles on abdominal segments circular, near anterior limit of lateral line and separated from lateral line approximately by distance equal to width of lateral line. Diameter of spiracles on segments 2-8 approximately two-thirds diameter of spiracle on segment 1. Segment 9 in dorsal view (fig. 21) in the form of an equilateral triangle, in lateral view (fig. 20) slightly curved dorsally at apex; apex with a very coarse, spinous seta, on each side of which is a smaller coarse seta, and laterally approximately one-third length from apex with coarse seta placed on short tubercle; other setal arrangement as in illustrations; anal opening with a pair of short membranous papillae.

Measurement.—Total length approximately 7.7 mm.

A CONSIDERATION OF THE SYSTEMATIC POSITION OF THE SALDIDAE AND THE MESOVELIIDAE (HEMIPTERA: HETEROPTERA)[1]

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It has been stated elsewhere (Gupta, in press) that Saldidae and Mesoveliidae are not related closely as stated by Scudder (1959). This conclusion was reached on the basis of anatomical studies of these two families. The purpose of this paper is to consider the systematic positions of these two families on the basis of their important structural characters. While there is comparatively little disagreement among the heteropterists regarding the systematic position of the Mesoveliidae, there has been little agreement on the probable position of the Saldidae. Tables I and II show in chronological order the views of different authors on the positions of the Mesoveliidae and the Saldidae respectively. It is evident from Table II that Saldidae has had no recognized position to date.

In order to throw some light on the probable positions of the Saldidae and the Mesoveliidae, it was considered necessary to compile a table showing the important features of the four higher taxonomic groups usually recognized in the Heteroptera (Leston et al., 1954). Information on the internal anatomy and other important features has been obtained from the literature to supplement characters found from the study of the external anatomy of these two families (Gupta, in press). References on the mandibular lever (Spooner, 1938), accessory salivary glands (Baptist, 1941; Southwood, 1954), wing venation (Hoke, 1926), testes (Pendergrast, 1956), ovary (Carayon, 1950; Miyamoto, 1957), sex determining mechanism (Makino, 1950), accessory fecundation canal (Pendergrast, 1957), eggs (Southwood, 1956) were consulted and the information obtained is included in Table III. This table lists only characters considered in recent works to be of real importance in the higher classification of the group. If the same characters are listed for the Saldidae and the Mesoveliidae (Table IV), and a comparison be made between Table III and IV, the possible systematic positions of the two families could be worked out.

Systematic position of the Saldidae.—It has already been stated in the introduction that the systematic position of the Saldidae is uncertain. A comparison of Table III and IV shows that on the basis of the labrum, mandibular lever, mesoscutum, lateral opening of scent-apparatus, metacoxal cleft, male genitalia and testicular follicles, the Saldidae cannot be included in the Amphibicorisae. And since Hydrocorisae are almost identical with the Cimicomorpha, the position of the Saldidae is to be sought either among Pentatomomorpha or Cimicomorpha. On the basis of labrum, accessory salivary

[1]Based in part on a thesis submitted in partial fulfillment of the requirement for the degree of Master of Science of the University of British Columbia, Vancouver, B. C., Canada.

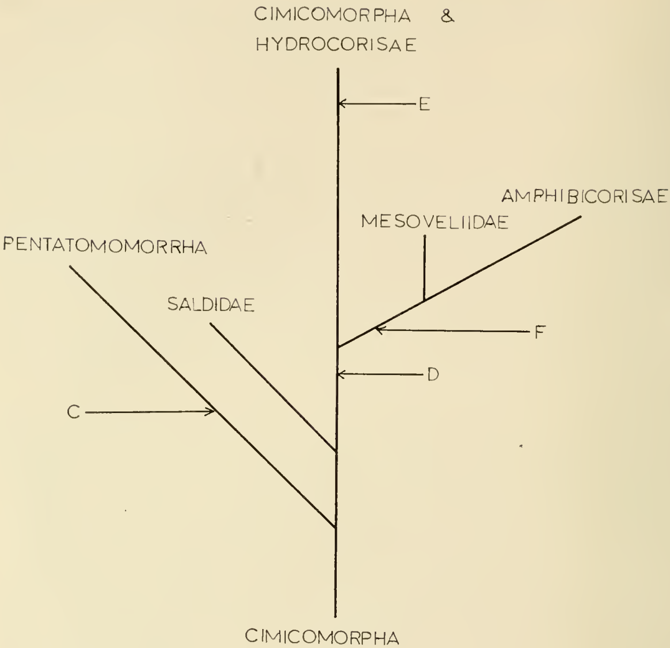

Fig. A

C—labrum not broad, and flap-like; accessory salivary gland tubular type; R and M in the hind wing separate distally; male genitalia pentatomomorph type; female genitalia usuall without gonoplacs; eggs with micropylar processes.
D—labrum broad and flap-like; accessory salivary gland of vesicular type; R and M of hind wing fused distally; female genitalia usually with gonoplacs; eggs with micropylar apparatus.
E—labrum broad and flap-like; mandibular lever three branched or triangular; orifice of scent-gland lateral or absent; metacoxal cleft present or absent; testicular follicles usually seven; accessory fecundation canal absent.
F—labrum broad, flap-like with epipharyngeal process; mandibular lever quadrangular; orifice of scent-gland median or absent; metacoxal cleft absent; testicular follicle one; accessory fecundation canal present except in Ochteridae.

gland, distally fused Radius and Media of hind wing and the oval reservoir of the scent-apparatus (Gupta, 1961) Saldidae shows affinity with Cimicomorpha, but in the structure of the male genitalia and the eggs it clearly belongs to Pentatomomorpha. Two alternative interpretations of this situation are possible, and these are pictorially

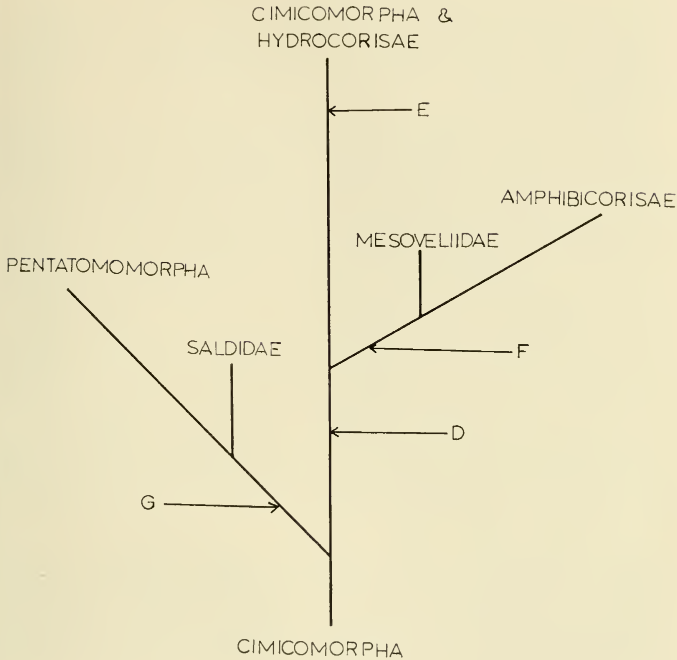

Fig. B

D, E, F as in Figure A; G—male genitalia, eggs.

illustrated in Figures A and B. If we consider the cimicomorph characters as the most important, and if it is accepted that parallel evolution can occur in the egg and male genitalia, it can be argued that the Saldidae is a cimicomorph, which has branched off the main cimicomorph stem and has evolved parallel to the pentatomomorph line, having subsequently developed the pentatomomorph type of male genitalia and eggs. However, it should be noted that there is little evidence for parallel evolution. But its possibility cannot be discounted since many cases are known elsewhere in the animal kingdom. The alternative systematic position can be determined by assuming that parallel evolution has not occurred. One must also state in this alternative scheme that the pentatomomorph complex of characters has evolved gradually and not by a single 'saltation'. The alternative scheme shows the Saldidae as a side branch of the main pentatomomorph stem, a branch which arose after the evolution of the male genitalia and eggs but before the evolution of the rest of the pentatomomorph characters.

The data that we have at the present time are not sufficient to enable one to state which of the two alternatives mentioned in this study is the correct one, although I am inclined to consider the Saldidae as a branch of the cimicomorph line, which probably subsequently developed the pentatomomorph male genitalia and eggs.
Systematic position of the Mesoveliidae.—The study of the external anatomy of the Mesoveliidae showed that this family is correctly placed in the Amphibicorisae. On the basis of the epipharyngeal process, mandibular lever, mesoscutum, mesosternum, median orifice of scent-apparatus, absence of metacoxal cleft, number of testicular follicles and the presence of accessory fecundation canal, Mesoveliidae distinctly belongs to Amphibicorisae. However, Scudder (1959) showed that the female genitalia of Mesoveliidae are of a primitive type with a well developed gonoplac; gonoplacs are usually absent in other Amphibicorisae as far as is known. It is probable that Mesoveliidae represents a primitive stage or separate branch of the amphibicorisae stem—a branch which separated before the gonoplacs were lost in the phylogeny (Fig. A).

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Table I. Views of Various Authors on the Systematic Position of Mesoveliidae

Author	Date	Views
Handlirsch	1908	Included both Mesoveliidae and Saldidae in Gymnocerata. He probably thought that Aepophilidae arose from Mesoveliidae.
Reuter	1910	Did not agree that Mesoveliidae is a branch of Gerroidea.
Pruthi	1925	Included Mesoveliidae and Hydrometridae in Gerridae.
Ekblom	1928	Maintained that Mesoveliidae showed perfect conformity with Hydrometra group.
China	1933	Included Mesoveliidae and Hydrometridae in Gerridae.
Leston et al.	1954	Placed Mesoveliidae in Amphibicorisae.

Table II. Views of Various Authors on the Systematic Position of the Saldidae

Author	Date	Views
Latreille	1825	Grouped Saldidae in Oculatae (Geocorisae).
Amyot & Serville	1843	Included Saldidae in Nudirostres (Geocorisae).
Osborn	1898	Allied Saldidae with Gerridae.
Kirkaldy	1908	Included Saldidae in the superfamily Notonectoidea.
Handlirsch	1908	Included Saldidae and Mesoveliidae in Gymnocerata.
Distant	1902-18	Associated Saldidae with Reduviidae.
Reuter	1912	Stated that Saldidae are closely allied to Nabidae.
Pruthi	1925	Put Saldidae in Pentatoma.
Ekblom	1926	Stated that Saldidae have affinities with Nabidae.
Esaki and China	1927	Put Saldidae and Leptopodidae in Hydrocorisae.
Borner	1934	Included Saldidae in superfamily Reduviodea.
Spooner	1938	Grouped Saldidae, Anthocoridae and Cimicidae together on the basis of flap-like labrum.
Larsen	1945	Differed in placing Saldidae intermediate between Cryptocerata and Gymnocerata.
Leston et al.	1954	Included Saldidae in Pentatomomorpha, although they stated "Saldoidea is far removed from the main Pentatomomorph stem."
China	1955	Put Saldidae at the base of Amphibicorisae on the basis of three pairs of cephalic trichobothria.
Pendergrast	1957	Stated that Saldidae have the type of spermatheca found in most Trichophora.
Scudder	1959	Included Saldidae in Cimicomorpha on the basis of the female genitalia.

Table III. Taxonomic Characters of Pentatomomorpha, Cimicomorpha, Amphibicorisae and Hydrocorisae

Parts	Pentatomomorpha	Cimicomorpha	Amphibicorisae	Hydrocorisae
Labrum.	Longer than broad.	Broad, flap-like or long.	Broad, flap-like, with epipharyngeal process.	Broad, flap-like.
Mandibular lever.	Triangular	Triangular.	Quadrangular.	Three branched or triangular.
Accessory salivary gland.	Tubular.	Vesicular.	Vesicular.	Vesicular.
Mesoscutellum.[2]	Does or does not project over abdomen.	Does not project over abdomen.	Does not project over abdomen.	Does or does not project over abdomen.

Mesosternum.[2]	Does or does not project over metasternum.	Does or does not project over metasternum.	Does not project over metasternum.	Does or does not project over metasternum.
Orifice of scent-apparatus.[2]	Lateral.	Lateral.	Median or absent.	Lateral or absent.
Metacoxal cleft.[2]	Present.	Present or absent.	Absent.	Present or absent.
R and M in hind wing.[2]	Distally separated.	Distally fused.	Distally fused.	Distally fused.
Male genitalia.	Pentatomid type or related thereto	Reduviid type or related thereto.	Reduviid type.	Reduviid type.
Female genitalia.	Gonoplacs usually absent; 8th paratergite not fused with 1st gonocoxa.	Gonoplacs usually present; 8th paratergite often fused with 1st gonocoxa.	Gonoplacs usually absent; 8th paratergite usually fused with 1st gonocoxa.	Gonoplacs usually present but may be absent; 8th paratergite usually not fused with 1st gonocoxa.
Testicular follicles.	Usually seven.	Usually seven.	Usually one.	Usually seven.
Male sex chromosomes.	XY or XO type.	XY or XO type.	XO type.	XY or XO type.
Eggs.	With micropylar processes.	With micropylar apparatus.	--------	--------
Accessory fecundation canal.	Absent.	Absent.	Present except in Ochteridae.	Absent.

TABLE IV. TAXONOMIC CHARACTERS OF THE SALDIDAE AND THE MESOVELIIDAE

Parts	Saldidae	Mesoveliidae
Labrum.	Broad, flap-like.	Broad, flap-like, with epipharyngeal process.
Mandibular lever.	Triangular.	Quadrangular.
Accessory salvary gland.	Vesicular.	--------
Mesoscutum.	Projects over abdomen.	Does not project over abdomen.
Mesosternum.	Projects over metasternum.	Does not project over metasternum.
Orifice of scent-apparatus.	Lateral.	Median.
Metacoxal cleft.	Present.	Absent.
R and M of hind wing.	Distally fused.	Distally fused.
Male genitalia.	Pentatomid type.	Reduviid type.
Female genitalia.	Gonoplacs present; 8th paratergite fused with 1st gonocoxa.	Gonoplacs present; 8th paratergite fused with 1st gonocoxa.
Testicular follicles.	Seven.	One.
Male sex chromosomes.	XO	XY type.
Eggs.	Operculum absent, egg buster present.	--------
Accessory fecundation canal.	Absent.	Present.

[2]Personal observation.

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BOOK REVIEW

Pests of Stored Grain and Grain Products by Richard T. Cotton, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. i + 318 pp., 108 figs., 18 tables. Burgess Publishing Co., Minneapolis, 1963. (5th Edition). Price $5.00.

For over 20 years, this book in its four editions has been a standard guide for control of insects and rodents. The 1963 (5th) edition is essentially identical to the 1956 edition with an additional chapter on insect control in bakeries. Included in the various chapters are thorough and succinct discussions of protective insecticides and of fumigants, fumigation methods and sanitation practices for seed and grain storage warehouses, flour mills and bakeries.

The work is of limited use to taxonomists because of the lack of keys and of technical information essential to the positive identification of many of the important insects, but this is not the primary purpose of the book. For the layman or field man, sufficient detail is included in the chapter on insects to enable him to be fairly sure of his problem species.

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STUDIES ON NORTH AMERICAN APION: THE APION PARALLELUM GROUP
(COLEOPTERA: CURCULIONIDAE)[1]

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This paper is a continuation of a series in which revision will be completed of the 260 species of *Apion* occurring in North America. Kissinger (1959a) presents a key to the 29 species groups of *Apion* known from this region. Explanation of abbreviations and measurements is given by Kissinger (1957b, 1959b).

Seven species known to belong to this group range from North Central and Eastern United States to Guatemala. Only two species. *A. pauper* Sharp and *A. disparipes* Fall, occur south of the United States. No host plants are known with certainty for the group. Specimens of *A. graciliforme* Fall are associated with *Kuhnistra obovata*. *A. disparipes* Fall was taken in quarantine "in unidentified plant," the two specimens are teneral.

Three distinctive characters of the group are the secondary sexual modifications of the tarsi of the male in which the first segment of one or two pairs of tarsi is produced into a spine on the posterior medial surface; the narrow, subcylindrical form of the body (as opposed to the usual pear-shaped outline seen in *Apion*); and the cylindrical prothorax which is not expanded laterally at the base. Additional characters are as follows:

Dorsal surface with very sparse but apparent, generally uniform pubescence; integument usually black (piceus in *graciliforme*), legs nearly black; beak slender, not expanded at the insertion of antenna, sexual dimorphism of beak not marked; antenna inserted at distance from eye equal to or slightly greater than width of frons, dorsal margin of antennal scrobe horizontal; frons moderately wide, wider than dorsal tip of beak, flat, at most feebly striate; eyes at most feebly prominent; prothorax subcylindrical, feebly constricted apically, apex not less than four-fifths as wide as base, base slightly bisinuate, not expanded laterally; femur and tarsus not stout; third tarsal segment strongly bilobed; claws with acute basal tooth (reduced in *tenuiforme* Fall).

The members of the *Apion spretissimum* group have similar male secondary sexual modifications of the tarsus. This group differs from the *parallelum* group in that the form is shorter, more robust; the anterior dorsal margin of the antennal scrobe is oblique; and the prothorax is acutely expanded laterally at the base.

KEY TO MALES OF NORTH AMERICAN SPECIES OF **Apion parallelum** GROUP

1. Two pairs of tarsi spined 2
   One pair of tarsi spined 3

[1]This study was aided by grant G 19600 from the National Science Foundation.

2. Femur 2 greatly swollen, tibia 3 with fringe of cilia on inner side, femur 3 with fine tooth .... **disparipes** Fall
   Femora 2 and 3 and tibia 3 not so modified .... **spinipes** Fall
3. Femur 2 notably stouter than femur 3........ 4
   Femora 2 and 3 of about same width 6
4. Color brown or piceus; pubescence rather coarse, scale-like .... **graciliforme** Fall
   Color black, pubescence fine 5
5. Eyltral intervals nearly flat, scales in striae and on intervals equal in width and length, minute .... **pauper** Sharp
   Scales in striae larger than those on intervals. .... **tenuiforme** Fall
6. Size greater than 2.0 mm.; elytral intervals nearly flat, finely, transversely rugose, with two rows of fine punctures; pubescence conspicuous .... **extensum** Smith
   Size less than 2.0 mm.; elytral intervals convex, nearly smooth, with one row of fine punctures; pubescence moderate .... **parallelum** Smith

Apion disparipes Fall
(Figure 2, 3, and 7)

Apion disparipes Fall, 1898, Trans. American Ent. Soc., 25: 169.—Kissinger, 1957a, Proc. Ent. Soc. Washington, 59: 40 [Holotype: male, Las Cruces, N. Mex., in Carnegie Museum, Pittsburgh.]

Apion brunneotibiale Wagner, 1912, Arch. Naturg. 78 (Abt. A. Heft 2): 122—Kissinger, 1957a, Proc. Ent. Soc. Washington, 59: 40 [Lectotype male, Guanajuate, Mexico, (BMNH)]

I hereby designate the lectotype of *Apion brunneotibiale* Wagner as the male type in the British Museum; a lectoparatype is supposed to be in the Wagner collection, but this may have been destroyed. I am greatly indebted to Mr. J. Balfour-Browne, of the British Museum (Natural History), who kindly compared a specimen of *A. disparipes* Fall with the type of Wagner's species; they are synonyms.

The male of this species is easily recognized by its unique combination of secondary sex characters, as listed in the key. It is the only *Apion* known to me that has the hind femur toothed. The female is very similar to the female of *A. pauper* Sharp and *A. tenuiforme* Fall and is rather difficult to distinguish from females of these species. The female of *disparipes* has the beak slightly, evenly curved and the scales in the elytral striae are as coarse as those on the intervals 1-3 being about 0.04 mm. long; the females of *pauper* and *tenuiforme* have the beak rather strongly curved. *A. pauper* has very fine, short scales on the elytral intervals and striae, the scales are about 0.02 mm. long, on the sutural interval the scales are arranged in two rows. *A. tenuiforme* has the scales on intervals 1-3 uniserial and about 0.03-0.04 mm. long, the scales in adjacent striae are a trifle longer but are distinctly coarser than the scales on intervals 1-3. I have attempted to illustrate these differences on the plate where portions of intervals 1-3 are pictured, the sutural interval is to the left. The three species differ from *A. parallelum* Smith in that the intervals have more or less distinct, fine, transverse rugae; *parallelum* has intervals which are nearly smooth, also the scales on the intervals are uniserial, the scales are rather coarse and about 0.04-0.05 mm. long, and scales in the striae are distinctly coarser than those on adjacent intervals. Females of *A. spinipes* Fall and *A. extensum* Smith may be distinguished from females of the four species mentioned above by their length which is more than 2.0 mm., and lack of greenish luster on the elytra; females of the four species mentioned above are less than 2.0 mm. long and the elytra have more or less pronounced greenish luster. The female of *graciliforme* Fall is apparently distinct from the females of all of the other species because of its brownish or piceus integument.

Length.—1.75 to 2.00 mm.; width 0.72 to 0.81 mm.

Material has been seen from the following localities:

UNITED STATES: Arizona: Sunnyside Canyon, Huachuca Mts., 9 VII 1940, L. J. Lipovsky (UK). New Mexico: no specific locality (TLCC); Grant Co. (ELS); Las Cruces, 3 VII 1940, L. C. Kuitert (UK); Jemez Spring, 8 and 20 VI 1922 (MCZ).

MEXICO: Distrito Federal:Mexico City, 20 VI 1922, E. C. Smyth (USNM); 37 miles southeast Mexico City, 15 III 1953, D. G. Kissinger (BMNH, DGK); Xochimilco, 26 IV 1946, J. & D. Pallister (AMNH). Durango: Tepehuanes (TLCC). Guanajuato (BMNH). Jalisco: Guadelajara, 16 X 1943, in unidentified plant intercepted at Nogales, Ariz. (USNM). Morelos: Puente de Ixtla (TLCC). Puebla: unspecified locality (CAS). Sonora: Nogales, 14 XI 1943, with geraneum leaves intercepted at Nogales, Ariz. (USNM).

Apion spinipes Fall

Apion spinipes Fall, 1898, Trans. American Ent. Soc., 25: 169. [Lectotype: male, Arizona (MCZ #25124)].

Apion notabile Buchanan, 1922, Proc. Ent. Soc. Washington, 24: 83.—Bleasdell, 1937, Iowa State College Jr. Sci., 11: 410. [Holotype: male, Lake Okoboji, Iowa (USNM)] *New synonymy.*

I hereby designate the lectotype of this species as the male specimen labeled "Arizona," in the Fall Collection, MCZ #25124; a lectoparatype is in the U. S. National Museum, male, with same data, #4240. A comparison of types in the U.S.N.M reveals no specific difference between *spinipes* Fall and *notabile* Buchanan.

The male of *spinipes* can be recognized easily because of the secondary sexual modifications of the tarsi. See discussion under *disparipes* for characters distinguishing the female from other species in group. The female is very similar to that of *extensum* Smith. The female of *spinipes* has the beak strongly curved; the elytral intervals are somewhat convex, nearly smooth with one row of fine punctures; and the punctures on the metasternum are separated by an interval wider than one-half the diameter of the punctures. The female of *extensum* has the beak slightly curved; the elytral intervals are nearly flat, with fine, transverse rugae, and there are two rows of punctures; and the punctures on the metasternum are separated by less than one-half the diameter of the punctures.

Length.—1.87 to 2.56 mm.; width: 0.84 to 1.18 mm.

Material has been seen from the following localities: CANADA: Montreal (MCZ). UNITED STATES: Arizona: unspecified locality (USNM, MCZ); Chiricahua Mts., 18 VII 1944 (ELS); Portal, 22 VII 1945, W. W. Jones (CIS); Georgia: Prattsburg, 25 VII 1930, P. W. Oman (UK). Iowa: Dickinson Co. (Bleasdell, 1937); Lake Okoboji, 24 VII 1916, L. Buchanan (USNM). Kansas: Bourbon Co., 800 ft., 1916, R. H. Beamer (UK). Missouri: St. Louis, 16 VI, Liebeck Colln. (MCZ). Nebraska: Grandledge, 3 VII 1946, A. T. McClay (UC); Platte River southeast of Grand Isle, 21 VI 1953, B. & B. Valentine (BDV, BMNH, DGK). Texas: Kerrville, 10 IV 1907, F. C. Pratt (USNM).

Apion graciliforme Fall

Apion graciliforme Fall, 1898, Tr. American Ent. Soc., 25: 170 [Holotype: male, "Dac." (Dakota), USNM.]

I have seen only a few specimens of this species. The outstanding distinguishing feature of the species is the brown integument; all other members of the group are nearly black. As suggested by Fall the color may be due to a teneral condition but there is at present no way to settle the point.

The species is distinct in features other than coloration. The beak of the female is strongly curved, as in *spinipes.* The scales of the elytra are comparatively wide, between 0.005 and 0.01 mm. wide, and between 0.04 to 0.06 mm. long; the scales on the elytra of all the other species except *extensum* are distinctly finer. The intervals have fine, minute transverse rugae. The scales in the striae are slightly coarser than those on the intervals. There is a tendency for the scales on intervals 1-3 to be arranged in two irregular rows, this is especially apparent on the sutural interval.

Length.—1.80 to 1.87 mm.; width: 0.75 to 0.87 mm.

Material has been from the following localities: "Dacota": no further data (USNM). Texas: Colorado Co., 25 VI 42 (ELS); Columbus, 20 VI 07, *Kuhnistra oborata* (USNM).

Apion pauper Sharp
(Figure 6)

Apion pauper Sharp, 1890, Biol. Centrali-Americana, Coleoptera, 4 (pt. 3): 54. [Type locality originally not specified, hereby fixed as Cuernavaca, Mexico, BMNM.]

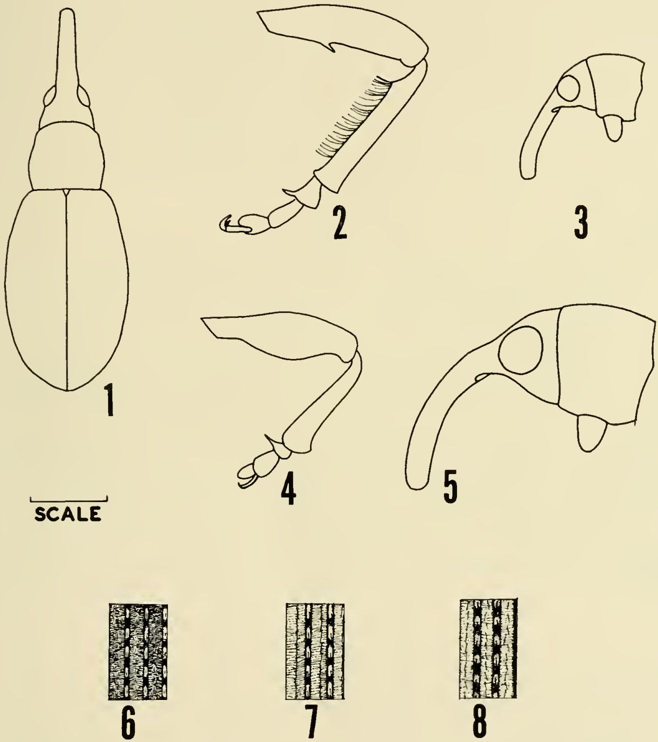
See key and discussion under *disparipes* for characters distinguishing this species from other members of the group. In addition the female may be separated from the female of *disparipes* because it has shorter, more bristling pubescence, especially on the legs.

Length.—1.44 to 1.68 mm; width: 0.63 to 0.68 mm.

Material has been seen from the following localities:

GUATEMALA: Guatemala, Champion, compared with type by Sharp (BMNH). MEXICO: "Puente de Ixtla" (TLCC). Mexico:

Temescaltepec (CAS). Michoacan: Ciudad Hidalgo, 14 VII 55, on grass, R. E. Selander (Kingsolver). Morelos: Cuernava, June (BMNH); 22 III 34, S. E. Jones (Texas A. & M.). Nayarit: Tepic, 15-17 IX 53, B. Malkin (Cas). Puebla: 35 mi. southeast Puebla, 25 II 53, D. G. Kissinger (DGK). Veracruz: Lago de Catemaco, 13 II 53 D. G. Kissinger (DGK).



Apion parallelum Smith. Fig. 1, entire dorsal view of female; fig. 4, middle femur, tibia and tarsus of male. *Apion disparipes* Fall. Fig. 2, hind femur, tibia and tarsus of male; fig. 3: lateral view of head and prothorax of female; fig. 7: elytral intervals 1-3 immediately behind scutellum, semidiagrammatic. *Apion tenuiforme* Fall. Fig. 5, lateral view of head and prothorax of female; fig. 8, elytral intervals 1-3 immediately behind scutellum, semidiagrammatic. *Apion pauper* Sharp. Fig. 6, elytral intervals 1-3 immediately behind scutellum, semidiagrammatic. Note: scale equals 0.25 mm. for all figures except 1 and 3 where it equals 0.5 mm.

Apion tenuiforme Fall
(Figure 5 and 8)

Apion tenuiforme Fall, 1898, Trans. American Ent. Soc. 25: 129, pl. 3, fig. 5, 5a—Blatchley and Leng, 1916, Rhynch. or Weevils of Northeastern America, p. 74. [Lectotype: male, Tampa, Florida, May MCZ.]

I hereby designate the lectotype of this species as the male specimen labeled "Tampa, Fla. 1.5 # 25127" in the Fall Collection; a female lectoparatype labeled "Orange Co., Fla. 8.5, Hubbard and Schwarz #1215" and a male lectoparatype labeled "Fla." are in the U. S. National Museum. The only other specimen seen is a female labeled "Dade Co., Fla., 2 VI 33" (ELS).

Fall describes the tarsal claws as simple but examination under 160 X reveals a small basal tooth on the tarsal claws.

See under discussion of *disparipes* for characters distinguishing female of this species from other members of the group.

Length.—1.50 mm.; width: 0.65 mm.

Apion extensum Smith

Apion extensum Smith, 1884, Trans, American Ent. Soc., 11: 61.—Fall, 1898, Trans. American Ent. Soc., 25: 170 [Holotype: female, Montana (no specific locality), USNM.]

See discussion under *disparipes* for characters distinguishing female from other species in group. Length: 2.2 mm.

The species has not been collected very often but it apparently has quite a wide range. I have seen specimens from the following localities:

CANADA: Saskatchewan: Pike Lake, 24 V 1940, A. R. Brooks (CNC). UNITED STATES: "Dak." [ota], no further data (MCZ). Kansas: Decatur Co., 6 July 1925, R. H. Beamer (UK). Montana: no further data (USNM). North Dakota: Bismark (MCZ).

The large size; flat, rugose elytral intervals with two rows of punctures bearing comparatively coarse scales; and the coarsely, densely punctured metasternum will separate this species from related forms.

Apion parallelum Smith
(Figure 1 and 4)

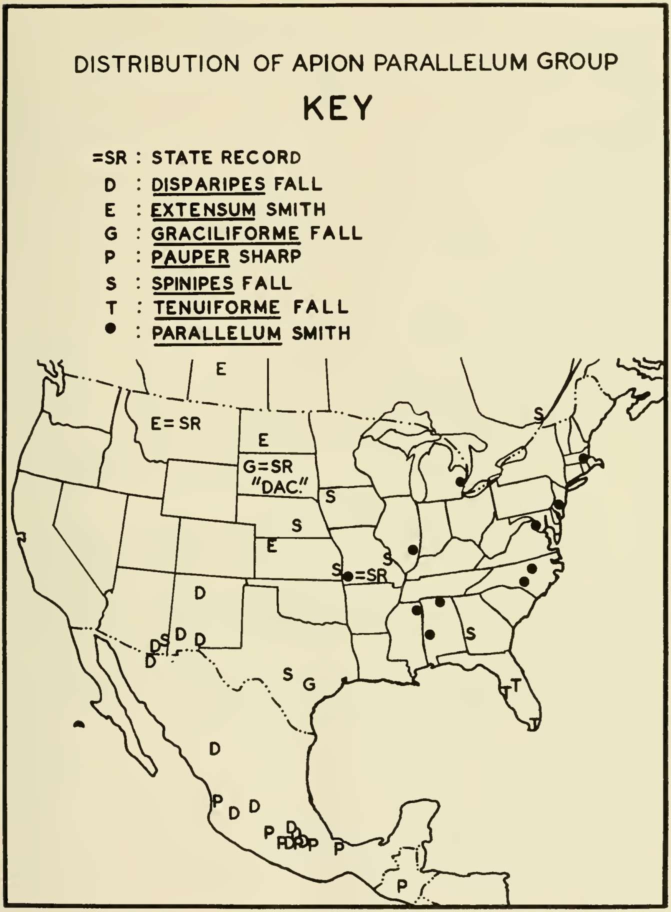
Apion parallelum Smith, 1884, Trans. American Ent. Soc., 11: 47—Fall, 1898, Trans. American Ent. Soc., 25: 170.—Blatchley and Leng, 1916, Rhynch. or Weevils of Northeastern American, p. 88. [Holotype: male, Washington, D. C., 25. IX # 392 in LeConte Collection, MCZ.]

See discussion under *disparipes* for characters distinguishing female from others in group.

Length.—1.37 to 1.98 mm.; width: 0.62 to 0.81 mm.

The following list of localities includes data on specimens I have seen plus data from Fall (1898):

Alabama: 5 mi. northwest Huntsville, 15 VI 59, D. G. Kissinger,



5 specimens on *Desmodium*, possibly associated with larvae found in July burrowing in pith in basal region of stem (DGK); 5 mi. north York, VII 54, D. G. Kissinger (DGK). District of Columbia, no data (MCZ), 17 V, Hubbard and Schwarz (USNM). Illinois: Roslyn, 7 VIII 50, Ross and Sanderson (INHS). Maryland: Cabin John, IX 1920, on *Meibomia*, Schwarz and Barber (USNM), Greenbelt,

11 IX 55, on *Desmodium*, D. G. Kissinger (DGK), Takoma Park, 1 VI 50 (DGK), 22 VI 50 (ELS). Massachusetts: no specific locality (Fall, 1898). Michigan: Detroit 23 VI, Hubbard and Schwarz (USNM). Mississippi: Belmont, 6 VII 21 (CAS). Missouri: no specific locality (USNM). New Jersey: southern part (Fall, 1898). North Carolina: Raleigh, 22 VIII 50, H. and A. Howden, weed field (Howden); Southern Pines, no data (TLCC), 30 V 19 (USNM). Virginia: Rosslyn, 4 VI, Chittenden (USNM).

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A REVISION OF DEMOPHELES
(HYMENOPTERA, ICHNEUMONIDAE)[1]

HENRY TOWNES, *Museum of Zoology, University of Michigan, Ann Arbor*

Demopheles is a Holarctic genus of ichneumonids belonging to the subfamily Gelinae. In recent years it has been placed in the tribe Hemigasterini (= Aptesini) because it agrees with the characters of this tribe as usually defined. (See the tribal definition by Townes and Townes, 1962, U. S. Natl. Mus. Bul. 216 (3): 4, 6.) Recent studies, however, indicate that it is probably best placed in the tribe Gelini, as in spite of its vertical second recurrent vein with a single bulla, and the white face of the male, it disagrees with other Hemigasterini and is similar to certain genera of Gelini in having the apical truncation of the scape rather weakly instead of strongly oblique, epipleurum of second tergite turned under rather than pendant, and lower tooth of mandible shorter than the upper tooth. The Gelini itself is a heterogeneous tribe. When the relations between its many genera are better worked out the tribe will probably be subdivided and at that time the taxonomic position of *Demopheles* can be indicated more exactly.

Genus **Demopheles**

Demopheles Foerster, 1868. Verh. Naturh. Ver. Rheinlande 25: 186. Type: (*Phygadeuon caliginosus* Gravenhorst ♀, not ♂) = *corruptor* Taschenberg. Included by Dalla Torre, 1902.

Mecocryptus Thomson, 1873. Opuscula entomologica fasc. 5, p. 520, 521. Type: (*Phygadeuon caliginosus* Gravenhorst ♀, not ♂) = *corruptor* Taschenberg. Original designation.

Demopheles can best be recognized from the habitus figure accompanying this article. (The figure is by Miss Y. Morimoto of Kyoto Prefectual University.) A peculiarity of the female is the strong, preapical transverse ridge on the clypeus which has a deep median notch, as shown in the figure. In the male the clypeus is simple but unusually wide, with its apical margin blunt and broadly, convexly arcuate.

The genus contains a single polytypic species, of Holarctic distribution. Our collections of it have been usually from damp, rich deciduous woods. The only known host is *Clytus* (Cerambycidae). A single cocoon of the parasite is at hand. It is elliptic, papery, and of a medium brown color. The exit hole is terminal.

Demopheles corruptor Taschenberg
(Fig. 1)

Front wing of male 3.5 to 4.5 mm. long, of female 3.8 to 6.3 mm. long. Structural characters of female as in the figure. Male somewhat more slender than

[1]This paper is an incidental result of other studies on ichneumonid taxonomy supported by the National Institutes of Health.

female, the apical margin of clypeus without a median notch but very bluntly rounded, and flagellum with about three elongate elliptic, strongly raised but flat-topped tyloids on segments 10-12, the largest tyloid on segment 11.

The species is Holarctic, with four subspecies as keyed and described below.

MALES (SO FAR AS KNOWN)

1. Hind coxa ferruginous, often fuscous basally; range: eastern United States and Canada .... a. **corruptor maturus** Provancher
   Hind coxa black; range: Europe .... c. **corruptor corruptor** Taschenberg

FEMALES

1. Hind coxa ferruginous; wrinkling on mesopleurum rather weak 2
   Hind coxa black; wrinkling on mesopleurum rather strong 3
2. Tergites 2 and 3 black; face entirely black or partly ferruginous; range: eastern United States and Canada .... a. **corruptor maturus** Provancher
   Tergites 2 and 3 ferruginous; face entirely ferruginous; range: western United States .... b. **corruptor rufatus**, new subspecies
3. Femora ferruginous; punctures on frons just below ocelli separated by about 0.8 their diameter; range: Europe .... c. **corruptor corruptor** Taschenberg
   Femora blackish; punctures on frons just below ocelli separated by about 1.3 their diameter; range: Japan .... d. **corruptor atripes**, new subspecies

a. **Demopheles corruptor maturus** Provancher, new status

Phygadeuon maturus Provancher, 1879. Nat. Canad. 11: 68 (Faune, p. 314). ♀. Type: ♀, St. Hyacinthe, Que. (Quebec).

Male.—Black. Frontal orbit, face, cheek, clypeus, mouth parts, scape except above, under side of pedicel, collar and lower edge of pronotum, hind corner of pronotum, tegula, subtegular ridge, and front and middle coxae and trochanters, white; front and middle legs beyond trochanters pale fulvous, their tarsi tinged with brown toward apex; hind coxa and femur ferruginous, the base of coxa often fuscous; hind trochanters fulvous; hind tibia fulvous, somewhat infuscate apically; hind tarsus fuscous.

Female.—Punctures on upper part of frons separated by about 1.8 their diameter; mesopleurum (except on speculum) with rather small but distinct punctures that are separated by about 1.5 their diameter, at and below the middle with fine longitudinal wrinkling in addition to the punctures. Black. Orbital stripe on lower 0.6 of frons which often extends to upper corner of face, and tegula white; clypeus, usually part and sometimes all of face and cheek, mandible, under side of scape and pedicel, and usually narrow collar and lower margin of pronotum, ferruginous; palpi fulvous; flagellum brown apically, especially beneath; subtegular ridge ferruginous to whitish; legs fulvoferruginous, the hind tibia and tarsus sometimes a little darkened.

Specimens.—46 ♂, 29 ♀ from Alberta (Edmonton); Connecticut (Litchfield); Georgia (Pine Mountain in Rabun Co. at 1,400 ft); Maine (Lincoln Co.); Maryland (Glen Echo and Takoma Park); Massachusetts (Holliston and Winchenden); Michigan (Ann Arbor, Clare Co., East Lansing, Gogebic Co., Huron Mountains, and Yellow Dog Plains in Marquette Co.); New York (Artists Brook in Essex

Co., Babylon, Ithaca, Lancaster, Millwood, and Poughkeepsie); North Carolina (Tryon); Ontario (MacDiarmid near Lake Nipigon, Muskoka District, Ottawa, and Timagami); Pennsylvania (Dushore); Quebec (Duchesnay, Laniel, L'Avenir, Quebec, and Stoneham); South Carolina (Cleveland); and Vermont (Laurel Lake near Jacksonville).

The record from Edmonton, Alta., reported above, is based on a male specimen. Since it is not known how males of *maturus* may be distinguished from those of the western subspecies *rufatus*, this specimen could possibly represent *rufatus* instead of *maturus*.

Collection dates are from late spring to mid fall. The earliest and latest dates are: May 1 at Winchenden, Mass.; May 14 at Pine Mountain, 1,400 ft., Rabun Co., Ga.; May 23 at L'Avenir, Que.; May 23 to 28 in Clare Co., Mich.; May 30 at Ann Arbor, Mich. and at Syracuse, N. Y.; August 26 to 28 at Ann Arbor, Mich.; September 9 at Timagami, Ont. and at Holliston, Mass.; and October 10 at Holliston, Mass. There is one reared specimen: ♂, from *Clytus ruricola*, Duchesnay, Que., June 4, 1941, Jos. I. Beaulne.

This subspecies occurs in North America east of the Rocky Mountains, ranging from the Upper Austral to the Canadian Zone.

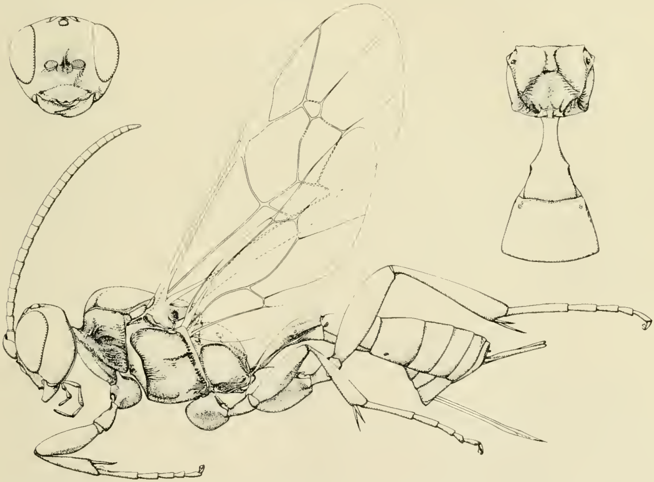

Figure 1. *Demopheles corruptor* ♀, side view, front view of head, and top view of propodeum and first two segments of abdomen.

b. **Demopheles corruptor rufatus**, new subspecies

Male.—Unknown.

Female.—Similar in structure to the female of the subspecies *maturus* except that the frontal and pleural punctures are slightly stronger. Black. Face, cheek, clypeus, mandible, scape, pedicel, collar and lower margin of pronotum, hind corner of pronotum, subtegular ridge, legs, and much or most of abdomen, ferruginous; orbital stripe on lower 0.6 of frons and tegula white; flagellum brown, ferruginous basally; palpi fulvous; abdomen ferruginous, the basal 0.4 to 0.8 of its first segment and more or less of its apical tergites blackish, the second and third tergites always ferruginous, with or without fuscous tinges.

Type.—♀, Fish Creek, Mt. Rainier, 2,900 ft., Wash., H. and M. Townes (Townes).

Paratypes.—♀, Phantom Valley, Rocky Mountain National Park, 9,400 ft., Colo., Aug. 10, 1948, H., M., D., and J. Townes (Townes). ♀, Lincoln National Forest, Cloudcroft, N. Mex., 1951 (Washington). ♀, same data as type (Townes).

c. **Demopheles corruptor corruptor** Taschenberg

Phygadeuon caliginosus Gravenhorst, 1829. Ichneumonologia europaea 2: 645. ♀, not ♂. The ♂ described by Gravenhorst is the true *caliginosus, teste* Taschenberg, 1865, Ztschr. Gesam. Naturw. 25: 22, 49.

Phygadeuon corruptor Taschenberg, 1865. Ztschr. Gesam. Naturw. 25: 49. ♀. Lectotype, hereby designated: ♀ (labeled lectotype by Townes), Warmbrunn, Germany (Wroclaw).

Male.—The male is unknown to me but Thomson and Morley describe it as having the hind coxa black and the femora ferruginous, as in the female.

Female.—Punctures on upper part of frons coarse, separated by about 0.8 their diameter; mesopleurum with small punctures that are separated by about 2.0 their diameter and with rather fine, mostly longitudinal wrinkling. The speculum is without wrinkles and partly punctate. Black. Apical 0.6 of clypeus, mouth parts, under side of scape and pedicel, and legs ferruginous, the hind coxa black and hind tibia and tarsus sometimes infuscate; narrow orbital stripe on lower 0.6 of frons and tegula white; flagellum brownish basally and apically, especially below; subtegular ridge ferruginous to whitish.

Specimens: 3 ♀ from Germany (Berchtesgaden, and Bodmann on the Bodensee).

This subspecies is widespread in Europe.

d. **Demopheles caliginosus atripes**, new subspecies

Male.—Unknown.

Female.—Punctures on upper part of frons separated by about 1.3 their diameter; mesopleurum covered with rather strong, mostly longitudinal wrinkling and rather small punctures that are partly obscured by the wrinkling. A part of the speculum is unsculptured. Black. Orbital stripe on lower 0.6 of frons (interrupted by the tentorial attachment) and tegula white; palpi and apical 0.4 of mandible fulvous or brown; front and middle legs beyond first trochanter brown, their knees and front side of front tibia pale brown.

Type.—♀, Sapporo, Japan, July 6, 1954, Townes family (Townes).

Paratypes.—♀, Aizankei (Ishikari), Hokkaido, Japan, Aug. 4, 1937, K. Yasumatsu (Townes), ♀, Mt. Norikura, 2,000 m., Japan, July 30, 1954, Townes family (Townes).

A SECOND NORTH AMERICAN SPECIES OF TRAGINOPS COQUILLETT
(DIPTERA, ODINIIDAE)

GEORGE C. STEYSKAL, *Grosse Ile, Mich.*[1]

In 1944, when I collected a few specimens of *Traginops* sp. on a tree wound, I noticed that some of them had red eyes while others were dark purple, but I could detect no other differences. Since that time the use of the postabdomen of both sexes has become of prime importance in distinguishing species of acalyptrate Diptera and I have had the opportunity of examining the postabdomen of the type specimen of *Traginops irroratus,* the type of the genus and only described North American species. I found ample differences in the postabdomens of both sexes and that the species with red eyes is *T. irroratus.* The other species is described below as *T. purpurops,* new species. In view of the facts here brought forth, it seems likely that the other known taxa, *T. orientalis* De Meijere, *T. orientalis naganensis* Kato, and *T. clathratus* Hendel (*vide* Shewell 1960) will be found just as distinct species—the figures of *T. orientalis* male in Hennig (1938, pp. 204, 207) certainly indicate a species distinct from our two.

Traginops irroratus Coquillett
(Figs. 1-3, 6)

1900. *Traginops irrorata* Coquillett, Entomol. News 11: 429.

Eyes in life red. A single vibrissa on each side, ending a row of much smaller bristly hairs.

Male postabdomen gaping widely after maceration (fig. 1); tergite 6 symmetrical, entirely free, bearing spiracles 6 near each lateral margin; spiracles 7 not evident; epandrium (fig. 2) nearly or quite divided dorsimedially; surstylus angularly bent forward, with rather long hairs on posterior hump and in posterior view straight on mesal margin; hypandrium (fig. 3) with pair of characteristic long pencils of hairs, compacted basally and frayed out apically, near base of each lateral lobe; cerci mesally conjoined by membrane, forming a scoop-like organ with a single pair of small bristles apically.

Female postabdomen or ovipositor (fig. 6) with no evident spiracles; all sternites and tergites well separated; tergite 7 nearly semicircularly emarginate apically, forming a pair of pointed lobes narrowly connected across dorsum; tergite 6 without distinct basidorsal sulcus and apically only slightly sinuate.

Two spermathecae present, black, at ends of slender ducts approximately 0.9 mm. long. At the base of the ducts a pair of spindle shaped accessory glands on much shorter ducts and a single short duct (? third spermatheca) ending in a black cap. Two specimens (Kerrville, Tex.) showed a pair of spermathecae of the form shown in Fig. 6a; those of a third specimen (Angora, Pa.) had one spermatheca each of the types shown in Figs. 6a and 6b; two more specimens (Albuquerque, N. Mex., and South Haven, Mich.) had both long-ducted spermathecae as in Fig. 6b. The subject calls for additional investigation.

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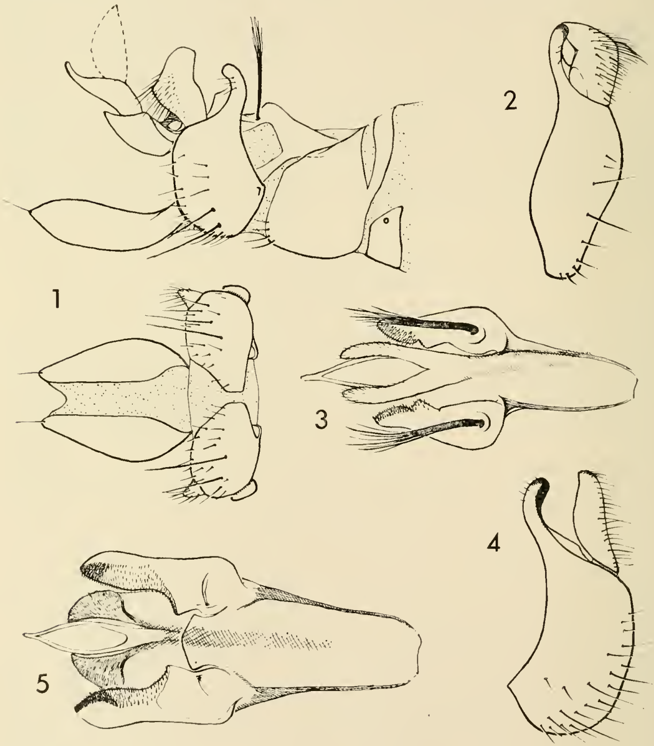
[1]Now Entomology Research Division, A.R.S., U. S. Department of Agriculture, Washington 25, D. C.

I have examined the following specimens. FLORIDA: Flagler Co., 18 March 1930, fruit fly trap survey (D. B. Webb), 1 ♀; Hillsboro Co., 8-15 March 1930, fruit fly trap survey (C. L. Rabb), 1 ♂; Sebring, 31 Dec. 1949, at exuding sap of oak (H. V. Weems, Jr.), 1 ♂; GEORGIA: "Southern Georgia" (Morrison), ♂ lectotype, allotype, and 7 paratypes; MARYLAND: Aitkin, 1 Nov. 1930 (C. T. Greene), 2 ♀; Camp Meade, June 1919 (R. C. Shannon), 8 ♂, 3 ♀; College Park, 5 July 1925 (G. M. Greene), 1 ♀; Plummers Id., 7 Aug. 1912 (P. R. Myers), 1 ♀; MICHIGAN: Detroit, 11 June 1944 (G. C.



Figs. 1-3. **Traginops irroratus** Coq. 1, Camp Meade, Va., male postabdomen in lateral view and dorsal view of andrium; 2, So. Georgia, paratype, lateral view of epandrium; 3, same, ventral view of hypandrium. Figs. 4, 5. **Traginops purpurops** Stey., sp. nov. 4, Plummers Id., Md., paratype, lateral view of epandrium; 5, same, ventral view of andrium.

Steyskal), 2 ♂; South Haven, 23 June 1938 (C. W. Sabrosky), 1 ♂; NEW MEXICO: Albuquerque, 18 July 1944; "orient survey / 44-17802 / peach cherry," 1 ♀; PENNSYLVANIA: Angora, 18 Aug. 1907 (C. T. Greene), 2 ♂, 3 ♀; Lehigh Gap, 14 July 1907, 2 ♀; TEXAS: Kerrville, 30 June 1953 (L. J. Bottimer), 3 ♀; VIRGINIA: Falls Church, 15 July, 1 ♀; same, 17 July 1912 (C. T. Greene), resting on trunk of *Fagus*, 2 ♂; same, 22 June 1912 (C. T. Greene), resting on trunk of *Quercus*, 2 ♂; all in United States National Museum, except the Michigan specimens, of which those from Detroit are in my collection and that from South Haven is in the collection of C. W. Sabrosky. Dr. Guy E. Shewell advices me that specimens from Ottawa and Niagara Glen, Ontario, are of this species.

Traginops purpurops, new species
(Figs. 4, 5, 7)

Very similar to *T. irroratus* Coq., except in postabdomen, dark purple color of eye in life, and in having duplicate vibrissae, that is, consisting of two bristles of nearly equal size on each side, about 0.1 mm. apart.

Male.—Postabdomen in general conformation much as in *T. irroratus*; epandrium (Fig. 4) somewhat broader and more curved in profile, anterior prong relatively longer and more curved; surstylus straighter, narrower, and in posterior view with 60° median tooth on mesal side; inner copulatory apparatus (Fig. 5) without the hair pencils of *T. irroratus*, in their place being only a few short,

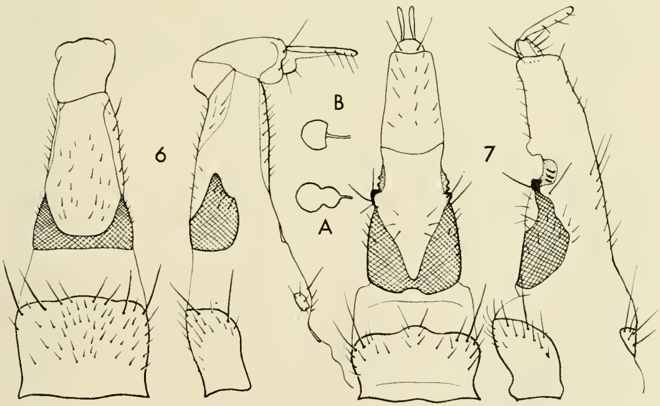


Fig. 6. **Traginops irroratus** Coq., Angora, Pa., dorsal and lateral views of female postabdomen (ovipositor); A, B, two types of spermathecae. Fig. 7. **Traginops purpurops** Stey., sp. nov., Detroit, Mich., paratype, dorsal and lateral views of female postabdomen. N.B.: In Figs. 6 and 7, tergite 6 is cross-hatched.

inconspicuos hairs; lateral lobes of hypandrium of quite different shape; phallobase with flared apical collar.

Female.—Postabdomen (Fig. 7) with tergite 6 distinctly scalloped apically, subbasally with pronounced transverse sulcus; tergite 7 deeply angularly emarginate, its lateral lobes knobbed at tip and followed by a saddle-like groove across the dorsum, at each side of which a small area bears two or three ridges.

Spermathecae two, much as in *T. irroratus*, one of the topotypical paratypes with one spermatheca each of types A and B and a Falls Church paratype with both spermathecae of type B; accessory glands oval, at the end of ducts nearly as long as those of the spermathecae.

Holotype (♂), allotype, and one pair of paratypes, Detroit, Michigan, 21 June 1942, on trunk of *Robinia pseudacacia* feeding at borer frass (G. C. Steyskal), in my collection; paratypes: same locality, 28 June 1942, 1 ♀, and 11 June 1944, 4 ♀, all collected by me and in my collection; KANSAS: Troy, 25 Aug. 1932 (R. L. Parker), 1 ♂; MARYLAND: Bowie, 12 June 1945, DDT Expt., 1 ♀; Camp Meade, May-June 1919 (R. C. Shannon), 2 ♂; Plummers Id., 3 Aug. 1912 (J. R. Malloch), 4 ♂; same, 4 Aug. 1912 (W. L. McAtee), 1 ♀; same, 7 Aug. 1912 (P. R. Myers), 1 pr.; MICHIGAN: Cassopolis, 24 June 1943 (C. W. Sabrosky), 2 ♂; TEXAS: Columbus, 15 Aug. 1904,, on sap of Celtis, 1 pr.; VIRGINIA: Falls Church, reared 9 May 1916, *Robinia*, host *Ecdytolopha insitiana* Zell., Hopkins no. 12103 N6 (C. Heinrich), 3 ♀; same, 9 July 1956 (W. W. Wirth), 1 ♀; Glencarlyn, 2 July (N. Banks), 1 ♂; all in U. S. Natl. Mus.

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THE DISTRIBUTION AND HABITS OF THE MINT APHID OVATUS CRATAEGARIUS (WALKER)[1]

(HOMOPTERA: APHIDAE)

MORTIMER D. LEONARD, *Washington, D. C.*

On May 29, 1960 a few small greenish yellow aphids, about 1.5 mm. in length, were found in the spearmint patch in the garden of Dr. Harold H. Shepard in Arlington, Virginia. These proved to be what has been called in American literature and collections as *Phorodon menthae* (Buckton). Never having seen this aphid alive before my curiosity was aroused to find out what is known about its distribution and habits. Its earliest occurrence in North America was recorded by Williams who collected it at Weeping Water, Nebraska in 1888, the next was from Aurora, Oregon in 1893 and the third was its collection by Pergande in 1902 at Cabin John Bridge, Maryland just over the District of Columbia line. It was not subsequently found on this Continent until 1933 when George E. Gould collected it in Indiana.

In his "Francis Walker's Aphids" on page 50, 1961 Mr. J. P. Doncaster calls this aphid *Ovatus crataegarius* (Walker). Dr. D. Hille Ris Lambers concurs in Doncaster's synonymy and wrote me in support of it on March 15, 1962. I quote what he says:

"The question of *Phorodon menthae* (Buckton) is more complicated than it would seem and it is certainly not a matter of preference whether this name or *Ovatus crataegarius* (Wlk.) should be used. From Buckton's material, which still exists, it is clear that the apterous female is not at all what you think but *Aulacorthum solani* (Kalt.) (Myzus *pseudosolani*). Doncaster is emphatically right in using the specific name *crataegarius* Wlk. for the mint aphid. This species also in North America hibernates as eggs on *Crataegus* and sometimes on apple and *Cydonia*. That is the reason why it got the name *crataegarius*. Besides, viviparae hibernate on *Mentha* when the climate is sufficiently mild.

"*Ovatus* is undoubtedly a name that ought to be used instead of *Phorodon* as far as this species is concerned. There is a well defined group of four old-world species that comprise the genus *Ovatus* which primarily is associated with Pomoideae (apple-like Rosaceae), migrates to Labiatae as summer hosts or has developed an independent cyclus with sexuales on Labiatae.

"*Phorodon* on the other hand is associated with Prunoideae (plum-like Rosaceae), from where it migrates to Urticaceae as summer hosts or has developed a complete cycle on Urticaceae with three old-world species of which you have one."

Examination of the literature and correspondence with other entomologists has shown that the mint aphid is widely distributed in the United States but that it is largely confined to the northern and temperate sections. Its known world distribution would indicate its preference for such areas which coincides with the distribution of the species of *Mentha*, its exclusive summer food plants.

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[1]Paper read at the 33rd Annual Meeting of the Eastern Branch, Ent. Soc. Am., Baltimore, Md., Oct. 30, 1961.

This aphid has never been found in Florida or Louisiana although a great deal of careful aphid collecting has been done in these States, especially in the former, for many years. Dr. Tissot in Florida writes me that the mints are scarce in the State but Dr. Boudreaux says that in Louisiana they are locally common. It is now known to occur in 21 States and the District of Columbia. In six of these it was not known to occur until 1960 when I induced a local entomologist in each to go out and establish its presence. It is probable that the mint aphid can be found in every State but its relative scarcity and small size renders it difficult of detection. In this hemisphere it has been collected only twice on *Crataegus*, both collections in New York and in 1960.

California.—"Collected at Stanford University, Cal. from April 1-30." (Paul S. Bartholomew, Ann. Ent. Soc. Am. 25: 727, 1932.). Berkeley, 30 Mar 1935 on *Mentha spicata* (Essig coll and det, 1 slide of 10 apterae in MDL's Coll.).

Colorado.—"On leaves of *Mentha* sp. Boulder and Ft. Collins. Apterous summer viviparae all months of the year; alate viviparae all months except April, May and July; fairly common." (M. A. Palmer in "Aphids of the Rocky Mountain Region" p. 345, 1952). In August 1960 Dr. Palmer wrote me that a total of 26 collections had been made from 1911 to 1929 and that it had also been recorded from Longmont.

Connecticut.—Yalesville, Sept 1954 (J. Curtiss col.) and Wallingford, June 1960 (J. Kring coll.)—in letter from Dr. Kring, Sept 1960.

District of Columbia.—Washington (Cosmos Club), 21 July 1960 (MDL coll.) on *Mentha spicata*, scarce, no alates.

Hawaii.—Paio (Prison Camp), Island of Hawaii, 3900 ft. on leaves of *Mentha* sp. (C. J. Davis, Proc. Hawaiian Ent. Soc. for 1946 13 (1): 20, 1947). C. E. Pemberton wrote me in 1960 that this locality is a cool mountain town and distinctly not tropical in climate.

Illinois.—Urbana, 7 Aug. 1960 on *Mentha vulgaris*, many apterae and nymphs (H. H. Ross & C. O. Mohr coll.). Urbana, 23 May 1952 on mint (E. A. H. Smith coll., 4 slides with 4 specimens in Canadian Nat. Coll.).

Indiana.—Although this aphid is undoubtedly present in small numbers throughout the commercial mint growing areas of the State it has only rarely been identified. In his "Insect Pests of Mint" (Purdue Univ. Agr. Exp. Sta. Circ. 211: 7, 1935) George E. Gould says "Several species of plant lice occur on field mint but no serious infestations have been observed to date. Plants used in the laboratory for insecticidal tests were severely infested with *Phorodon menthae* (Buckton). A decided preference was shown for the terminal growth with most of the lice feeding on the stems, although a few were found on the underside of the leaves. In a few weeks time the stems became twisted and the leaves curled so that the plants had to be discarded. The field infestations to date would not warrant the usual insecticide control measures recommended for plant lice."

The USNM has 2 slides with several apterae from Warsaw, Ind., 8 Aug 1933 on peppermint collected by Geo. E. Gould. In Nov 1960 Dr. Gould wrote me that mint growers tell him that lice are found on spearmint but are rare on peppermint. He adds "I found none on peppermint this summer and I did do quite a little searching for them."

Maine.—Presque Isle, Sept 1951 from trap catches, in Me. Agr. Exp. Sta. Coll. (Essig det., data from G. W. Simpson).

Maryland.—Cabin John Bridge, 20 June 1902 on "wild mint," many apterae, 1 alate (2 slides by Pergande in USNM). Westgate (almost on the DC line) 8 June 1960 on *Mentha* sp. (E. J. Hambleton coll., LMR det.). College Park, 28 July 1960 on *Mentha spicata*, about 3 dozen apterae (P. J. Spangler, Jr. coll.); Lusby (Calvert Co.), 15 June 1960 on *Mentha spicata* (T. L. Bissell coll.). University Park, 9 July 1960 and 28 May 1961 on *Mentha spicata* (T. L. Bissell coll.).

Massachusetts.—Amherst, 6 Aug 1960 on *Mentha piperata* (C. P. Alexander coll.).

Michigan.—Although Michigan is one of the principal mint growing States the mint aphid has never been identified from it. Dr. Ray Hutson, Head, Department of Entomology, Michigan State University, wrote me in July 1960 "We have never recognized *Phorodon menthae* (Buckton) on mint."

Missouri.—Columbia, 4 June 1961 on *Mentha spicata*, apterae and 1 immature (W. R. Enns coll.).

Nebraska.—Weeping Water, 11 Oct. 1888 on wild mint (*Mentha canadensis*, now called *M. arvensis* var. *villosa*) (T. A. Williams, Nebraska Univ. Studies 10 (2): 82-83, 1911).

Nevada.—Logandale, 13 May 1935 Knowlton coll. (George Knowlton, Ent. News 54: 124, 1943). Reno, Idlewild Park, 21 Oct 1939 on mint (E. A. Drews, Pan-Pacific Ent. 17(2): 59, 1949).

New Jersey.—Highland Park, 5 June and Mountainville, 4 Nov 1960 on *Mentha spicata* (H. E. Wave coll.). Medford, 7 Oct a few apterae and 20 Oct 1962 several apterae on *M. spicata* (Marie C. Quinden coll.). Medford Lakes, 25 Sept 1961, 1 aptera on *M. spicata* (G. G. Rohwer coll.).

New Mexico.—Mesilla Park, 5 April 1956 on mint (1 slide in USNM).

New York.—Its known distribution indicates that this aphid is present throughout the State. Ithaca, 26 July 1939 on *Mentha spicata* (Griswold coll., 2 slides in CU Coll.); 27 June 1952, an alate collected "near a potato field" (Kerr coll., 1 slide in USNM). Lockport, 11 Aug. and 22 Nov. 1960 on *Mentha spicata*, a very few apterae (L. L. Pechuman coll.) and 4 July 1960 on *Crataegus oxycantha* var. *paulii* (Pechuman coll., CFS det.). Remsen, 24 Sept. 1960 on *Mentha cardiaca*, a very few apterae and a few alatoids on the leaves and stems (Geo. N. Wolcott coll.). Long Island: Orient 11 Aug. 1959, in heads, and 27 July 1960, a few young in top leaves of *Mentha crispa*; also 23 July 1960, a few, nearly all immature, on *Mentha spicata*

(Roy Latham coll.); Orient, 11 June 1960 on *Crataegus chrysocarpus* (Latham coll., Clyde F. Smith det.); Orient, 13 Sept. on *M. crispa* and 1 Nov. on *M. citrata* 1961 and 14 Sept. on *M. crispa,* 4 Oct. on *M. piperata* and 21 Oct. on *M. longifolia* 1962—only a few specimens in each case and all Latham coll.

North Carolina.—10 Mar. 20, 28 May 1959 and 16 Apr. 1960, all on mint (data from C. F. Smith).

Oregon.—Although this is the second largest mint producing State the mint aphid is little known here. The only definite records of its occurrence are the following: Amora, 6 June 1893 on mint, many apterae, 1 alate (3 slides in USNM, Pergande det. No. 5764).[1] Madras (in central Oregon) 22 July 1960 and in the Wilamette Valley, 20 July 1960 a number of apterae, on peppermint (H. E. Morrison coll.).

Pennsylvania.—Dr. J. O. Pepper collected the mint aphid in a garden in State College on 12 and 25 Aug. 1960 and again nearby at The Rock along Spring Creek, 20 Aug. 1961. He writes that only a very few wingless aphids were found outdoors but that when sprigs of mint were brought indoors and placed in a glass of water the aphids soon reproduced so rapidly as to kill the little branches. He states this was the only way he could get winged specimens.

Utah.—"In Utah on *Mentha spicata* at Hooper, 24 July 1942 with *Orius tristicolor* Wh. feeding on one of the specimens; Hurricane, Logan, Ogden, Providence, St. George and Santa Clara; on *Mentha penardi* [*canadensis* (*arvensis*)—Canada mint] at Mt. Timpanagos, 26 July 1942; (Geo. F. Knowlton, Ent. News 54: 124, 1943).

"A five-spotted ladybird beetle, *Hippodamia quinquesignata* Kirby, was found to be feeding on a tiny wingless aphid, *Phorodon menthae* (Buckton), on *Mentha spicata* at Nephi, Utah, 26 June 1945" (Geo. F. Knowlton, Ent. News 60: 234, 1949).

"The two-spotted ladybird beetle, *Adalia bipunctata* (L.) was observed feeding on . . . *Phorodon menthae* on ditch bank spearmint at North Farmington, Utah, 9 July 1947. For several weeks this *Mentha spicata* was heavily infested with this little aphid which in turn was attacked by numerous larval and adult ladybird beetles of several species as well as by large numbers of *Orius tristicolor* besides a few *Anthocoris melanocerus* Reuter and Syrphid and aphid-lion larvae." (Knowlton, l.c. pp. 235-236).

"Common on *Mentha spicata* in Northwestern Utah; being preyed upon by both 2-spotted and convergent ladybird beetles, by *Orius tristicolor* (White) and by Syrphid larvae in a heavy infestation at Farmington on the Experimental Farm, 19 June 1947 (Knowlton); at Hooper, Logan, Magna, Nephi, Ogden, Provo Canyon, Mt. Tim-

[1]Although these slides are clearly labelled in ink "Amora, Ore" Dr. Morrison can find no such locality on any Oregon maps, past or present, available to him. He suggests that Amora may have been written in error for Aurora which is a small town on 99E between Oregon City and Woodburn about 200 miles South of Portland.

panogos and Midvale." (Knowlton in Utah Agr. Exp. Sta. Mimeo Series 387: 21-22, 1952).

Virginia.—Arlington (residence of Dr. Harold H. Shepard), 29 May 1960, several apterae, a few immatures and 3 alatae from a small patch of spearmint (D. P. Leonard coll.) on 2 Dec. 1960, although nearly all the plants were dead, 3 apterae and 1 alatoid nymph were found and several apterae on 25 June 1962 (MDL Coll.).

Washington.—This is the largest commercial mint growing State. According to USDA's Crop Reporting Board in 1958 there were 1200 acres of peppermint and 3000 acres of spearmint under cultivation. The State Extension Service reported the value of the oil at about \$3.8 million and \$1.1 milion respectively. Plantings are concentrated mostly in the Yakima Valley where mint has been grown for many years. B. J. Landis, Entomology Research Branch, ARS, USDA, wrote me in July 1960 that "This species causes economic damage to peppermint during some years, and in some fields—usually the latter part of July. I have seen peppermint foliage sticky from honewdew, most of which, I presume, came from apterae of *menthae*. Usually the infestation does not last too long; growers have, in past years, applied TEPP and possibly other phosphate-type insecticides for control of this aphid."

Davis, Landis and Gibson report the earliest collection of the mint aphid (on peppermint) in the Yakima Valley between 1947 and 1953 as 24 August and the latest on 21 October. (Jour. Econ. Ent. (47(*6*): 1120, 1954).

Herman Menke, Consulting Entomologist of Wapato, Wash., has worked closely for several years past with the mint growers in the Yakima Valley on their insect control problems. He wrote me in November 1960 that the mint aphid is not a critical economic pest of peppermint and spearmint there, having been bad in only one year out of the past four, to the extent that there is considerable honewdew a few weeks before cutting.

K. E. Frick, also working in the same area, reports that "The mint aphid has seldom become sufficiently numerous to cause damage, but its continued presence in most mint fields has posed a constant threat. An application is generally made for aphid control, usually in combination with an acaracide. Several of the phosphate insecticides have been used successfully." (Jour. Econ. Ent. 54(4): 645, 1961).

Specific records available are as follows: Toppenish, 6 July 1949, alatae from potato foliage; Union Gap, 24 Aug. 1951, apterae on peppermint; Harrash, 24 Aug. 1951 apterae on peppermint; Wapato, Aug. 1955 on peppermint (data from B. J. Landis, LMR det.); Prosser, 31 July 1956 (1' slide in USNM, LMR. det.). Othello, 22 July 1960 on mint, alates and apterae (B. J. Landis coll., MDL det.).

Puerto Rico.—In "The Insects of Puerto Rico" (Jour. Agr. Univ. P. R. 32(1): 155, 1948) G. N. Wolcott states that aphids from mint have been identified by P. W. Mason as *Phorodon methae* (Buckton). No slides to support this statement can be found in the USNM. Dr.

C. F. Smith tells me that he was unable to find any aphids on a patch of mint at Rio Piedras he examined in the spring of 1960.

Latin America.—In the USNM are slides of this aphid from interceptions on mint made by USDA Plant Quarantine inspectors from Mexico, Brazil and Chili. The localities in which the mint originated are unknown except for Brazil which came from Campinas on *Mentha arvensis.* The interception was made in New York, 10 Mar. 1937. Edson J. Hambleton of USDA, who was formerly Entomologist of the Instituto Biologico there, tells me that Campinas is in a semitropical climate in which bananas and citrus fruits are grown.

Canada.—British Columbia—Vancouver, 8 May 1958 on *Mentha* sp., 2 slides, 2 specimens, H. R. MacCarthy coll. and Ontario—8 June 1954 on apple, 1 slide, 5 specimens, G. Garlick (data from W. R. Richards from records in the Canadian National Collection).

The following records are from Dr. M. E. MacGillivray: New Brunswick—Covered Bridge, 10 June 1957, alates, Curries Mt., 17 June, 1 aptera and 24 June, 1 alate 1957 on *Malus* (apple), MacGillivray coll.; Maugerville, 21 Oct. 1955 on *Mentha arvensis,* 1 aptera (Pond. coll.); Fredericton, 12 Sept. 1951, 3 nymphs and 30 Oct. 1955, 4 nymphs on *Mentha* (MacGillivray coll.). Nova Scotia—all on *Malus* (apple): Horton, 14 Jan. 1959, alates (Horsburg coll.); Brookland, 13 Jan. 1950 (H. T. Stultz coll.); North Grand Pre, 14 Oct. 1959, alate (Horsburg coll.); Gaspereaux, 14 Oct. 1959, 2 alate females and 3 alate males (Horsburg coll.).

Europe.—In August 1960 Dr. Hille Ris Lambers wrote me that this aphid is indigenous to Europe and so common that there is no need to specify localities. He stated that it occurs in: Denmark, Sweden, England, Netherlands, Germany, Poland, Czechoslovakia, Romania, Bulgaria, Yugoslavia, Austria, Italy, France, Switzerland, Belgium and that the countries not here listed undoubtedly have it if they have *Mentha.*

Great Britain.—Mr. V. F. Eastop writes me that the BM has numerous records for England from Walker's time onward but gives two specific records from the BM—Wales, 10 July 1923 on garden mint (Theobald coll.) and Gurnsey, 4 June 1951 on *Mentha piperata* (VFE coll.). He adds that it has not been recorded from either Scotland or Ireland but assumes it occurs in both. I have found a slide with 2 apterae from mint in the USNM. This is from an interception from "Scotland" by USDA's Plant Quarantine Inspector Max Kisliuk, Jr. at Philadelphia, Pa. on 7 Sept. 1923.

In "The Plantlice or Aphididae of Great Britain" vol. II, pp. 278-279, 1926 Theobald, under the name *Phorodon menthae* (Buckton) lists this aphid from Windermere, Wye, Bartley, New Forest, Chelsea, South Wales; Penyfford, North Wales. He gives as food plants water mint (*Mentha aquatica*), *Mentha arvensis* var. *vulgaris* and garden mint (*Mentha viridis*). He states "It lives under the leaves of watermint, often close to the damp earth or water, and also in the blossom heads. On the garden mint it lives in the same manner."

Australia.—E. H. Zeck in the Australian Naturalist, 9(2): **135,** 1933, records it from Haberfield, New South Wales, on *Mentha viridis*. USDA Plant Quarantine inspectors at Hawaii intercepted this aphid on the leaves and stems of spearmint from "Australia" 21 June 1952 (1 slide in USNM). V. F. Eastop (in litt.) adds records in the BM from Canberra, A.T.C., 9 Sept. 1959 on mint (Mary Carver coll.); Melbourne, Victoria, 22 Mar. 1959 on garden mint and 3 June 1959 on *Mentha rotiundifolia* (VFE coll.).

Russia.—It also occurs here where it may be widely distributed although I have been able to locate only two published references. One is by V. P. Nevsky in Usbek Exp. Plant Sta. (Uzostazra) No. 16, p. 148, 1929 who records this aphis from Tashkent on the stems and both sides of the leaves of *Mentha sylvestris* and on the leaves of *Inula* among colonies of *Phorodon inulae*. The other reference is by J. Zirnitz in Zeitschr, f. Wiss. Insectenbiol. bd. 22: 207, 1927 who records it from Priekuli near Riga, 30 July 1926 on *Mentha arvensis*.

New Zealand.—In his excellent book "Aphids of New Zealand" (N.Z. Dept. SCI. and IND. Res., Bul. 106, 1953) Dr. W. Cottier discusses the mint aphid on pp. 263-269 under the name of *Ovatus menthae* (Walker). Feeling that there was a possibility that the aphids occurring on *Crataegus* and on *Mentha* might be different species he describes and figures each in detail. Concerning this aphid he says:

"In New Zealand the insect is very common on garden mint (*Mentha spicata* L.). It seldom causes severe damage, however, although beds of this plant are often heavily infested. It has been taken on young shoots of hawthorn (*Crataegus oxycantha* L.) in December and January. Infestation does not appear to be severe enough to be of much economic importance, colonies containing only a few individuals. In May apterous viviparous females and overwintering eggs were collected on hawthorn, eggs when first laid being greenish but later turning glistening black. It is probable that the species is widely distributed, since it has been found on widely separated localities such as Palmerston North in the North Island and Lumsden in the South."

Hosts and Distribution are given as follows:

Crataegus oxycantha L., Lumsden, W. Cottier, 22 Jan. 1930; Palmerston North, W. Cottier, 14 Jan. 1935, 5 Jan. 1937.

Mentha piperata L., Aukland, W. Cottier, 10 Oct. 1939.

Mentha spicata L., Stratford, W. Cottier, 28 Dec. 1936, 29 Mar. 1937; Palmerston North, W. Cottier, Dec. 1936; Aukland, W. Cottier, Oct. 1939.

V. F. Eastop (in litt. March 1962) adds: Ashburton, Dec. 1929, Cottier coll., in BM on *Mentha viridis* and Ohakune, March 1923, no plant given, T. H. Harris coll., in BM).

Formosa.—The only record is by Takahashi from Taihoku. "Many winged and wingless viviparous females were collected by the author on Oct. 24, 1922 on *Mentha arvensis* L. var. *vulgaris* Beuth. ("Aphids of Formosa," Pt. 2, pp. 23-24, 1923).

Japan.—M. Hori recorded the mint aphid on *Mentha arvensis* var. *vulgaris* in Hokkaido Agr. Exp. Sta. Rept. No. 23, pp. 80-82, Oct. 1929. Dr. Takahashi, in a letter of Oct. 1960 calls to my attention that the late George O. Shinji listed *Myzus menthae* (Buckton) from over 50 localities in Hokkaido, Honshu and Kyushu in his "Monograp of Japanese Aphididae" p. 997, published in Japanese in Tokyo, 1941. Takahashi adds "The species is common near Osaka on the wild species of *Mentha.*"

China.—Takahashi (in litt. Sept. 1960) writes that he knows of no records from China but believes it is probably found there. Mr. J. P. Doncaster wrote me in September 1960 that the BM has a slide with 3 aptere collected before the war by a Chinese entomologist, M. S. Yang, about whom he has no information. He is not sure if these aphids are *crataegarius* or *insitus* although the available evidence on their distribution suggests that the former is more probable.

South Africa.—"Some of the apterae were found together with larvae on *Mentha* sp. on 29 Aug. 1956 at Irene." (Müller and Schöll, Jour. Ent. Soc. S. Afr. 21(2): 401, 1958).

Southern Rhodesia.—3 Feb. 1958 on garden mint (Dept. Agr.)—a record in the BM furnished by V. F. Eastop.

MEDETERA LONGIMANA VAN DUZEE A SYNONYM OF MEDETERA CALIFORNIENSIS WHEELER

(DIPTERA: DOLICHOPODIDAE)

It has been possible to examine and compare the holotype male of *Medetera longimana* M. C. Van Duzee (1933, Amer. Mus. Nov., No. 655: 12) with the series of eight cotypes (four males and four females) of *Medetera californiensis* W. M. Wheeler (1899, Proc. California Acad. Sci., (3)2(1): 27) that are deposited in the collection of the American Museum of Natural History. As a result of this study I believe *M. longimana* Van Duzee, 1933, to be a synonym of *M. californiensis* Wheeler, 1899.

The type locality for both names is Palo Alto, California. The holotype male of *M. longimana* is a teneral specimen with the head, abdomen, and legs partially collapsed. It was described as 2.5 mm. in length, but this short length is due to the collapse of the abdomen; probably it would be at least 3 mm. in length if the abdomen were properly extended. Also the wing length of 4 mm. given for *longimana* is excessive; it is closer to 3.5 mm. When the type of *longimana* and the cotypes of *californiensis* are run in Van Duzee's key to the genus *Medetera* (1928, Psyche, 35: 38-43), the interpretation of couplet 18, which compares "Bristles above fore coxae black" versus "Bristles above fore coxae pale, white or yellowish," offers some difficulties. There are two bristles on the left side above the front coxa visible in the type of *longimana,* and the color of these appears to be brown for the lower bristle and off white for the upper bristle, rather than black, as described by Van Duzee. Wheeler described the bristles above the fore coxae in *californiensis* as white, which Van Duzee followed in his key, but I find that these may vary from light yellowish-white to brown, differing on various cotype specimens. Wheeler keenly observed a "small tooth-like projection" on the inner side of the hind metatarsus in the male of *californiensis.* I find this also present in *longimana,* even though it is not mentioned in the original description.—

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BOOK REVIEW

A Catalogue and Reclassification of the Indo-Australian Ichneumonidae by Henry Townes, Marjorie Townes, Virendra K. Gupta. With collaboration on the subfamily Ichneumoninae by Gerd Heinrich, and a key to the genera by Henry Townes. iv, + 522 pp. Published by The American Entomological Institute, 5950 Warren Road, Ann Arbor, Mich. 1961. Photolithoprinted. Price $14.50 postpaid.

This publication is a must for taxonomists interested in, or working on Ichneumonidae from the Indo-Australian region as defined by the authors on page one. The prospective user of this work should make certain he first reads the paragraphs at the beginning headed: Geographic and Biblographic Scope; Taxonomic Objectives; Nomenclature; and Type Specimens.

The catalogue has a format very similar to that of Hymenoptera of America North of Mexico—Synoptic Catalog, U. S. Dept. Agr. Monograph No. 2. It contains keys to the subfamilies and tribes as well as to the genera of the Indo-Australian region. These are very useful keys and are helpful to workers in Ichneumonidae of other regions as well, and especially so, if the user will remember the author's statement to the effect that characters used were in some instances applicable only to the species from the Indo-Australian area. This was done "for the sake of an easier key." Generally, characters applicable to world fauna were used.

Other good features of the publication are: The index to hosts and parasites of ichneumonid species; the table of contents which is quite complete, giving not only the subfamilies and tribes but the subtribes and genera also; and a list of Museums and collections containing type specimens noted in the catalogue.

In this, as in other recent works of Dr. Townes, the names *Pimpla, Ichneumon, Ephialtes,* and *Cryptus,* for example, are not applied in the sense of the type species set by the International Commission on Zoological Nomenclature and this must be kept in mind when using the catalogue.

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A NEW SPECIES OF GHILIANELLA FROM HAITI
(HEMIPTERA REDUVIIDAE)

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The present paper describes a new species of *Ghilianella* from Haiti. This is the third species known from Haiti, the other two are *G. haitiana* Maldonado and *G. gerstaeckeri* (Dohrn)

The author is indebted to Mr. Leonce Bonnefil, entomologist from the Department of Agriculture, Port-au-Prince, for his cooperation and assistance.

Ghilianella zomata, new species

Easily separated from all other known species, excepting *G. monense* Maldonado, by the banded appearance of the abdomen. *G. monense* also has a banded abdomen but the silver bands are basal while the golden bands of *G. zomata*, new species, are caudal.

Male.—Head dorsally, thorax, abdomen, and mid and hind legs blackish; head ventrally, beak, and fore legs dark brown. Abdomen with banded appearance due to a heavy concentration of short golden yellow hairs on caudal fourth of segments three to five; on the sterna the hairs are more concentrated laterally. Interantennal spine yellowish; legs unbanded. Sparse, short, appressed pilosity over body, more concentrated on abdomen and causing the above mentioned banding.

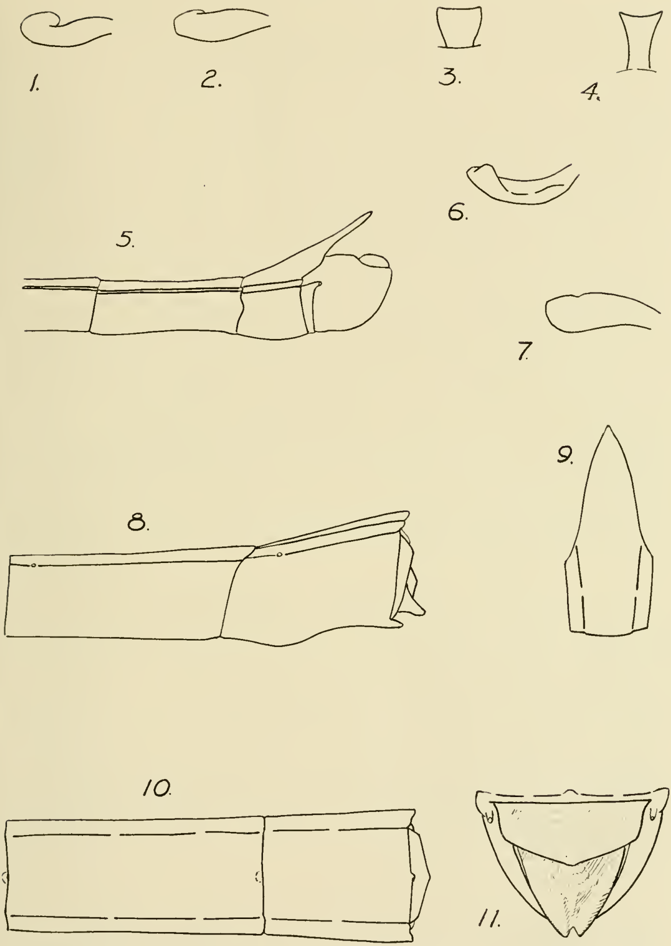
Head sparsely granulated; eyes small. Interantennal spine long and straight. Fourth antennal segment twice as long as third.

Thoracic segments sparsely granulate, relative lengths of segments: 4.2, 4.0, 3.3. Claws of fore tarsi two, the inner very short and closely appressed to base of outer. First spine of fore femur at three and one half times its own length from tip of trochanter; basal half of fore femur gradually thickened to first spine. Armature of fore femur with inner row consisting of bristles arising from wart-like bases.

Abdomen almost parallel sided; posterior angles of terga not produced; terga with low longitudinal median ridge. Hind margin of each tergum straight, with small black median wart. Fifth tergum longer than sixth; sixth longer than seventh (relative lengths: 3.5, 3.1, 2.9). Seventh tergum slightly widening to basal third where the constriction begins, thence tapering in a very shallow s-curve to apex; reaching to apex of hypopygium (fig. 9). Hind margins of second to fifth sterna straight; of sixth concave medianly and convex on sides; of seventh very shallowly concave on sides; of eighth straight. Eighth sternum visible on its entire width, spiracle pedunculate (fig. 5). Hypopygium opening upwards; upper margin laterally with a shallow elongate concavity. Clasper on lateral view nearly three times as long as wide, curved mesad as seen from above (figs. 6 and 7). Apical process of hypopygium hidden by claspers, upper margin shallowly concave, lateral margin concave (fig. 4).

Over-all body length: 26 mm.

Female.—Body dark brown, paler than male. Interantennal spine straw colored. Mid and hind legs and antennae light brown; antenna with first and second segments with five or six dark brown annuli; mid and hind femora each with three or four brownish annuli; mid and hind tibiae each with a conspicuous dark brown



Ghilianella monense Maldonado, male. Fig. 1, clasper, dorsal view; fig. 2, clasper, lateral view; fig. 3, apical process of hypopygium, caudal.

Ghilianella zomata n. sp. Fig. 4, male, apical process of hypopygium; fig. 5, male, last abdominal segments, lateral; fig. 6, male, clasper, dorsal; fig. 7, male, clasper, lateral; fig. 8, female, last abdominal segments, lateral; fig. 9, male, seventh tergum; fig. 10, female, last abdominal segments dorsal; fig. 11, female genitalia, caudal.

basal and apical band. Tarsi dark brown. Forelegs brownish, irregularly variegated with yellowish brown; femoral spines pale yellow with black apices.

Thorax with very scarce short pilosity. Third to fifth abdominal segments with a concentration of golden short appressed pilosity on apical third giving them a banded appearance; pilosity heavier on terga than on sterna, banding less conspicuous than in male. Remaining parts of abdomen with scarce pilosity but heavier than on thorax.

Head very sparsely granulate; eyes small. Long interantennal spine, straight. Fourth antennal segment twice as long as third.

Thoracic segments very sparsely granulate; relative lengths of segments: 3.1, 3.0, 2.5. Claws of fore tarsi two, the inner very short and closely appressed to outer. First spine of fore femur at three and one-half times its own length from tip of trochanter; basal half of fore femur gradually thickened to first spine. Armature of fore femur as in the male.

Abdomen parallel-sided, not bulbous; last abdominal segment the widest (fig. 10). Posterior angles of terga not produced; each tergum with a low median ridge and a small inconspicuous wart medianly on apical margin. Fifth tergum longer than sixth; sixth longer than seventh (4, 3.5, 2.1). Seventh tergum longer than wide; hind margin not declivate; with apical angles produced, with a median tubercle subequal to apical angles (fig. 10). Eighth tergum slightly over twice as long; hind margin roundly produced; transversely corrugate and with a median ridge. Ninth tergum corrugate; apex upcurved (fig. 8), apical margin distinctly emarginate; with three transverse corrugations on basal half and a median carina on apical half of disc, as in figure 11.

Seventh sternum shorter than sixth, somewhat inflated below before middle; hind margin produced; projection rectangular, slightly longer than wide at base (fig. 8). Over all body length: 28 mm.

This species is very closely related to *Ghilianella monense*, the only other species with a banded abdomen. In both cases, the banded appearance is due to a concentration of pilosity. However, in *G. monense* the pilosity is basal and silvery and in *G. zomata* it is apical and golden. The external genitalia of both male and female are different in these two species. Details of the claspers (fig. 1 and 2) and of the apical process of the hypopygium (fig. 3) of *G. monense* are illustrated.

Types.—Holotype, male, collected five miles south of Cap Haitien, along the road to Grande Rivière-du-Nord, from hanging dead leaves of banana plants, July 26, 1961; J. Maldonado-Capriles and Leonce Bonnefil collectors; U.S.N.M. Type No. 65934. Allotype, female, same data: in the author's collection.

REFERENCE

Maldonado-Capriles, J., 1960. Assassin bugs of the genus *Ghilianella* in the Americas (Hemiptera, Reduviidae, Emesinae). Proc. U. S. Nat. Museum 112 (3440): 393-450.

CORRECTION IN THE TYPE LOCALITY OF ENDERLEINELLUS MARMOTAE FERRIS

(ANOPLURA: HOPLOPLEURIDAE)

Recently when reviewing the published records for *Enderleinellus marmotae* I became aware of a discrepancy in the type locality as listed by Ferris (Stamford Univ. Pub., Univ. Ser., Biol. Sci. 2(1): 47, 1920) in his original description. This error was repeated by Ferris in one of his later publications and by at least one other author. It is felt this mistake should be corrected before it becomes firmly entrenched in the entomological literature.

In the original description the holotype female is listed as collected from *Marmota monax rufescens* at "Grafton, S. D." The same locality was listed by Werneck (Mem. Inst. Osw. Cruz 45(2): 305, 1947) and again by Ferris (Mem. Pacific Coast Ent. Soc. 1:110, 1951). Insofar as I am aware these are the only published references in which the type locality is mentioned.

The examination of several atlases failed to disclose a Grafton, South Dakota but always a Grafton, North Dakota. The type host has never been recorded from South Dakota although it is known from eastern North Dakota and there is a record from Grafton, North Dakota (Hall and Kelson, The mammals of North America, p. 324, 1959). For these reasons I propose Grafton, North Dakota as the type locality for *Enderleinellus marmotae* Ferris. The correct citation should read:

Enderleinellus marmotae Ferris, 1920

Type locality—Grafton, North Dakota

Type host—*Marmota monax rufescens*

In an attempt to determine the origin of this error, information was solicited concerning the exact labeling on slides of the type series, from this locality. Only one slide, containing two paratypes (BM(NH) 1920-558), could be located and it bore the designation "Grafton, S. Dakota." Inquiries addressed to Stanford University Natural History Museum, U. S. National Museum, British Museum (NH) and Zoological Survey of India failed to disclose the holotype. It is evident that the type locality designation was not a typographical error but an error in the transcribing of collection data, either at the time the host was collected or from the host label if the lice were collected from a museum skin.

Information on the material in the four collections was supplied by J. P. Wourms, Jr. (SUNHM), C. F. W. Muesebeck (USNM), T. Clay (BM(NH)) and K. S. Pradhan (ZSI). Their assistance is appreciated.

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NEW SYNONYMS IN AMERICAN CULICOIDES
(DIPTERA: CERATOPOGONIDAE)

Culicoides hollensis (Melander and Brues)

Ceratopogon hollensis Melander and Brues, 1903, Biol. Bull. 5: 13 (Woods Hole, Massachusetts).

Culicoides canithorax Hoffman, 1925, Amer. Jour. Hyg. 5: 284 (Brunswick, Georgia). **NEW SYNONYMY.**

One of the two syntype specimens (see Foote and Pratt, 1954, Pub. Hlth. Monogr. 18: 24) of *hollensis* has come to the U. S. National Museum in the Melander collection. It was mounted on a slide and upon examination proved to be the salt marsh species from the Atlantic and Gulf Coasts known until now as *canithorax* Hoffman. This specimen is hereby designated as the lectotype of *hollensis* and bears the U.S.N.M. Type Number 66,589. The second specimen could not be found and is presumed lost.

Culicoides luglani Jones and Wirth

Culicoides luglani Jones and Wirth, 1958, Jour. Kansas Ent. Soc. 31: 89 (Texas).

Culicoides tenuilobus Wirth and Blanton, 1959, Proc. U. S. Nat. Mus. 109: 354 (Panama). **NEW SYNONYMY.**

A close comparison of the types, and examination of more extensive material from the Southwest, reveals this unfortunate synonymy. New records of *luglani*:

ARIZONA: Cave Creek, Chiricahua Mts., 7000 ft., 24 June 1927, J. A. Kusche, 1 female. Montezuma Wells Nat. Mon., 30 June 1953, W. W. Wirth, 1 female. Oak Creek Canyon, Sedona Ranger Station, 1 July 1953, W. W. Wirth, light trap, 12 males, 10 females; 22 July 1959, C. W. O'Brien, light trap, 3 males, 3 females. Superior, Southwest Arboretum, 16 Aug. 1953, B. Benson, light trap, 1 male, Springerville, Water Canyon Ranger Station, 2 July 1953, W. W. Wirth. light trap, 1 female. Sycamore Canyon, Ruby, Santa Cruz Co., 22 May 1954, G. D. Butler, 1 male, 3 females. MEXICO: Agua Caliente, Sonora, 25 Aug. 1954, Ryckman, Christianson and Spencer, light trap, 1 female. Cholla Bay, Sonora, 25 Apr. 1959, M. S. Adachi, light trap, 1 male. Baja California, 4 mi. n. Todos Santos, 2 Sept. 1959, Radford and Werner, light trap, 1 female. NEW MEXICO: Catron Co., 5 mi. e. Glenwood, 24 June 1953, W. W. Wirth, at light, 1 male.

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RURIC CREEGAN ROARK

1887 - 1962

Dr. Ruric Creegan Roark, head of the chemical research on insecticides in the U. S. Department of Agriculture from 1927 to 1956, died suddenly on May 9, 1962 at his home in Washington, D. C.

Dr. Roark was the son of Ruric Nevel Roark and Mary Creegan Roark. He was born in Glasgow, Kentucky on March 13, 1887. He attended Kentucky State University, Clark College in Worcester, Mass., and the University of Cincinnati, where he received his B.A. degree in 1907. His graduate work was carried out at the University of Illinois (M.A. 1908), University of Wisconsin, and George Washington University (Ph.D. 1917—A Chemical Study of Pyrethrum). In 1913 he married Anna Brown, who survives him.

In 1908 Dr. Roark entered the U. S. Department of Agriculture as an Assistant Chemist in the Laboratory of Vegetable Physiology, Bureau of Chemistry, in Washington, D. C. In 1910 he transferred to the Insecticide and Fungicide Laboratory to work on the development of chemical methods of analysis for insecticides, fungicides, and disinfectants, which the Insecticide Act of 1910 brought under federal inspection. He served as Referee on Insecticides for the Association of Official Agricultural Chemists. In 1918 he left the federal service for employment in industry. He was chief chemist of the United States Sanitary Specialties Corporation in Chicago for a short time, during which he originated and patented the widely used perfumed paradichlorobenzene deodorizing block. From 1918 to 1923 he was a research chemist with the General Chemical Company in Baltimore, where he carried on research to develop products and processes from the laboratory stage to full scale production and also supervised the laboratory which tested all raw materials and finished products of a factory that produced insecticides and a number of other chemicals.

In 1923 Dr. Roark returned to the Department of Agriculture as an Associate Chemist. He spent some time in Texas in association with Dr. F. C. Bishopp and E. W. Laake investigating repellents for the screwworm fly. Later he collaborated with Dr. R. T. Cotton in developing a number of new fumigants, including ethylene dichloride, ethylene oxide, and the formates, to replace the highly flammable carbon disulfide then widely used. Millions of pounds of these new fumigants were used for destroying insects in stored products. The National Association of Manufacturers recognized this accomplishment with a Modern Pioneer Award presented to Drs. Roark and Cotton in February 1940.

A Department reorganization in 1927 resulted in the creation of the Insecticide Division in the Bureau of Chemistry and Soils. Dr. Roark was appointed chief of this Division, which was transferred in 1934 to the Bureau of Entomology and Plant Quarantine and now is the Pesticide Chemicals Research Branch of the Entomology Research Division. Under Dr. Roark's leadership this group made many contributions to the development of new insecticides, improvements in formulating and applying insecticides, and research on insecticide residues. The group also carried out chemical research on insect control materials important to national defense. Dr. Roark served as an adviser on insecticides to the War Production Board during World War II. In 1946 the Surgeon General of the Navy commended Dr. Roark and his staff for exceptionally meritorious service rendered to our naval forces in that war. The Department of Agriculture presented a Distinguished Service Award to this research group in 1948 and honored Dr. Roark personally in 1956 with a Superior Service Award for his inspirational leadership and service to agriculture in developing and improving the use of chemical control methods for insect pests.

When Dr. Roark retired toward the end of 1956 he had published nearly 200 papers and reviews on the chemistry and economics of insecticides and had obtained 11 patents.

Although Dr. Roark's major interest was in the field of chemistry, he was closely associated with entomology throughout his career. He joined the Entomological Society of Washington in 1937. He also was a member of the Entomological Society of America, the American Chemical Society, the Association of Official Agricultural Chemists, the American Association for the Advancement of Science, and the

Insecticide Society of Washington. He served as vice-chairman and chairman of the Division of Agricultural and Food Chemistry of the American Chemical Society in 1928-30 and for a number of years before his death was editor of the Pesticides section of Chemical Abstracts. He was active in the organization of the National Association of Insecticide and Disinfectant Manufacturers, which was the predecessor of the Chemical Specialties Manufacturers Association, was an honorary member of the National Pest Control Association, and also maintained close contact with the National Agricultural Chemicals Association. He was elected to Sigma Xi while a graduate student at the University of Illinois and was a charter member of the Illinois Academy of Science. He also belonged to the National Geographic Society and the Audubon Society and greatly enjoyed their lectures and activities.

Dr. Roark's even temperament, unfailing courtesy, and keen but kindly sense of humor won him many friends. His respect for the individual and his encouragement of his coworkers to develop their abilities and work out their own ideas were characteristic of the bigness of his nature. He will be remembered with warm regard by all his associates.

Ruth L. Busbey

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List of Patents Issued to R. C. Roark

No.	*Date Issued*	*Date of Application*	*Title*
1,346,337	July 13, 1920	Oct. 23, 1918	Deodorizing Material
1,515,364	Nov. 11, 1924	Apr. 19, 1922	Deodorant and Insecticide
1,524,882	Feb. 3, 1925	Aug. 6, 1923	Insecticide
1,524,883	Feb. 3, 1925	Aug. 6, 1923	Insecticide
1,524,884	Feb. 4, 1925	Aug. 6, 1923	Insecticide
1,549,220	Aug. 11, 1925	Mar. 23, 1922	Insecticide
1,553,112	Sept. 8, 1925	July 16, 1923	Insecticide
234,456 (Brit.)	Apr. 22, 1926	Mar. 30, 1925	Insecticide or Fumigant and Fumigating Method
1,649,254	Nov. 15, 1927	Aug. 4, 1924	Fumigant
1,789,322	Jan. 20, 1931	Nov. 23, 1927	Fumigant
1,791,429	Feb. 3, 1931	Feb. 23, 1929	Fumigant

SOCIETY MEETINGS

710th Regular Meeting, Oct. 4, 1962

The 710th meeting of the Society was called to order by the President, Dr. H. H. Shepard, on October 4, 1962, at 8 p.m. in the regular meeting room in the U. S. National Museum. Forty members and 16 guests were in attendance. Minutes of the previous meeting were accepted as read.

Four candidates to membership were announced: *Marjorie C. Townes, A. M. Heimpel, Hans O. Longlitz,* and *Philip O. Charpentier.* Three candidates were accepted to membership: *Leonard W. Trager, Jr., Jay Linham,* and *C. Jacot Guillarmod.*

An announcement was made of the death of *Dr. Ruric C. Roark* for whom an obituary is being prepared by Ruth Busby. The death of our honorary president, *Dr. Robert E. Snodgrass,* was announced by the president. Dr. Foote told of plans for making the December issue of the Proceedings a memorial to Dr. Snodgrass. The Snodgrass Memorial Fund which is to be used to provide scholarships to entomology students was announced. It is being administered by R. H. Nelson.

T. E. Snyder read a review (which is being published separately in the Proceedings) of Rachel Carson's *Silent Spring,* and presented arguments in rebuttal. Dr. Shepard placed the book, its original serialization in the New Yorker, and many newspaper clippings about it on exhibit.

T. J. Spilman exhibited specimens of a large tenebrionid, *Megazopherus chiliensis* (Gray), decorated with bright paints, with pieces of colored velvet, or with brilliant costume jewels. The decorated beetles were alive when captured at U. S. ports of entry and were apparently purchased in Yucatan, Mexico. They were worn as ornaments, being attached to the wearer's coat lapel by fine thread or chain. This is possible because of their sluggish demeanor and ability to live a long time without food or water.

Brother Frenette of Catholic University gave a most interesting and informative illustrated talk on "Collecting in the Seychelles." Dr. Eugene J. Gerberg of Insect Control and Research, Inc., showed slides taken as "An entomologist on a U. S. trade mission to Nigeria."

The meeting was adjourned at 10:30.

OLIVER S. FLINT, JR., *Recording Secretary.*

711th Regular Meeting, Nov. 1, 1962

The 711th meeting of the Society was called to order by the President, Dr. H. H. Shepard, on November 1, 1962, at 8 p.m. in the regular meeting room in the U. S. National Museum. Twenty one members and six guests were in attendance. Minutes of the previous meeting were accepted as read.

Three candidates to membership were announced: *Wallace T. Garrett, H. Irving Brigham,* and *Dale W. Parrish.* Four candidates were accepted to membership: *Marjorie C. Townes, A. M. Heimpel, Hans O. Longlitz,* and *Philip O. Charpentier.*

Alan Stone showed two new books on mosquitoes. The first in 2 volumes, titled *The Mosquitoes of the South Pacific* by John N. Belkin, and the second, *Entomologica Medica,* 1°volume, *Parte Geral, Diptera, Anophelini* by Oswald Paulo Forattini from the Faculdade de Higene e Saúde Pública da Universidade de São Paulo.

H. H. Shepard showed a new edition of *Open Door to Plenty,* a resume of the use of agricultural chemicals prepared by the National Agricultural Chemical Association, and a booklet-catalogue, Product Handbook, from Plant Protection, Ltd.

C. W. Sabrosky noted that the face fly was recorded from Labrador in 1930 under the name *Musca corvina,* a synonym of *M. autumnalis.* An attempt is being made to locate the specimen on which the record is based.

Dr. George C. Steyskal of the Insect Identification and Parasite Introduction Research Branch, U.S.D.A. presented the evening's talk titled "Extrapolating Taxonomic Trends." After showing that the curves of the number of insects described in most groups are apparently asymptotic, he suggested that the entomologists have only begun to describe the insect world. After considerable discussion the meeting was adjourned at 9:30.

OLIVER S. FLINT, JR., *Recording Secretary*

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PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY
of
WASHINGTON

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

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THE
ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884

MEETINGS

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

MEMBERSHIP

Members shall be persons who have demonstrated interest in the science of entomology. Annual dues for members are \$5.00; initiation fee is \$1.00 (U. S. currency).

PROCEEDINGS

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PROCEEDINGS OF THE
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THE FLEAS OF EGYPT. TWO NEW FLEAS OF THE GENUS NOSOPSYLLUS JORDAN, 1933
(SIPHONAPTERA: CERATOPHYLLIDAE)

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Fleas of the genus *Nosopsyllus* Jordan, 1933, rank second to *Xenopsylla* Glink., 1907 in number of references to plague relationships in medical literature. Since members of the subgenus *Nosopsyllus* regularly infest *Rattus*, they are suspect as potential vectors of zoonoses involving rats. Most *Nosopsyllus* fleas occur in northern Africa, the Middle East, Europe, Asiatic U.S.S.R. and China. Certain species, such as *N. fasciatus* (Bosc, 1801) and *N. londiniensis* (Rothschild, 1903), are quite cosmopolitan, apparently having been transported with their hosts to many parts of the globe. Indeed, *N. fasciatus* has even been found on *Rattus rattus* on the subantarctic island of Macquarie (Dunnet, 1961). In desert regions, *Nosopsyllus* generally infest gerbils (*Gerbillus*) and belong to the subgenus *Gerbillophilus* Wagner, 1934. The subgenus *Nosinius* Smit, 1960 was also based on a parasite of gerbils.

Both nomenclatorially and biologically the genus *Nosopsyllus* is a rich one. Many names and some synonyms occur in the literature. Nevertheless, species obviously new to science are being collected in the Near East, the Middle East, and other relatively unstudied areas. The status of some names and species is very difficult to evaluate, owing largely to inadequate series of specimens available for study. Intensive collecting in desert areas often fails to yield more than one or two specimens of *Nosopsyllus* (*Gerbillophilus*), even though many other kinds of fleas may be present. As Smit (1960) points out, the genus is in need of revision but it is still premature to undertake such a venture.

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Thanks to the investigations of the U.S. Naval Medical Research Unit No. 3, based in Cairo, much has recently been learned about arthropods of potential medical importance in Egypt. The Department of Medical Zoology, under the direction of Dr. Harry Hoogstraal, as part of its organized program, has collected and examined thousands of Egyptian rodents from various habitats. As a result, valuable and extensive collections of fleas have become available for study. Among the material represented are two species of *Nosopsyllus* which add to our knowledge of this important group of parasites. One of these, from spiny mice (*Acomys*), in Sinai, is herein described as a new subgenus and new species. The second, a very common parasite of *Arvicanthis niloticus niloticus*, the Nile Grass Rat, is described as a new subspecies of *N.* (*Nosopsyllus*) *londiniensis*. The new subspecies of *N. londiniensis* and *Xenopsylla cheopis* (Rothschild, 1903), the established vector of plague, both infest the same host in Egypt, (Traub and Hoogstraal, in preparation).

Penicus subgen. nov.

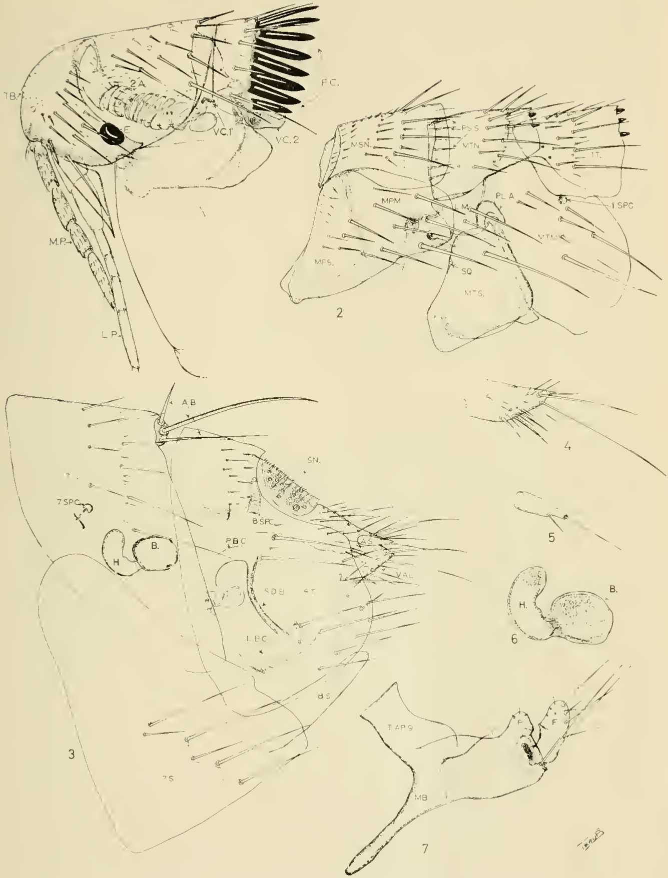
Diagnosis and Description—Immediately separable from nominate subgenus *Nosopsyllus* and subgenera *Gerbillophilus* Wagner, 1934 and *Nosinius* Smit, 1960 by the possession of three rows of postantennal bristles, instead of merely one row (caudomarginal) and only one or two ventro-marginal or subventral bristles representing a second row. Similar to *Gerbillophilus* and *Nosinius* in that the bristles on the second segment of the hind tarsus extend beyond the fourth segment (in contrast to nominate *Nosopsyllus*), but differing from them by the presence of two complete rows of bristles on the preantennal region rather than a single ocular row plus (at most) two or three bristles near antennal groove. (In the subgenus *Nosopsyllus* there may be an anterior preantennal row, but often it is not complete.) In the subgenus *Penicus*, the bristles on the second antennal segment of the female are short, less than a third of the length of the club, instead of ranging in size from more than half the length to exceeding the club in length. With the manubrium (fig. 7, MB.) relatively narrower than in the other subgenera, about ten times as long (measured from level of ventral margin of tergal apodeme (T.AP.9)) as broad at midpoint, instead of about five to seven times as long as broad.

Resembling *Gerbillophilus* in major respects except for diagnostic features above and further points as follows: Movable finger (figs. 7 and 9, F.) relatively short and broad, slightly shorter than or subequal to over-all height of immovable clasper, instead of clearly exceeding it. Tergal apodeme of ninth segment (fig. 7, T.AP.9) proportionately longer, due to narrowness of manubrium. Spermatheca with hilla (fig. 6, H.) not recurved over bulga (B.) to any appreciable degree.

Type of subgenus: The new species described immediately below.

Nosopsyllus (Penicus) geneatus sp. n.

Types—Holotype male and allotype female (B-15347-1) ex *Acomys russatus russatus* Wagner, 1840, the golden spiny mouse; Egypt: Sinai Province, St. Catherine's Monastery, approx. 5000 ft. elev.; 16 Nov., 1952; collector, H. Hoogstraal, for U.S. Naval Medical Research



NOSOPSYLLUS (PENICUS) GENEATUS N. SUBGEN., N. SP. FIGS. 1–7

Fig. 1, Head and prothorax; fig. 2, Meso- and metathorax; first abdominal tergum; fig. 3, Modified abdominal segments of female; fig. 4, Ventral anal lobe of female proctiger; fig. 5, Anal stylet; fig. 6, Spermatheca; fig. 7, Male ninth tergum, immovable process and movable finger of clasper.

Unit No. 3 (Cairo). Paratypes as follows: One female with same accession number and data as holotype; two pairs (B-15349) ibid.; one male (B-17444) ibid. but collected 13 May, 1953; seven males and four females (B-15350) ex *Acomys dimidiatus dimidiatus* (Cretzschmar, 1826), the Arabian spiny mouse; loc. cit., 16 Nov., 1952; two males and one female (B-15335) with same data as B-15350, but 13 Nov., 1952, and one female (B-15348) ibid. but 16 Nov., 1952.

The holotype and allotype and one pair of paratypes deposited in the collections of the U.S. National Museum. One pair of paratypes deposited in the British Museum (Natural History) at Tring, Herts.; one pair in the Chicago Natural History Museum, and the remainder in the author's collection pending further distribution.

Diagnosis—The chaetotaxy of the head, mentioned above, serves to distinguish *N.* (*Penicus*) *geneatus* from all other species in the genus. The other characters cited categorize the species, as does the fact that the crochets of the aedeagus (figs. 11 and 12, CR.) are very broad proximad to the acuminate beak-like apex, whereas in *Nosopsyllus* and *Gerbillophilus* the margins of the crochets are subapically rather parallel.

Head—(fig. 1, male). With a distinct frontal tubercle (TB.). Preantennal region in the male typically with an ocular row of four bristles, of which the first ventromarginal and third are much longer than the second and fourth; in female generally with three bristles in ocular row, of which the middle one is the shortest. Preantennal region with a second row of bristles, ranging from base of maxillary palpi to base of antennal groove, and in the male consisting of about seven or eight bristles in an irregular row, at times preceded by two or three small bristles; in female with about six or seven bristles in the main row. Eye (E.) distinct, well sclerotized, subovate. Genal process subacute, more subtruncate in female. Maxillary lobe acutely triangular, extending to near apex of third segment of maxillary palpus (M.P.). Labial palpi (L.P.) five-segmented; the distal segment more than 1½ times length of penultimate; extending slightly beyond apex of procoxae. First antennal segment with small bristles upon apparent dorsal margin and an apical fringe of similar bristles. Second antennal segment (2 A.) about thrice or four times as broad as long; in male with apical bristles scarcely longer than segment; in female these bristles about twice length of segment but less than one-third length of club. Postantennal region with three rows of bristles arranged in male approximately 4(5)-4-5 per side; in female generally 2(3)-3-5, the first two rows often irregular in spacing; in each sex the ventralmost bristle in third row is the longest, and it is about twice lengh of bristle above it.

Thorax—Pronotum quite narrow, at midpoint about two-thirds as long as spine of pronotal comb (P.C.) at that level; with one row of bristles of which ventralmost is more than twice length of one above it. Pronotal comb with a total of about 18 fairly narrow spines, of which the fifth spine from bottom is about 6½ times as long as broad at midpoint. Mesonotum (fig. 2, MSN.) with two complete rows of bristles; its flange with about six or seven pseudo-setae (PS.S.) per side. Mesepisternum (MPS.) generally with two fairly long caudomarginal bristles, of which that at ventrocaudal angle at times appearing to be on mesepimere; with two smaller bristles between these but submedian in origin; with about two small bristles anterior to last-mentioned and a group of 9-12 small thin bristles scattered near cephalodorsal angle. Mesepimere (MPM.) with one marginal bristle near cephaloventral angle; with a median vertical row of three bristles and a subcaudal vertical row of three bristles, one of these below and anterior to spiracular fossa, one above it and the uppermost subdorsal. Metanotum (MTN.) with two full rows of bristles preceded by one or two subdorsal small bristles; its flange with two subdorsal apical spinelets. Lateral metanotal area (L.M.) higher than ventral half is long; with a long bristle near dorsocaudal angle and a smaller submedian one; at times with an additional very small ventromarginal bristle. Metepisternum (MTS.) with one long bristle in dorsocaudal quadrant; squamulum (SQ.) small and weakly sclerotized. Pleural arch (PL.A.) well-developed, strongly convex and narrow. Metepimere (MTM.) about three-fifths as long as high at maxima; generally with two small bristles in cephalodorsal quadrant and a vertical row of four bristles starting below small oblate spiracular fossa of first abdominal segment (1 SPC.) and extending down to below midpoint; of these, ventralmost bristle by far the longest; with a long submedian bristle midway between row and caudal margin. Dorsal margin of metepimere short, straight; caudal margin with a sinus at dorsal and ventral extremities; ventral margin with a narrow deep convexity. Meso- and metanota (and anteriormost abdominal terga) lacking a "mane" formed by conspicuous dorsomarginal subvertical longish bristles.

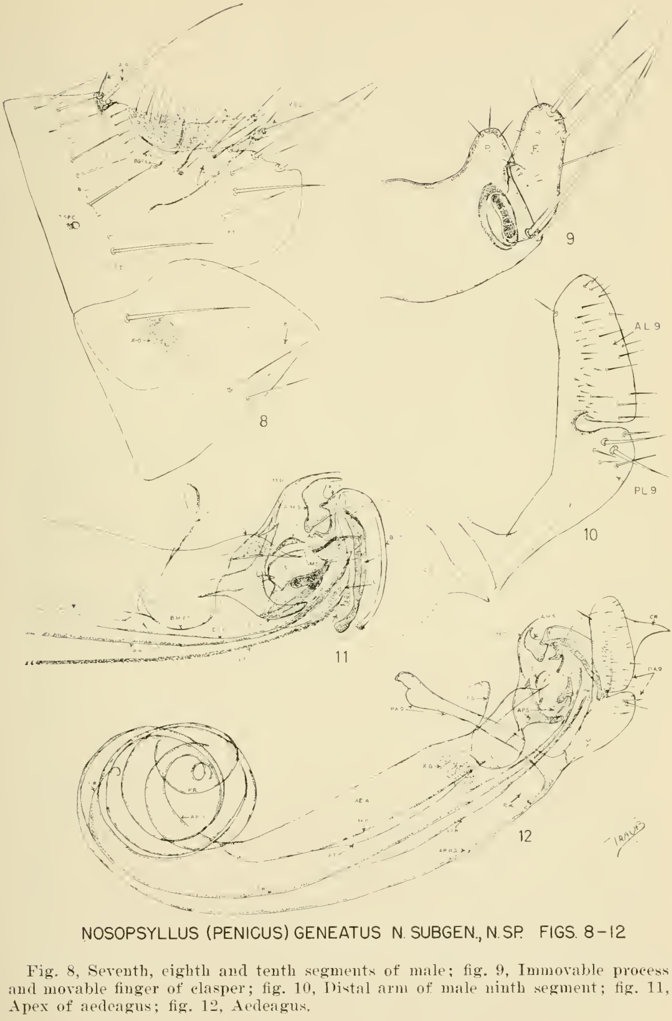
Profemur with about seven to ten small, thin, lateral submedian bristles; with two to four such bristles near the dorsomarginal bristles and two short stout ones near dorsoapical long bristle; with a subapical long ventromarginal bristle; with one mesal submedian bristle. Protibia with stout single and paired notched dorsomarginal bristles arranged as follows: 1:2:1:2:1:2:2 (the last of which are subapical). Protarsus with none of tarsal bristles extending beyond apex of next segment, but first segment with two long dorso-marginal bristles. Fifth segment of protarsus with basal pair of lateral plantar bristles displaced mesad but still proximad to second pair. Mesocoxa with two subapical lateral bristles and two apical longer ones; with a row of three to five bristles almost contiguous to the cephalomarginal ones, of which the ventralmost in row is adjacent to the leucodisc on coxa. Mesofemur with only two non-marginal lateral bristles, and these in dorsoapical region; with two widely separated mesal bristles; with one subapical ventromarginal bristle. Mesotibia with notched dorsomarginal bristles as follows: 1:2:1:2:2:1:2:2. Mesotarsus with no bristles extending beyond apex of following segment. Distal segment of mesotarsus with first pair of plantar bristles displaced somewhat mesad. Metafemur with three small lateral bristles near ventral margin, on middle third; one long ventromarginal bristle at apical third; and a shorter subapical one; the latter virtually paired with a mesal one; with two small mesal bristles near dorsal margin, subapical in position. Metatibia with notched dorsomarginal bristles as follows: 1:2:1:2:2:1:2:2; with scattered lateral bristles over dorsal two-thirds; these bristles single basally, occurring in horizontal rows of two medially, and in such groups of three or four apically; with five or six mesal bristles extending the length of segment, mainly subventral in position. With one apicodorsal bristle on second segment of metatarsus extending to or beyond apex of fourth segment. Fifth tarsal segment with first pair of plantar bristles only slightly displaced. Measurements (in microns) of tibiae and tarsal segments of holotype (petiolate base deleted) as follows:

		Tarsal Segments				
Leg	Tibia	I	II	III	IV	V
Pro	165	63	63	51	42	96
Meso	297	111	99	63	51	111
Meta	396	279	171	96	54	120

Abdomen—First tergum (fig. 2, 1 T.) subdorsally somewhat longer than broad (high); with two rows of bristles, preceded by one or two subdorsal ones; with a total of four to six apical spinelets. Terga 2, 3 and 4 generally with total number of apical spinelets as follows: Male: 4 to 6-4-2 or 0; female: 4 to 5-2-0. Unmodified terga with first row of bristles terminating above level of spiracular fossa, those of second row extend slightly below this level (figs. 3 and 8, 7 SPC.). Bristles of second row about three-fourths length of tergum. Spiracular fossa very small, only about as long as large adjacent setal bases, and 1½ times as broad (high); ovate. Second sternum in male devoid of bristles except for one ventromarginal one per side; female in addition with one median. Typical sterna in male with a vertical row of two bristles near ventral margin of anterior segments; with a row of three such bristles on the more caudal segments. In female, these sterna with three and four such bristles, respectively. With three antesensiliary bristles per side in each sex; in male (fig. 8, A.B.) the middle one is very long, the upper and lower ones are minute, yet the dorsalmost is 1½-2 times the length of the ventralmost. In the female (fig. 3, A.B.), the middle bristle is about 1⅓ times the length of the lower one and thrice the length of the upper one. The plate bearing bases of antesensiliary bristles dorsomarginal in position.

Modified Abdominal Segments—Male—Eighth tergum (fig. 8, 8 T.) extending caudad to a point slightly beyond apex of anal lobe and ventrad to a level below the ventral margin of the clasper; that portion caudad to an imaginary vertical line down ventrad at level of caudal margin of sensilium (SN.) is about as long as broad; with four long dorsomarginal bristles; a vertical row of three median bristles, two small bristles below first of dorso-marginal row; a small bristle ventrad and caudad to base of elongate fossa of eighth spiracle (8 SPC.); cephalodorsal area, between 8 SPC. and base of A.B., with a row of small bristles. Eighth sternum (8 S.) extremely reduced; indistinct, visible only as a vestige mesad to seventh sternum (7 S.).

Immovable process of clasper (figs. 7 and 9, P.) short and broadly rounded; that portion apicad of the caudal notch which articulates with the sclerotized papilla on the anterior margin of the movable finger (F.), scarcely longer (higher) than broad at midpoint; with three small apical bristles. Dorsal margin of clasper with a long shallow sinus whose posterior margin is the anterior margin of P. Caudal margin of P. declivous below notch to acetabulum, whose bristles arise from contiguous bases that are marginal at ventrocaudal angle. Movable finger or process of clasper (F.) ovate; only about 2⅓ times as long as broad at level of sclerotized papilla at midpoint of anterior margin, its broadest point; with one long apical bristle; one long caudomarginal bristle at apical fifth; a small bristle between the foregoing; a fairly long bristle near middle of caudal margin; with a small subapical bristle on anterior margin; with a few cephalomarginal, very small, thin bristles on distal half, and with a few such bristles scattered over F. Manubrium (fig. 7, MB.) relatively elongate, sides subparallel except where slightly narrowed at middle.



NOSOPSYLLUS (PENICUS) GENEATUS N. SUBGEN., N. SP. FIGS. 8–12

Fig. 8, Seventh, eighth and tenth segments of male; fig. 9, Immovable process and movable finger of clasper; fig. 10, Distal arm of male ninth segment; fig. 11, Apex of aedeagus; fig. 12, Aedeagus.

Ninth sternum with proximal arm (fig. 12, P.A.9) relatively long and narrow, about 16 times as long as broad at midpoint; ventral margin with a subapical convexity so that dorsal portion appears extended as short sub-rounded process; arm somewhat narrowed apicad at midpoint. Distal arm of ninth sternum (D.A.9 and fig. 10) with apical lobe (A.L.9) almost twice as long as broad at midpoint. Cephalic (dorsal) margin of A.L.9 fairly straight but becoming convex near insertion of single subapical bristle; caudal margin almost paralleling cephalic margin but slightly convex, so that lobe is generally gently narrowed apically; with many thin scattered bristles, most congregate at cephalic third, but about 10-14 near caudal margin. Proximal lobe (P.L.9) of distal arm of ninth sternum, as measured from base of arm to conspicuous notch, longer than A.L.9 and more than twice as long as broad at maximum level; with two stout submedian bristles near apex of bulge; two or three smaller bristles proximad to these and one marginal bristle at apex of lobe. Apodemal rod or tendon of ninth segment (fig. 12, AP.R.9) terminating in one coil.

Aedeagal apodeme (fig. 12, AE.A.) with a long apical appendage (AP.A.) which is somewhat coiled distally, and a well developed proximal spur (P.S. and fig. 11); about 6½ times as long (measured from base of apodemal strut to base of apical appendage) as broad (measured to ventral margin of well-sclerotized middle plate (M.PT.)). Middle plate with a conspicuous bay (B.M.PT.) that is as long as middle plate is broad at this point. The caudal extensions of lateral plates (E.L.PT.) appearing on each side as a broad protrusion that rapidly becomes acuminate and reaches level of dorsal lobe (D.S.) of apodemal strut and the fairly thick crescent sclerite (C.S.). Pouch wall (P.W.) weakly sclerotized and largely inapparent. Apicomedian sclerite of end-chamber (A.M.S.) talon-shaped, about twice as long as broad below base of stout, curved claw-like apex; extending from just below short median dorsal lobe (M.D.L.) to a level below the apex of the sclerotized inner tube (A.S.I.); somewhat larger in size than the conspicuous, biconvex lobed portion of the median sclerite (M.S.) of the apodemal strut. The distal portion of the sclerotized inner tube consisting of 1) a truncate apex (A.S.I.) which is narrower than base of A.M.S., and which possesses an acuminate spur directed cephalad, and 2) a broad expanded basal portion which terminates dorsally (anteriorly) into a conspicuous upturned spur-like extension of the armature ($A_1S.$), the spur of which extends into the end-chamber for a distance equal to two-thirds the length of the crescent sclerite (C.S.). The proximal portion of the sclerotized inner tube consists of a subquadrate structure whose armature projects into the end-chamber as a broad spur-like thickening ($A_2S.$) which is stouter and longer than A_1S. The lateral sclerotization of the armature of the inner tube (L.S.I.) elongate, arising from just below A.S.I. and extending ventrad to below the lightly sclerotized vesicle (V.); its apex slightly dilated. Sclerotized band of inner tube (B.I.T.) long, paralleling L.S.I. and extending somewhat beyond its apex, before becoming semimembranous. Crochet (CR.) a somewhat globose structure with a flattened base and a narrow beak-like distal portion, whose acuminate apex is fairly well sclerotized; basal portions of crochet weakly sclerotized; ventral margin subapically semimembranous, frayed and here appearing as a series of tiny tufted filaments or spicules. Lateral lobes (L.L.) lightly sclerotized. Ventral intramural rod (V.I.R.) fairly well sclerotized. Penis rods (tendons) (P.R.) making one or two coils proximally.

Sensilium (fig. 8, SN.) dorsally flat or slightly concave; with about 21 sensory pits per side. Proctiger proximally spiculose (SPI.); its dorsal anal lobe (D.A.L.) in shape of an acute triangle and possessing about four or five small dorsomarginal bristles and four apical ones, of which one is quite long, and two small submedian ones. Ventral anal lobe of proctiger (V.A.L.) apically very narrow, almost cylindrical; with two or three small dorsomarginal bristles; two or three submedian ones and two fairly long apical ones. Ventral sclerite of proctiger (V.P.) or subanal sclerite lightly sclerotized.

Modified Abdominal Segments—Female—Seventh sternum (fig. 3, 7 S.) with cephalic margin fairly straight and long, so that segment is nearly twice as broad (high) as long at midpoint; caudal margin shallowly concave for upper two-thirds and slanting at an angle of about 45°; with a small sinus at ventral fourth; margin below sinus somewhat convex; with an oblique row of four large bristles, the uppermost of which is median but below midline of segment, and lowermost near ventral margin at caudal third; with a small bristle near bases of uppermost two bristles. Eighth tergum (8 T.) with cephalic margin shallow convex for most its length; with a group of 9-13 small bristles in two irregular rows above and in front of narrow eighth spiracular fossa (8 SPC.); with two long submedian bristles, the uppermost of which is at dorsal third, in line with sensilium; with about four bristles near straight portion of caudal margin commencing at level of the ventral anal lobe (V.A.L.); one caudomarginal bristle just below V.A.L. and a group of about five marginal or submarginal bristles along ventrocaudal margin; with two submedian bristles at ventral fourth of segment. Eighth sternum (8 S.) long and narrow; apically elliptical, weakly developed. Sensilium (SN.) somewhat longer and narrower than in male; with about 18 sensory pits per side. Tenth abdominal segment with about 8-11 non-marginal bristles; a row of dorsomarginal bristles, of which the subapical ones of dorsal anal lobe of proctiger are the longest; with a group of two or three ventromarginal bristles immediately below cephaloventral angle of anal stylet (A.S.), which, in turn, is about 3½ times as long as broad at midpoint (fig. 5) and possesses one ventromarginal bristle at apical fourth, in addition to the usual long apical one. Ventral anal lobe (V.A.L. and fig. 4) trapezoidal; about twice as long as broad at level of ventrocaudal angle; caudal margin with bristles as follows: one short and one long bristle near dorsocaudal angle, one long subapical bristle; a thin one adjacent to this, three short, stout, slightly curved ones ranging from about midpoint to ventrocaudal angle, the last preceded by two or three submarginals; with five to eight submedian small bristles.

Bulga of spermatheca (figs. 3 and 6, B.) ovate, about 1.2 times as long as broad; dorsal margin slightly convex; ventral margin quite straight. Hilla (H.) of spermatheca broad; about 2.5 times as long as broad; evenly curved somewhat towards bulga, but only slightly extending over anterior part of bulga, if at all; lacking an apical papilla; hilla and bulga well demarcated. Bursa copulatrix of the usual "?" shape so characteristic of the genus; the sclerotized duct (S.D.B.) in the shape of a shallow arc about 16 times as long as broad at midpoint, the arc facing caudad. Perula of bursa copulatrix (P.B.C.) coloniform, cucullate or shaped like a reversed letter "C"; about 7½ times as long as broad. Lura of the bursa copulatrix (L.B.C.) about as broad as perula; lightly sclerotized; arched as a quarter circle.

Remarks—The chaetotaxy of the head of this species does not agree with the generic description of *Nosopsyllus*, and hence specimens would not key down correctly in taxonomic keys and diagnoses to the genera of fleas such as those of Jordan (1933). Nevertheless, the generic placement of this species is unmistakable on the basis of the reduction of the male eighth sternum; the structure of the ninth sternum, including the characteristic shape of the apical and proximal lobes of the distal arm and the presence of the two large bristles on the latter; the morphology of the aedeagus, such as the shape of the apicomedian sclerite and the details of the armature of the sclerotized inner tube; the stout, curved hilla and the broadly ovate bulga of the spermatheca; and the diagnostic pattern of the bursa copulatrix.

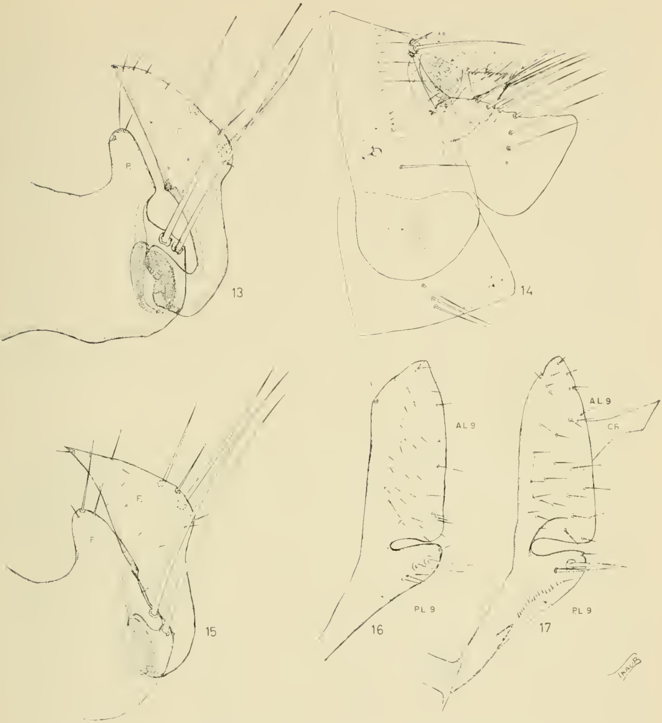
The subgeneric name derived from the Greek word for false hairs or wigs, was suggested by the "anomalous" presence of bristles on the postantennal region of this species, just as the specific name, based upon the Greek term for bearded, was chosen because of the supernumary preantennal bristles.

Despite the intensive collection of fleas by Dr. Hoogstraal and his colleagues in a variety of habitats in Egypt, this species was taken only in the Sinai area. In addition to the paratype series, taken from two species of spiny mice (*Acomys*) at St. Catherine's Monastery at 5000 ft. elevation, one male was taken from a gerbil (*Gerbillus*) at sea level. This last specimen exhibits some morphological differences from the type series, but these cannot be evaluated without additional material.

Among the seven males and four females from *Acomys d. dimidiatus* (B-15350) were two female *N.* (*P.*) *geneatus* which were unusual in possessing four antesensiliary bristles and, in general, a somewhat denser chaetotaxy than all the other specimens—having one or two additional bristles on MPS., MPM., MTM., etc., but in other respects essentially agreeing with typical *geneatus*. In the light of our insufficient knowledge of this group of fleas from Sinai, it is not known if these differences represent individual variations, as I believe they do. These specimens have not been designated as paratypes pending clarification of their status.

Nosopsyllus (Nosopsyllus) londiniensis declivus ssp. n.

Types—Holotype male and allotype female (B-17327-1) ex nest of *Arvicanthis niloticus niloticus*, the Nile Grass Rat or Nile Kusu; Egypt: Giza Province, Imbaba, Ausim; 28 Feb., 1953; collector H. Hoogstraal (U.S. Naval Medical Research Unit No. 3). Paratypes, all from Egypt and collected by H. Hoogstraal, as follows: six males and six females with same data as holotype; five males and five females (B-22374) ibid., but from Saft El Laban; 14 Apr., 1954; two males and one female (B-30360) ibid.; 21 March, 1955; two females (B-30378) ibid.; 2 Feb., 1955; one female (B-15941) ibid., but from Bashtil; 12 March, 1953; five females (B-22006) ibid., but from Kirdasa; 14 Dec., 1953; six males and two females (B-30635) ibid., but



NOSOPSYLLUS (NOSOPSYLLUS) LONDINIENSIS LONDINIENSIS (ROTHS.,1903) FIGS. 15,16
NOSOPSYLLUS (NOSOPSYLLUS) LONDINIENSIS DECLIVUS SSP. NOV. – FIGS. 13,14,17

Fig. 13, Immovable process and movable finger of clasper; fig. 14, Seventh, eighth and tenth segments of male; fig. 15, Immovable process and movable finger of clasper; fig. 16, Distal arm of male ninth segment; fig. 17, Distal arm of male ninth segment.

from Minshat El Bakkari; 10 Apr., 1955; one male (B-21828) ibid., but from Nahya; 1 Nov., 1953; one male (B-17286) ibid., but from Beheira Province, El Dilingat; Feb., 1953; one female (B-17287) ibid., but from Abu Si'eifa; Feb., 1953; one male and seven females (B-17293) ibid., but from Daqahliya Province, Aga, Kafr Ti'eilib; Feb., 1953; one male and one female (B-21838) ibid., but from Minshat El Ikhwa; 12 Nov., 1953; four males and three females (B-21875) ibid., but from Royal Shooting Club, 3 mi. N. of Faiyum; 5 Jan., 1954; three males and three females (B-17199) ex *Arvicanthis niloticus nilocticus;* Giza Province, Imbaba, Minshat El Bakkari; 22 March, 1953; one male and two females (B-17203) ibid., but from Nahya; 22 March, 1953; two males and 12 females (B-8635) ibid., but from Faiyum Province; Oct., 1951; five males and two females (B-21878) ex *Crocidura olivieri,* Egyptian Giant Shrew; Royal Shooting Club, 3 mi. N. of Faiyum; 5 Jan., 1954; one male (B-17306) ex nest of *Crocidura olivieri;* Gharbiya Province, Shirbin, Kafr El Battik; 11 Feb., 1953; one male and one female (B-21874) ibid., but from Giza Province, Imbaba, Nahya; 4 Jan., 1954; one male (B-17383) ex nest of *Mus musculus,* house mouse; ibid., but from Saft El Laban; 4 March, 1953; one male (B-21876) ex *Mus musculus;* Royal Shooting Club, 3 mi. N. of Faiyum; 5 Jan., 1954; one female (B-17381) ex nest of *Rattus rattus;* Giza Province, Imbaba, Kirdasa; 4 March, 1953; one male (B-17344) ex nest of *Gerbillus gerbillus,* a gerbil; ibid., but from El Mansuriya; 25 Feb., 1953; one male (9001) ex *Vulpes vulpes niloticus,* a fox; Failyum Province, Kom O Shim; 6 Feb., 1948; one female (B-15642) ex rodent burrow; Daqahliya Province, Kom El Nur, Mit Ghamr; 28 Jan., 1953.

Holotype and allotype and four pairs of paratypes deposited in the collections of the U.S. National Museum. Paratypes deposited in the British Museum (Natural History) at Tring, Herts. (three pairs); the Chicago Natural History Museum (two pairs); the U.S. Naval Medical Research Unit No. 3, at Cairo (three pairs) and the remainder in the author's collection pending further distribution.

Diagnosis—Separable from *Nosopsyllus* (*Nosopsyllus*) *londiniensis londiniensis* (Rothschild, 1903) in that in the new subspecies there is a deep sinus on the caudal margin of the immovable process of the clasper (figs. 13 and 21, P.), so that the excised area distad to the upper acetabular bristle is only about 1.3 times as long as deep; the processe is narrow, about 2.5 times as long (high) as broad[1]); caudal margin declivous to apex of deep sinus, distad of acetabulum; this portion of caudal margin forming an angle of about 23° with vertical axis of P.; movable finger (F.) relatively narrow, about 3.6 times as long as broad at maxima; anterior margin of F., above papilla straight; distal arm of ninth sternum with apical lobe (fig. 17, A.L.9) distally relatively acute; narrow, about 2.5 times as long as broad at midpoint. In contrast, in *N. l. londiniensis,* described from London, England, the sinus above acetabulum on the immovable process (fig. 15, P.) is extremely shallow, about 10-20 times as long as deep; the process P. is broader so that it is only about 1.4-1.8 times as long as broad; apex somewhat rounded; caudal margin apically slightly convex and forming an angle of about 40° with vertical axis of P.; movable finger (F.) about 2.8 times as long as broad at maxi-

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[1]Height measured from distal margin of sinus, opposite sclerotized papilla on cephalic margin of movable finger (F.), to apex; breadth measured at midpoint of caudal margin of P.

ma; F. with cephalic margin sinuate, upper portion slightly concave; distal arm of ninth sternum with apical lobe (fig. 16, A.L.9) apically subtruncate distad of bristle at cephalodorsal angle; about 2.2 times as long as broad at midpoint. The females of the two subspecies apparently lack significant distinguishing features.

Description—Head—Frontal tubercle small. With an ocular row of three bristles; preceded by a fairly complete row of six to seven bristles, some of these irregular in position. Eye distinct, subovate. Labial palpi reaching to apex of procoxae. Bristles on second segment of antenna about length of this segment in male; in female, some bristles about half the length of club. With a single, caudomarginal complete row of postantennal bristles; with a long ventral bristle near midpoint of antennal groove; with a smaller one in line, near base of scape of antenna.

Thorax—Pronotal comb with a total of about 20 spines; the length of most spines definitely greater than that of pronotum. Mesonotum with two rows of bristles and about five to eight pseudosetae per side. Mesepisternum with one long bristle near ventrocaudal quadrant and four or five scattered small ones. Mesepimere with about six bristles, of which three are ventromarginal. Metanotum with two rows of bristles and one or two apical spinelets per side. Lateral metanotal area with two bristles. Pleural arch distinct. Squamulum feebly sclerotized. Metepimere often with bristles arranged 3-2-1, or 4-3-1. Meso- and metanota (and anteriormost abdominal terga) with dorso-marginal bristles subvertical, fairly long, forming a "mane." Tibiae with numbers of stout dorsolateral bristles, arising in notches, arranged as follows (from base to apex): 1:2:2:2:2:2, except for metatibiae, which bear a group of three bristles apically. Metatibiae with an additional small bristle above the penultimate pair; this at times appears to arise from a notch, and thus simulates a dorsolateral bristle. Pro- and mesotarsi lacking bristles which extend beyond apex of following segment. Metatarsi with second segment bearing a distomarginal bristle which extends beyond apex of third segment. Proximal pair of lateral plantar bristles of fifth segment of pro- and mesotarsi somewhat displaced mesad, but not distad. In metatarsi this mesad displacement is very slight.

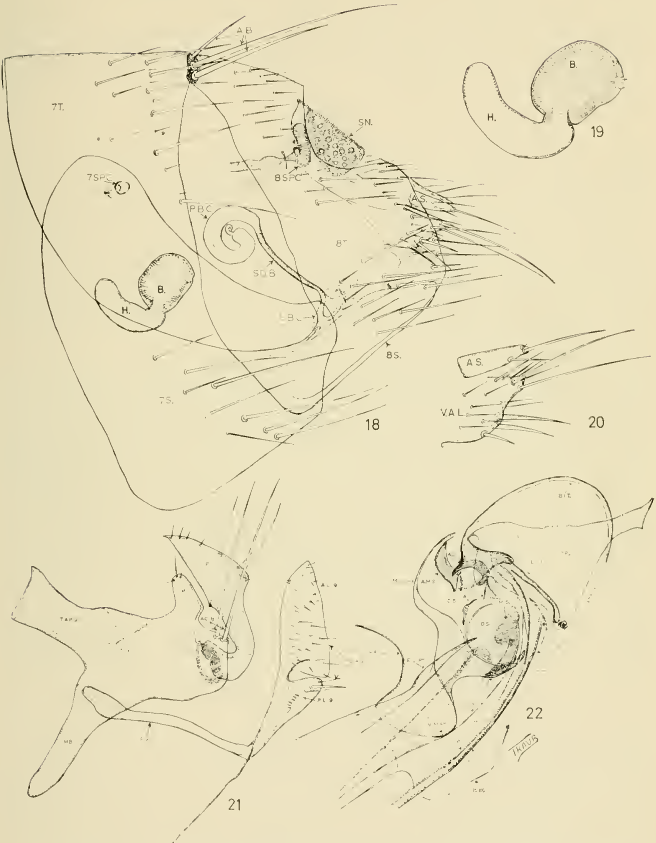
Abdomen—First abdominal tergum generally with a total of three or four apical spinelets. Terga 2, 3 and 4 usually with total number of apical spinelets as follows: 4(3)-2-2. Unmodified terga generally with first row of bristles extending only about one-half or three-fourths of distance towards spiracular fossae in males; almost to fossae in females; second row of bristles terminating at or slightly below level of fossae in males and somewhat more ventrad in females. Second abdominal sternum with only one pair of bristles and that ventro-marginal. Other unmodified sterna in males with a vertical row of three fairly long bristles; with one or two small ones above these; in females the row consists of four to five bristles with one or two small ones above or in front of these. Spiracular fossae (figs. 14 and 18, 7 SPC.) gibbous or globate, almost thrice size of bases of adjacent large setae. Male with one long antesensiliary bristle per side (fig. 14, A.B.), a very small one above this and a minute one below. Female with three antesensiliary bristles (fig. 18, A.B.) of which the ventralmost is usually almost as long as middle one (subequal in allotype) and uppermost about one-third length of middle one.

Modified Abdominal Segments—Male—Eighth tergum (fig. 14, 8 T.) with portion caudad of sensilium (SN.) about 1.2 times as long as broad (high) at maxima; with four dorsomarginal bristles and a median row of three commencing with caudalmost of dorsal margin. Immovable process of clasper (figs. 13 and 21, P.) thumb-like, with margins subapically almost parallel; with three apical bristles. Movable finger (F.) with anterior margin straight except for sclerotized papilla near midpoint. Caudal margin of F. broadest near this level; distal half convex, sharply becoming concave so that proximal half of F. is narrowed, with margins subparallel for proximal third. Caudomarginal long bristles on F. as follows: one at apical fourth, one at level of anterior papilla, near maximum convexity. Manubrium (MB.) about 5½ times as long as broad at midpoint. Ninth sternum with proximal arm (P.A.9) subequal in length to distal arm (D.A.9); arched medially; sides somewhat parallel except for rather dilated distal portion, which is subovate apically. Proximal lobe of distal arm (P.L.9) broadly ovate; with the two stout bristles almost contiguous in a horizontal line. Apical lobe of distal arm (D.L.9) with 25-30 scattered, small, thin bristles of which usually six to ten are at or near caudal margin.

Aedeagal apodeme with an apical appendage whose sclerotized portion is short and straight, much shorter than breadth of apodeme at midpoint, and about one-third length of sclerotized portion of proximal spur (fig. 22, P.S.); apical appendage with an additional lightly sclerotized thin distal portion, at times not readily apparent, which extends toward cephalic ends of penis rods, but is not coiled. Aedeagal apodeme about 5.5 times as long as broad. Bay of middle plate (B.M.PT.) as broad as long. Extensions of lateral plates (E.L.PT.) highly acuminate. Pouch wall (P.W.) weakly sclerotized; emarginate at basal point of origin, the resulting convexity broad. Apicomedian sclerite (A.M.S.) talon-shaped, but narrow, more than 2.5 times as long as broad. Apex of sclerotized inner tube (A.S.I.) slightly sinuate, its spur acuminate. Apical spur of armature of inner tube (A_1S.) up-curved, almost as long as A.S.I. Proximal extension of armature (A_2S.) broad, not well demarcated. Lateral sclerotization of inner tube (L.S.I.) vermiform, extending to vesicle (V.). Sclerotized band of inner tube (B.I.T.) well-developed; very long. Crochet (CR.) apically truncate and pointing dorsocaudad; margins subparallel for distal third or fourth; then diverging sharply towards broad, weakly sclerotized base. Penis rods or tendons (P.R.) making two or more coils proximally.

Sensilium (fig. 14, SN.) dorsally flat or slightly concave, with about 20-22 sensory pits per side. Proctiger proximally spiculose. Ventral anal lobe (V.A.L.) subapically more narrowed than dorsal anal lobe (D.A.L.).

Modified Abdominal Segments—Female—Seventh sternum (fig. 18, 7 S.) about 1½ times as broad (high) as long at maxima; caudal margin with a conspicuous subventral flattened lobe; with an oblique row of five or six long bristles, preceded by a row of three to five smaller ones. Eighth tergum (8 T.) with two large bristles below sensilium; with about three long submarginal ventral and three long submedian bristles; with five to nine smaller submedian bristles; with two caudomarginal bristles and two submarginal mesal bristles below ventral anal lobe. Tenth abdominal segment with two or three bristles at ventrocaudal angle, immediately below base of anal stylet (A.S.), which, in turn is about 3½ times as long as broad at midpoint and possesses one long apical bristle, often a



NOSOPSYLLUS (NOSOPSYLLUS) LONDINIENSIS DECLIVUS SSP. NOV. FIGS. 18–22

Fig. 18, Modified adominal segments of female; fig. 19, Spermatheca; fig. 20, Anal stylet and ventral anal lobe of female proctiger; fig. 21, Male ninth sternum and clasper; fig. 22, Apex of aedeagus.

minute one at its base, and a ventral one at apical fifth (fig. 20, A.S.). Ventral anal lobe (V.A.L.) with caudal margin sinuate subapically; the three stout bristles near ventrocaudal angle slightly curved; with two long subapical bristles. Bulga of spermatheca (figs. 18 and 19, B.) subovate but dorsal and ventral margins somewhat flattened; about 1¼ times as long as broad. Hilla (H.) of spermatheca about 3½ times as long as broad, arching back towards bulga or extending slightly over it. Sclerotized duct of bursa copulatrix (S.D.B.) about 16 times as long as broad at midpoint; only slightly convex. Perula (P.B.C.) coloniform, cucullate, about 7½ times as long as broad. Lura (L.B.C.) narrower than perula.

Remarks—In Egypt *Nosopsyllus* (*Nosopsyllus*) *londiniensis declivus* is apparently a prime parasite of *Arvicanthis niloticus*, the Nile Grass Rat. The majority of specimens in the long series of paratypes were taken from this host and from its nest. Significantly, this form was taken only in cultivated areas in the Nile Delta, although Dr. Hoogstraal and his associates examined thousands of rodents, in all types of habitats in Egypt. All specimens were taken from October to April, the cool months of the year (Hoogstraal and Traub, in preparation).

It is of especial interest that *Xenopsylla cheopis* (Rothschild, 1903) also predominates as a parasite of *Arvicanthis* in Egypt. Data indicate that 81 per cent of all *X. cheopis* collected by Hoogstraal were from this host and from the Nile Valley and Delta area only. Other rodents (including *Rattus*) and predators inhabiting the same vicinity or habitat carried relatively few *X. cheopis*, as is evidenced by the fact that the remaining 19 per cent of the *X. cheopis* were taken from different hosts throughout the country (Traub and Hoogstraal, in preparation). These observations suggest that both *X. cheopis* and *N. londiniensis* may have originated on *Arvicanthis* in the Nile Delta, secondarily became adapted to rats of the genus *Rattus*, and were transported with it to various parts of the world.

The new subspecies of *N. londiniensis* is based on comparison with material from England, received from the N. C. Rothschild Collection through the courtesy of the late Dr. Karl Jordan, who had kindly verified the status of the Egyptian form. Since *N. londiniensis*, like *X.cheopis*, has been introduced into many parts of the world as accouterments of rats, some importations may be recent and successive introductions may have occurred. A mingling of forms of *N. londiniensis* may have taken place in some areas, and it is not surprising that specimens from France or even England at times exhibit a narrowed immovable process P. These structures, however, are not as narrowed as in *N. l. declivus*, and the sinus on P. is not nearly so pronounced, along with other characters mentioned in the diagnosis.

If the Nile Valley was indeed the center of development for *N. londiniensis* and *X. cheopis* (as Rothschild's name also intimates), and *Arvicanthis* is the true host for both species of fleas, then study of the vector efficiency of *N. londiniensis* in plague, utilizing modern methods, may be warranted, for its role in this regard has never been definitely evaluated.

ACKNOWLEDGEMENTS

Once again I am indebted to Dr. Harry Hoogstraal for his interest, enthusiasm and diligence in furthering our knowledge of the ectoparasitic fauna of Egyptian mammals, and for making it possible for me to study the resultant valuable collections of fleas. Thanks are extended to Miss Helle Starcke and Mr. Thomas M. Evans for editorial assistance.

LIST OF ABBREVIATIONS

A.B., Antesensiliary bristle; **A.L.9**, Apical lobe of distal arm of ninth sternum; **A.M.S.**, Apicomedian sclerite of aedeagus; **A.S.**, Anal stylet; **A.S.I.**, Apex of sclerotized inner tube; **AE.A.**, Aedeagal apodeme; **AP.A.**, Apical appendage of aedeagal apodeme; **AP.R.9**, Apodemal rod of ninth sternum; **A_1S.**, Conspicuous spur-like thickening at base of distal portion of armature of sclerotized inner tube of aedeagus; **A_2S.**, Broad sclerite on proximal portion of sclerotized inner tube; **B.**, Bulga (head) of spermatheca; **B.I.T.**, Sclerotized band of inner tube; **B.M.PT.**, Bay or ventral convexity of middle plate of aedeagal apodeme; **C.S.**, Crescent sclerite of aedeagus; **CR.** Crochet of aedeagus; **D.A.L.**, Dorsal anal lobe of proctiger; **D.A.9**, Distal arm of male ninth sternum; **D.L.9**, Apical lobe of distal arm; **D.S.**, Dorsal lobe of apodemal strut of aedeagus; **E.**, Eye; **E.L.PT.**, Caudal extensions of lateral plates of aedeagal apodeme; **F.**, Movable finger or digitoid of clasper; **H.**, Hilla (tail) of spermatheca; **L.B.C.**, Lura of bursa copulatrix; **L.L.**, Lateral lobe of aedeagus; **L.M.**, Lateral metanotal area of metathorax; **L.P.**, Labial palpus; **L.S.I.** Lateral sclerotization of inner tube; **M.D.L.**, Median dorsal lobe of aedeagus; **M.P.**; Maxillary palpus; **M.PT.**, Middle plate of aedeagal apodeme; **M.S.**, Median sclerite of apodemal strut of aedeagus; **MB.** Manubrium; **MPM.**, Mesepimere; **MPS.**, Mesepisternum; **MSN.**, Mesonotum; **MTM.**, Metepimere; **MTN.**, Metanotum; **P.**, Immovable process of clasper; **P.A.9**, Proximal arm of male ninth sternum; **P.B.C.**, Perula - dilated portion of bursa copulatrix; **PC.**, Pronotal comb; **P.L.9**, Proximal lobe of distal arm of ninth sternum; **P.R.**, Penis rods; **P.S.**, Proximal spur of aedeagus; **P.W.**, Wall of aedeagal pouch; **PL.A.**, Pleural arch of metathorax; **PS.S.**, Pseudosetae; **S.D.B.**, Sclerotized duct of bursa copulatrix; **SN.**, Sensilium; **SPI.**, Spicules; **SQ.**, Squamulum; **T.AP.9**, Tergal apodeme of ninth segment; **TB.** Frontal tubercle; **V.** Vesicle of aedeagus; **V.A.L.**, Ventral anal lobe of proctiger; **V.I.R.**, Ventral intramural rod of aedeagus; **V.P.**, Subanal sclerite (ventral or proximoventral sclerite of proctiger); **1 SPC.**, First abdominal spiracle (associated with metepimere); **1 T.**, First tergum; **2 A.**, Second antennal segment; **7 S.**, Seventh sternum; **7 SPC.**, Spiracle (fossa) of seventh segment; **8 S.**, Eighth sternum; **8 SPC.**, Spiracle (fossa) of eighth segment; **8 T.**, Eighth tergum.

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BOOK REVIEW

MAYFLIES OF MICHIGAN TROUT STREAMS, by Justin W. Leonard and Fannie A. Leonard. Bloomfield Hills, Michigan, Cranbrook Institute of Science. x +139 p. Col. fronts., 6 col. pls., 82 figs. 1962. $6.00 paper, $7.00 cloth.

This handsomely illustrated volume by the Leonards, due for publication several years ago, has at last appeared under the imprint of the Cranbook Institute. The original intent of the study of the Michigan mayflies was to present a professional report of this order as it occurs in Michigan. However, there has been a decided changed in the orientation of the work so that the information has been slanted to appeal to the informed trout fisherman. I believe, though, that there are few of those who will do more than study the colored press illustrating the adult stage and the black-and-white illustrations of the nymphs.

Because the Leonards had completed their work on this volume several years ago, no references later than 1954 are included and the reorganization of families proposed in that year by Edmunds and Traver, although used by other Ephemeropterists today, is not employed here. Nevetheless, most of the research subsequent to 1954 would not significantly alter the material contained in the volume in spite of the fact that some rather important papers have been published since then, many in Europe.

There are features of this volume that will be particularly useful to the entomologist such as a graph showing the seasonal occurrence of the adult stage of 28 species. The Leonards also describe and illustrate the methods by which they obtained their excellent color photographs and have included a useful section on collecting, preserving, and rearing mayflies.

The bulk of this little volume, pages 22-132, is devoted to classification, including simplified keys to families and genera of both nymphs and adults. The keys are designed to help the novice separate the higher categories easily, mostly with only the assistance of a hand lens. Further, the key to genera is limited to those which occupy trout streams. There are no keys to species, but the nymph, subimago, and imago, where these forms are known, are briefly described. The descriptions are followed by a discussion of the ecology of the species and pertinent characteristics distinguishing them are given.

For the student of Ephemeroptera there are drawings of the male genitalia of 62 of the species treated in the book. However, the most helpful parts of the book for the professional entomologist or aquatic biologist are the illustrations, comments on habitat, period of emergence, and habits of the adults and nymphs with regard to their specific ecological niches and mating swarms.

This little volume will be a welcome addition to the literature on North American Ephemeroptera and helps vastly in enlarging our knowledge of these fragile and beautiful insects.

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ANNOUNCEMENT

Short scientific articles not exceeding one printed page, with or without small illustrations, are welcome and usually will be published promptly. A printed page equals approximately 55 typewritten lines. See this issue for format.—Editor.

VARIATION IN THE QUANTITATIVE AND QUALITATIVE EVALUATION OF FREE AMINO ACIDS IN INSECTS DUE TO SAMPLING TECHNIQUES[1]

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INTRODUCTION

For a score of years the investigation of the amino acids and their role in insect metabolism and nutrition has been supplemented by more rapid, accurate methods of analysis. Paper chromatography, and the trace amounts of material necessary for analysis, has permitted tracing orally administered dietary supplements through the alimentary canal and its eventual disposition as fecal excretion or incorporation in the body fluid of the organism.

Demonstration by Auclair and Maltais (1950) that the resistance of the certain pea varieties to pea aphid attack is largely due to the differences in essential amino acids; by Lemonde and Bernard (1951), House (1949), Singh and Brown (1957) and others that each species of insect has its own specific daily minimum requirements of essential amino acids; by Bricteaux-Gregoire et al (1957) that hydrolysis of larval tissue to free amino acids serves as the source material for adult tissue synthesis, in part attests to the basic information that can be made available through chromatographic techniques.

More recently several authors have proposed the evaluation of amino acids as tools in systematics (Ball and Clark, 1953; Buzzati-Traverso and Rechnitzer, 1953; Micks, 1954, 1956; and Micks and Gibson, 1957), suggesting that the degree of similarity in the amino acids is a direct indication of the relationship among the forms tested. Our attempts to repeat some of the experiments have resulted in data not at all comparable with those of other workers. At least two major causes for these discrepancies immediately come to mind. One is that the genetic variability between and among populations of the same species is of such magnitude that the quantitative and qualitative differences observed are inherent with the populations tested; the second is that the differences in analytical technique alone can account for the lack of replicability.

Although many of the studies have claimed blood analysis, the sampling techniques include: heart puncture; whole body homogenates followed by centrifugation; whole body homogenates followed by deproteinization with ethanol and chloroform; inserting several specimens in a syringe and expelling the exudate for analysis; using adults of various degrees of maturity; and aging or heating spotted chromatograms prior to running to prevent peptide or protein streaking.

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The purpose of this work is to explore the amount of variability that can be attributed to these different sampling methods.

Materials and Methods

The American cockroach, *Periplaneta americana* (L.), was selected as the test animal because of its availability and ease of manipulation. Single adult specimens of the roach were used in each of the four experiments undertaken. Five roaches more than two months beyond the adult moult were isolated and starved for a period of one month; the sixth specimen used was a non-starved adult that had just emerged from the last larval moult. In all four tests the sample of whole blood, taken directly from a heart puncture in the dorsal intersegmental membrane, was used as the standard of comparison to the other methods.

The analysis of the blood was accomplished by ascending chromatography, using a method modified slightly from that outlined by Block and Weiss (1956). Five samples were applied to each 7" x 11" sheet of Whatman No. 1 filter paper and permitted to dry before being developed. A single solvent system was used to isolate the eight amino acids selected as standards for comparison. It was felt that these would serve to indicate the variability that could be expected in the other amino acids in this and in other solvent systems. The BAW solvent system used was prepared by mixing n-butyl alcohol, acetic acid and water in proportions of 250:60:250 v/v. After separation, the lower layer was drained into beakers and the alcohol phase used as the solvent. Beakers containing aqueous phase (lower layer) were placed in the chamber.

The spotted sheets were suspended from glass rods with stainless steel clips and mounted on a stainless steel frame. The unit was placed in the chromatographic chamber and sufficient solvent added to bring the level just below the lower ends of the suspended filter paper sheets. The chamber was covered and allowed to equilibrate for one hour. Following this, enough solvent was added to bring the level of the liquid to within 1.5 cm of the application line. The chromatograph was allowed to develop until the solvent front reached the 25 cm. line, whereupon it was removed and dried at room temperature. Each chromatogram was developed three times in the solvent and then stained with ninhydrin.

Twenty-four hours after staining, densitometer readings were made on a photoelectric densitometer (Photovolt Corp.) and the maximum density recorded.

In the first test, a four lambda sample of blood was removed through a heart puncture and applied to the chromatogram. The specimen was then washed and homogenized in a Waring blender with three volumes of distilled water. The material was centrifuged at 2000 RPM and 4 lambda and 12 lambda (to account for the 3 times dilution) of the supernatant were applied to the same sheet. The remainder of the supernatant was deproteinized by adding one volume of 95% ethanol to a 5 ml. aliquot and centrifuging. The supernatant was then shaken with three volumes of chloroform and again centrifuged at a very low speed. The resulting aqueous phase was removed for amino acid analysis. A four lambda and a 48 lambda (to account for dilution in deproteinization) samples were applied to the chromatographic sheet and allowed to dry before development. The data are recorded in Table 1.

In the second test the above procedures were repeated only using a recently moulted non-starved adult. The data are recorded in Table 3.

The third test was undertaken to compare another sampling technique. The technique involves inserting several specimens into a syringe and using from one to four drops of the expelled fluid for analysis. Again, a four lambda sample of whole blood was taken from the heart of a mature, starved female roach for a standard of comparison. The roach was then dropped into boiling water for 30 seconds, removed, dried, and placed into a 10 ml. syringe. The fluid contents were expelled through a number 27 needle of which four lambda, four drops and one drop were applied to the chromatogram for analysis. The data are recorded in Table 3.

The fourth test was devised to determine the effect of aging and heating of chromatograms on the quantitative and qualitative amino acid composition of samples. During certain periods of development in both hemimetabolous and holometabolous insects adequate separation of the amino acids are rendered impossible in most solvent systems due to what is felt to be peptide streaking. This is particularly evident at moulting periods in the hemimetabola and during the early pupal stage of the holometabola. It has been suggested previously by the authors that this is attributable to tissue breakdown and tissue resynthesis at these times. Deproteinization with the alcohols, chloroform and acetone does not eliminate the streaking. At least two methods can be used to partially overcome streaking at these periods; one is merely by permitting a spotted chromatogram to stand for four weeks at room temperature, and the second by heating the spotted chromatogram at 110°C. for 24 hours. Three starved, aged females were sampled by heart puncture and triplicate four lambda samples were applied to each of three sheets. The first sheet was run immediately, the second at the end of the 24 hour heating period and the third at the end of the month of aging at room temperature. The data are recorded in Table 4.

As this study was of a comparative nature, rather than a definitive one, the actual amounts of amino acids are not determined. The readings merely represent the maximum color density reading for each of the eight amino acids selected for analysis. In addition, the tables include a column recording the percentage difference as an increase or decrease, in relation to the quantitative data on the whole blood standard.

TABLE 1.

MAXIMUM DENSITY READINGS OF NINHYDRIN AMINO ACID SPOTS FROM THE BLOOD OF A SINGLE ADULT FEMALE OF P. AMERICANA

Starved Aged Specimen

AMINO ACID	4 λ Whole Blood	12 λ Body Homogenate	% change	4 λ Body Homogenate	% change	48 λ Homogenate Deproteinized	% change	4 λ Homogenate Deproteinized	% change
CYSTINE	.30	.20	−33	.10	−66	.57	+90	.16	−47
HISTIDINE	.66	.65	− 2	.32	−52	1.14	+58	.26	−61
SERINE	.56	.61	+ 9	.33	−41	.92	+64	.30	−46
GLUTAMIC ACID	.71	.78	+10	.40	−44	1.10	+55	.34	−52
ALANINE	.58	.61	+ 5	.28	−52	1.06	+83	.24	−59
PROLINE	.27	.29	+ 7	.14	−48	.50	+85	.16	−41
TYROSINE	.32	.16	−50	.06	−81	.24	−25	.08	−75
LEUCINE & ISOLEUCINE	.24	.24	0	.12	−50	.38	+58	.16	−75

TABLE 2

MAXIMUM DENSITY READINGS OF NINHYDRIN AMINO ACID SPOTS FROM THE BLOOD OF A SINGLE ADULT FEMALE OF P. AMERICANA

Recently Molted Not Starved

AMINO ACID	4 λ Whole Blood	12 λ Body Homogenate	% change	4 λ Body Homogenate	% change	48 λ Homogenate alcohol and chloroform ppt.	% change	4 λ Homogenate alcohol and chloroform ppt.	% change
CYSTINE	.14	.29	+107.1	.12	− 14	.37	+164.2	.06	−57
HISTIDINE	.80	.75	− 6	.36	− 55	.98	+ 22.5	.27	−66
SERINE	.84	.70	− 17	.32	− 62	.93	+ 10.7	.24	−71
GLUTAMIC ACID	.22	.84	+281.8	.37	+168.1	1.18	+463.3	.41	+86
ALANINE	.41	.81	+ 97.5	.30	− 27	1.14	+178.0	.35	−15
PROLINE	.22	.26	+ 18.1	.11	− 50	.42	+ 90.9	.18	−18
TYROSINE	.34	.20	− 41	.10	− 71	.36	+ 5.8	.14	−59
LEUCINE & ISOLEUCINE	.51	.53	+ 3.9	.19	− 63	.71	+ 39.2	.20	−61

TABLE 3

MAXIMUM DENSITY READINGS OF NINHYDRIN AMINO ACID SPOTS FROM THE BLOOD OF A SINGLE ADULT FEMALE OF P. AMERICANA

Starved Aged Specimen

AMINO ACID	4 λ Whole Blood	4 λ Syringe	% change	4 Drop Syringe	% change	1 Drop Syringe	% change
CYSTINE	.13	.22	+ 69	.75	+477	.33	+154
HISTIDINE	.28	1.05	+275	1.80	+453	1.45	+418
SERINE	.28	.42	+ 50	.98	+250	.59	+111
GLUTAMIC ACID	.13	.73	+462	1.18	+808	.94	+625
ALANINE	.14	.30	+14	.77	+450	.52	+271
PROLINE	.18	.30	+ 67	.80	+344	.44	+144
TYROSINE	.16	.21	+ 31	.40	+150	.24	+ 50
LEUCINE & ISOLEUCINE	.12	.14	+ 17	.60	+400	.36	+200

TABLE 4
THE EFFECT OF AGING AND HEATING ON QUANTITATIVE DETERMINATION OF FREE AMINO ACIDS IN THE BLOOD OF P. AMERICANA

AMINO ACID	Straight run Limits	Average	Aged 30 days Limits	Average	% change	Heated 110 C/48 hrs. Limits	Average	% change
CYSTINE	.12-.24	.19	.13-.31	.24	+26	.08-.13	.10	−48
HISTIDINE	.41-.56	.49	.34-.44	.40	−21	.20-.29	.24	−51
SERINE	.55-.76	.61	.54-.74	.63	+ 3	.... trace		
GLUTAMIC ACID	.21-.30	.26	.22-.30	.26	0	.14-.23	.17	−35
ALANINE	.24-.54	.43	.33-.67	.46	+10	.21-.40	.28	−35
PROLINE	.20-.33	.25	.22-.28	.25	0	.16-.22	.19	−24
TYROSINE	.22-.47	.37	.20-.40	.32	−13	.21-.26	.23	−38
LEUCINE & ISOLEUCINE	.23-.46	.35	.23-.35	.29	−17	.10-.22	.18	−49

RESULTS

One is immediately impressed by the high variability in the amino acid content of the whole blood samples among the six specimens as cited in the first column of each of the four tables. There is over a 100% difference between the low and high samples of cystine, alanine, tyrosine and isoleucine and leucine taken from the three specimens used as checks in Table 4. Even greater differences in the densitometric values are evident when specimens used in the other experiments are compared. For example, the blood samples taken from the females used in tests 1 and 3 and cited in Tables 1 and 3, are from individuals whose age and treatment is approximately identical, yet the quantitative determination of glutamic acid is 5½ times greater in one than the other.

In tables 1 and 2 the columns headed as 4 λ whole blood, 12 λ body homogenate, and 48 λ body homogenate with alcohol and chloroform precipitate, represent equivalent amounts of tissue content when the dilution factors are considered. The analysis of supernatant from whole body homogenates of the starved, aged specimen in Table 1 indicates a reduction in tyrosine of 50% while the glutamic acid is increased by 10% when compared to the whole blood standard. The equivalent tissue extract as represented by the 48 λ of homogenate following deproteinization shows even greater variation with increases in all amino acids except tyrosine.

This deviation is magnified in the data on the recently moulted not starved adult female recorded in Table 2. The enormous increases in glutamic acid, alanine and cystine over the whole blood standard, plus the disproportionate increase (or decrease), in the other amino groups, illustrates the magnitude of variability that can be expected without standardization of sampling technique.

The data in Table 3 represents the quantitative differences in the eight amino acids when using syringe expelled fluid from the roach. It can be noted that all eight amino groups show a marked percentage increase but again the increase is disproportionate, ranging from a 31% increase in tyrosine to 462% increase in glutamic acid. The absence of quantity control using the "4 drop" technique of some workers makes the data valueless in comparative studies.

The effects of aging and heating chromatograms prior to solvent development are recorded in Table 4. It can be noted that aging for 30 days at room temperature had little quantitative, and no qualitative effect on the amino acids under study. However, heating at 110°C. for 24 hours caused a marked reduction in all of the test amino acids, and eliminated serine completely. Neither aging or heating of the spotted chromatograms completely eliminated the peptide streaking when the chromatograms were run in the phenol solvent system, but did materially reduce the amount in those specimens that were just about to, or had just completed moulting.

Discussion

The interindividual variability in quantitative evaluation of amino acids is striking in the several individuals used in these tests, in spite of careful selection for unmated roaches of the same chronological age. The sources of some of the variation can certainly be attributed to aging, but the degree of change in a mature individual in a given period of time is unknown. Perhaps the most obvious conclusion that can be drawn from this data, as well as other as yet unpublished data of the authors, is that chronological age is not necessarily indicative of physiological age, and until rather detailed work is done on this aspect of the problem, comparative studies on whole body homogenates can only remain meaningless.

Previous studies on holometabolous insects by Agrell (1949) and Micks and Ellis (1952) have revealed fluctuations in the free amino acid levels during the development of the pupae. In both papers the authors used whole body homogenates of a number of individuals at a particular stage of development for analysis. The conclusion of Micks and Ellis that the free amino acid concentrations decrease during the pupal stage are undoubtedly correct if one were to consider only those individuals representing the late pupal stage. In a previous paper (Stephen and Steinhauer, 1957) the authors have found that during the early parts of the pupal stage of the holemetabolous species, *Lichnanthe rathvoni* and *Smerinthus cerisyi*, both the protein and the amino acid pool of the pupae resemble an undifferentiated mass of larval tissue which has undergone lysis. Attempts to separate either proteins or amino acids during this very short interval in the early pupal stage were unsuccessful because of the interference of great quantities of peptides. The work of Bricteaux-Gregoire, Verly and Florkin (1957) on *Sphinx ligustri* expands on this premise to show that most of the amino acids used for adult protein synthesis comes directly from larval tissue that has been hydrolysed to free amino acids before being used for adult tissue synthesis. It can therefore be appreciated that the physiological age of the specimens used can materially affect the data gleaned from this type of analysis; in fact, it is imperative, in this type of study, that only careful work on a developing individual will yield the type of information necessary to better understand requirements and developmental change.

Qualitative differences in amino acids from whole body homogenates of mosquitoes have been shown by Clark and Ball (1952), Ball and Clark (1953), Micks and Gibson (1957) and Lewallen (1957). In the former two papers the authors give no indication of the amounts of the sample utilized except to state than 6 to 40 specimens were used in the preparation. It is possible that their ability to separate the species of *Culex* used in their studies on the basis of qualitative differences may stem directly from the difference in sample size, for amino acids are not detectable by the ninhydrin reaction if they are present below certain threshold concentrations. Both Micks and Gibson, and Lewallen found quantitative and qualitative differences in amino acids between and among strains of *Aedes aegypti* and *Anopheles occidentalis*, *A. maculipennis* and *A. freeborni*. This is not surprising in view of the many recent studies carried on by population geneticists, in fact it is rather to be expected. Perhaps the general concepts of population genetics now widely accepted elsewhere have been treated too lightly by the physiologist, particularly with the current interest in comparative invertebrate physiology that has paralleled the improvement of microtechniques. It is conceivable that greater variation in free amino acids or lipoprotein may be found at the infraspecific level than found at the interspecific level, for species are composed of individual semi-isolated populations, each with their own adaptive genotype, inversion frequency, and mutation rate. Few, if any, species occupy a continuous range, but rather are composed of independently evolving interbreeding units responding to the selective rigors of the local environment. Working with populations of the same species, Dobzhansky and Spassky (1944) have shown the strong selective influence of temperature on the karyotype in *Drosophila pseudoobscura;* DaCunha (1951) working with the same species, indicates that the selective coefficient of the karyotype depends upon the food available in a given niche, and Birch and Battaglia (1957) come to the same conclusions in working with the inversion frequencies in *D. willistoni*. Other factors such as season, crowding, and other types of karyotypes in the same population exert pressures on the integrated adaptive peak of each population, and any genotypic difference, no matter of what magnitude, must be expressed in biochemical and phylsiological terms.

The fact that each population in a given species is a dynamic evolving entity would lead us to the tenet that each and every population is better adapted to its singular niche today than at any time in the previous history of the group. This would imply that with time such changes as exerted through selection should be able to be determined biochemically, which in turn would prevent absolute replicatability. Thus, what may be found through micromethod determination today will not necessarily be true tomorrow, and biochemically what may apply to population A of a given species need not necessarily apply to population B of the same form.

Unfortunately developmental and biochemical genetics are yet in their infancy, but the information available is sufficient to speculate on the biochemical significance of minor genotypic changes through inversions and mutations. The studies of Hinton and his coworkers indicate that some spontaneous mutations and inversions in *Drosophila melanogaster* drastically alter the nutritional requirements of strains of that species making nucleic acid and adenine necessary for their normal maturation. The selective significance of such mutants is profound and were such individuals to survive under natural conditions, they would require a dietary supplement or utilization of heretofore unused subtrate. Thus the karyotype frequencies of populations can be modified by the selective properties of seasonal change, food, temperature, crowding, etc., each of which may exert an influence on the nutritional requirements and dietary uptake, which in turn may be reflected in the microanalysis of the blood and tissue. As microtechniques become even more refined, the influence of the genotype as a source of biochemical variation will demand much more scrutiny than is presently being given it.

Additional sources of variability have been shown to affect the free amino acid levels of the blood of insects. Auclair (1953) found that ingestion of alanine by cockroaches caused an increase in glutamine in the blood, L-glutamic acid brought about an increase in glutamine and alanine, and a-ketogluteric acid raised the glutamic acid level. Beadle and Shaw (1950) have shown that the free amino acid concentration in *Sialis* increases and decreases to compensate for fluctuations in the chloride of the blood. The free amino acids are thus a part of the osmoregulatory system of these insects and are directly influenced by the environment. A recent paper by Dennell (1958) indicates that alanine is released in the cuticle as a result of deamination of dihydroxyphenylalanine during cuticle hardening.

With these multitudes of developmental, genetic and dietary factors that can influence the quantitative and qualitative determination of free amino acids in insects, it is imperative that more rigid control of the causes of variation be considered in experimental work in comparative physiology. The possibility of elimination of all variables is obviously remote, however, even a standardization of sampling technique can reduce their effect.

Summary

A series of experiments were designed to explore the amount of variability in amino acid determination that can be attributed to the wide variety of sampling techniques presently used for comparative studies. Comparisons were made against whole blood samples using a whole body homogenate, a whole body homogenate that had been deproteinized by ethanol and chloroform, inserting several specimens in a syringe and using the expelled fluid for analysis, using adults of different stages of maturity, and the effect of aging and heating of spotted chromatograms prior to development.

The differences in free amino acid composition among the specimens used as standards in the four experiments is striking with the glutamic acid of one specimen 5½ times greater than the low level recorded.

The effect of whole body homogenization and its subsequent deproteinization, of using the syringe expelled fluid, of age, and of heat treatment magnified the variability causing disproportionate increases or decreases in amino acids when compared to the whole blood standards.

Numerous other factors are discussed which may lead to quantitative and qualitative variability in the free amino acid level of a given species. The magnitude of variation that can be attributed to developmental, genetic and dietary factors make it imperative that more rigid control of the causes of variation be considered in experimental work in comparative physiology.

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NOTES ON SOME SPIDER WASPS OF INCORRECT OR AMBIGUOUS TYPE LOCALITY

(HYMENOPTERA: POMPILIDAE)

I have recently had occasion to examine the types of several Pompilidae described by early European authors. The following notes pertain to three names which were listed as "Pompilidae of Uncertain Position" in the Catalog of Hymenoptera of America North of Mexico (1951). Two of these names do not apply to North American species, and the third can now be listed as a synonym of a well known U. S. species.

Pompilus ephippiger Smith, 1855. The type is a female in good condition at the British Museum. It is a typical specimen of the Palaearctic *Anoplius* (*Lophopompilus*) *samariensis* (Pall.), and Smith's name should be added to the synonymy of that species, his type locality ("North America") obviously being in error.

Pompilus brevicornis Taschenberg, 1869. This species was described from "Illinois and Mexico"; the name is a primary homonym and was renamed *fiorentinii* by Dalla Torre (1897). The type, at the Zoologisches Institut, Halle, is a male from Illinois which proves to be *Evagetes ingenuus* (Cresson). The female allotype is a specimen of *Allochares azureus* (Cresson) from Mexico.

Pompilus obscurus Dahlbom, 1845. Dahlbom merely gave "America" as the type locality of this wasp, but the type, in good condition at the University of Lund, is a female labeled as from Buenos Aires. It is apparently a valid species of the genus *Anoplius*, subgenus *Arachnophroctonus*, not unrelated to *americanus* Beauvois.

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TEN KILOMETERS OF SWARMS OF AN ANT

Suitable meteorological and biological conditions regularly cause the emergence of great numbers of winged ants at one time, but the following case is notable for the numbers of individual swarms involved. The visibility of the swarms was also exceptional, since they occurred in a mountain valley without trees or habitations to impede the view and were clearly silhouetted against a continuous mountain ridge. The location was Western Argentina, approximately in Longitude 71° West, Latitude 39° South, 30 Oct. 1960.

The ants were *Araucomyrmex tener* (Mayr), described in 1868 (Ann. Soc. Natural. Modena, 3: 166) as *Dorymyrmex tener* from Mendoza, Argentina. The worker is a medium-sized ant and the females are markedly larger than the males. The species is confined to Southern South America. Time was limited in which to make observations since my party was travelling by truck, jolting along a rocky trail, and it was necessary to make camp before dark.

Swarms of ants had been noted in the late afternoon along the rough trail, but it was not until 6:00 P.M. that their abundance became notable. By this time the later afternoon sun caused them to be clearly visible against the shaded east slope of a largely north-south ridge.

Each swarm appeared to be an independent unit and the ants, zigzagging in their flight, formed columns of an estimated one-half meter in diameter and from less than one to perhaps two meters in height. Often the swarms nearly touched; commonly they were one to several meters apart. The columns probably contained individuals of the order of magnitude of 500 to several thousand. The columns at times suggested the wavering light of candles, as they swayed in the breeze. The columns most visible were several meters above the ground.

By the time the site of the night's camp was reached at 7:00 P.M., the swarming had stopped. Fully 10 kilometers of trail had been traversed and over much of this distance numerous swarms had been continuously in view. Many had been intercepted by the truck windshield. The site of the camp offered one of the few places where the ground sloped comparatively little, and here as elsewhere were numerous craters of this ant. The soil surface was dry and the worker ants, with some males, were milling about. Many males were scattered through the grass. A few females were at the entrances. The nests were of multiple-crater type like those of the Holarctic *Lasius* or *Acanthomyops*. A low sound caused me to place my ear within a few centimeters of the ground and a distinct buzzing or stridulation was markedly apparent. Each ant by itself made an almost imperceptible sound and thousands must have been stridulating to produce the volume of sound that was heard. There was also a faint odor, and when one or two workers were crushed between the fingers the odor was distinctive. It was not the common Tapinoma-type of related ants and could not be likened to any well-known odor.

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MUTANT FORMS OF ANOPHELES ALBIMANUS WIEDEMANN

(Diptera: Culicidae)

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Anopheles albimanus is one of the mosquitoes which presents problems to malaria eradication in that it has developed insecticide resistance and also appears to adjust behavioristically to household residual sprays. In our studies on dieldrin resistance, we have been rearing individual progenies, inbreeding them, and again obtaining individual progenies resulting from brother-sister matings. Although this was being done primarily for other purposes, this did offer an opportunity to look for mutant forms. It is the purpose of this paper to report the findings of three mutants of *A. albimanus* recognizable by morphological characters.

The bisignatus mutant. The appearance of the hind tarsal segments of normal ("wild") *albimanus* is shown in Figure 1. The second hind tarsal is about one half black basally; the distal part of this segment, and all of the third and fourth segments are white, and the fifth segment has a basal black ring. The *bisignatus* leg is shown in Figure 2. The third hind tarsal segment has a basal black ring, so that the broad white area of the hind tarsi is interrupted by two black rings. This figure also shows the second segment to be almost entirely black, but in most specimens the second segment will show a more moderate increase in darkening, so that the distal fourth to half is white.

From a population of *A. albimanus* from El Salvador, some 60 individual progenies were reared, representing F_1, F_2, F_3, and F_4 generations. All were given at least a cursory examination while the specimens were being transferred to various containers in tests for insecticide resistance, and several groups were examined carefully under the microscope. The *bisignatus* mutant was found twice; and by inbreeding and selection, a colony was established. The pedigree of the *bisignatus* colony is as follows:

Parent ♀ 8 from breeding cage "wild" type

↓

F_1 ♀ A —wild type

↓

F_2 ♀ e —wild type, but several siblings with this black ring at base of second tarsal segment

↓

F_3 ♀ ♀ 2 and 3—with ring on second tarsal segment

[1]These observations were made in the course of a program supported in part by research grants from the National Institutes of Health and the Pan American Health Organization.

↓

F_4 adults from ♀♀ 2 and 3 were used to start the *bisignatus* colony. These included 10 mutant ♀♀, and 25 mutant ♂♂. To ensure egg production, 6 normal ♀♀ were also placed in the breeding cage.

The *bisignatus* mutant was also noted in another series of brother-sister matings; of the progeny produced by one F_2 ♀, 1 of 19 ♀♀ and 3 of 14 ♂♂ were *bisignatus*.

The trisignatus mutant. This is characterized by a black ring at the base of the third and fourth, as well as the fifth hind tarsal segment (Figure 3). Individuals with these markings were fairly common among the progenies of the F_4 ♀♀ in the first series. The following table shows the distribution of the three kinds of individuals among the progenies of four *bisignatus* and 1 "wild" type F_4 females.

Parent ♀		*Progeny—F_5*			
No.	*Type*	*Sex*	*Normal*	*bisignatus*	*trisignatus*
1	bisig	♀	0	61	8
		♂	0	60	8
2	"wild"	♀	10	55	0
		♂	2	50	1
5	bisig	♀	4	63	0
		♂	0	50	0
6	bisig	♀	12	30	0
		♂	3	38	0
8	bisig	♀	1	22	1
		♂	0	24	7

In subsequent generations, as continued selection is being made for the *bisignatus* colony, the *trisignatus* form continues to appear. Apparently it represents a more marked expression of the *bisignatus* gene or genes.

Short-palp mutant. Among the progeny of ♀ 5 in the above table, was one *bisignatus* female which also had one short palp (Figure 4). We were unable to bring about the insemination of this specimen. This mutant has not been found a second time.

Discussion

Studies of the genetic basis of insecticide resistance in mosquitoes, as well as other work on the genetics of mosquitoes, have stimulated a search for mutant marker genes. Laven (1956) and Kitzmiller (1958) showed it was possible to produce several mutants of *Culex pipiens* by exposure to X-rays. Craig and Vandehey (1962) and Vanhehey and Craig (1962) described a number of mutants of *Aedes* *aegypti* obtained by inbreeding. It is evident that we are only beginning to appreciate the potential existence of many mutant forms of mosquito species. If these can be established as colonies, they should be of great value in advancing our knowledge of mosquito genetics.

The white hind-footed *Nyssorhynchus* group of anophelines show considerable variation in colorational markings. *A. triannulatus* was the name given by Neiva and Pinto (1929b) to a 3-ringed form of a mosquito later described by Petrocchi (1925) as *A. bachmanni* with the normal tarsal markings. A 2-ringed form of *triannulatus* (*cuyabensis*) also may be found. Anduze (1948) has described 2- and 3-ringed forms of *A. aquasalis*, under the names *guarauno* and *delta*.

Hoffmann (1938) proposed that the 2- and 3-ringed forms of *A. albimanus* should be recognized as varieties, with the names *bisignatus* and *trisignatus*. Vargas (1940) expressed the belief that these are only variations of *A. albimanus*, and that they have no hereditary basis. Vargas and Palacios (1950) referred to the extra rings as being an unstable character which they interpreted as a manifestation of melanism.

The present study demonstrates that the *bisignatus* and *trisignatus* mutants have a genetic basis. The mechanism of inheritance has not as yet been determined, but the fact that the genes for the character exist in normal appearing adults suggests they are recessive. Whether further selection of the *trisignatus* form will lead to the establishment of a population homozygous for this character is uncertain. One attempt at such selection has failed.

The fact that aberrant kinds of *Nyssorhynchus* mosquitoes have been observed from time to time in nature suggests that these species may have considerable potential value for genetic studies. If the gene for extra tarsal rings is linked with other characters of selective value in a given area, a population consisting to a large extent of rather strikingly different individuals may be found. An example may be *A. rondoni*, which is separable from *A. evansae* (= *strodei*) with certainty only by its 2-ringed hind tarsus. *A. rondoni* was described by Neiva and Pinto (1922a) from 3 specimens taken in a region of Matto Grosso where "*Cellia trasimaculata*" (? = *evansae*) was also present. Apparently the 2-ringed form, represented by 3 specimens in a general collection of anophelines, may have been fairly abundant here. In our own deartmental collection, there is a series of 17 adult specimens collected in March, 1927, at Ledesma, Argentina, by N. C. Davis. From the observations made by Davis and Shannon (1928), it is evident that *rondoni* was relatively abundant at the time in the vicinity of Ledesma. Because progeny reared from captured females bred true, Davis (1933) argued that *rondoni* could not be "a mere variety of *A. tarsimaculatus* or of *A. strodei*." But since the *bisignatus* mutant of *albimanus* will breed true after selection and inbreeding, it seems reasonable that selection in the field may have produced the population of *rondoni* at Ledesma. It seems quite possible that *A. evansae* Bréthes (1926) must be synonomized with *A. rondoni* Neiva and Pinto (1922).

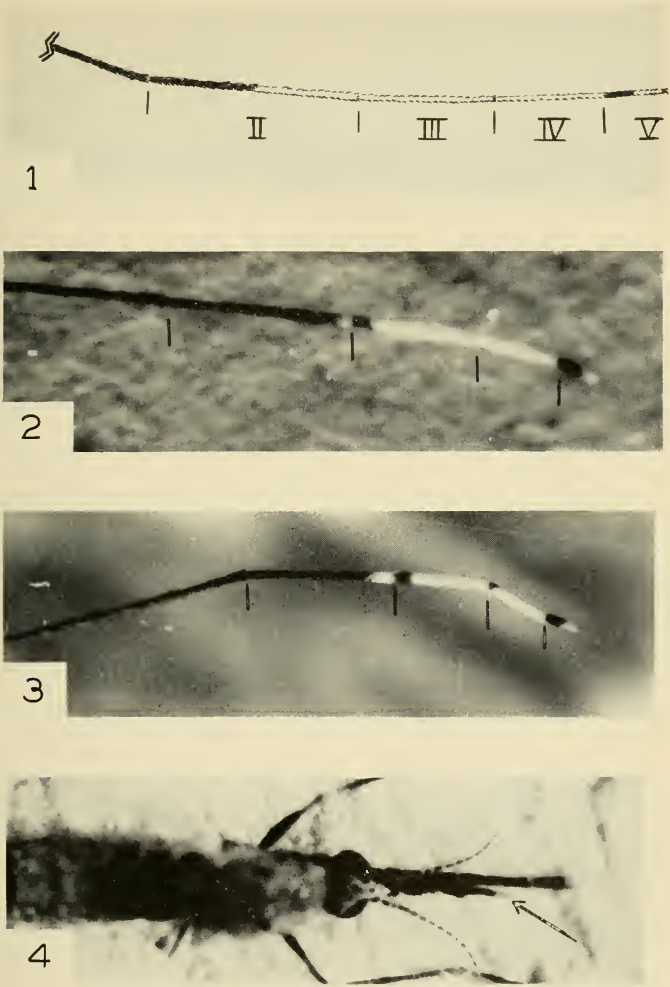

Fig. 1, Hind tarsal segments II to V of normal, i.e. "wild type" *A. albimanus;* Fig. 2, Hind tarsus of *bisignatus*, showing a black ring at the base of the third segment; Fig. 3, Hind tarsus of *trisignatus*, showing a black ring at the base of the third and fourth segments; Fig. 4, Mutant female with a short right palpus.

The mutants with the extra tarsal rings are quite spectacular, but it seems likely that potentially there are many others. Mutants with biological advantages may also exist among the *Nyssorhynchus* species, and aside from the development of insecticide resistance, selection for these mutants may complicate malaria eradication programs.

Summary and Conclusions

Three mutant forms of *Anopheles albimanus* Wiedemann are described. Through selection and inbreeding, a colony of the *bisignatus* mutant has been established. Extra tarsal rings have been observed in wild-caught specimens of several *Nyssorhynchus* species, and it appears that these, too, are mutant forms. The existence in some areas of fairly large populations of *A. rondoni* suggests that selection for these mutants may take place in nature, perhaps because of linkage with other characters conferring a biological advantage in the particular area or season.

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NOTES ON THE TYPES OF NEARCTIC PEPSINAE AND CEROPALINAE THAT ARE IN LONDON, LUND, OTTAWA, AND QUEBEC

(Hymenoptera: Psammocharidae)

In 1957 the author published a revision of the Nearctic spider wasps of the subfamilies Pepsinae and Ceropalinae (U. S. Natl. Mus. Bul. 209, 286 pages). Most of the types had been seen prior to publication. Those that were not seen were in museums in London, Lund (Sweden), Ottawa, and Quebec. Incidental to travel for study of ichneumonid types (supported by the National Science Foundation and the National Institutes of Health), it was possible to study the remaining types. The types of *Agenia caerulescens* Dahlbom, *A. fulvipes* Dahlbom, *A. rufigastra* Provancher, *Ceropales longipes* Smith, *C. superba* Provancher, *C. minima* Provancher, *Hemipepsis ustulata* Dahlbom, *Pompilus comparatus* Walker, *P. maculipennis* Smith, *P. pyrrhomelas* Walker, and of *Priocnemis nebulosus* Dahlbom all proved to have been correctly interpreted in the revision. Three additional types, however, need comment:

Agenia atrata Provancher (1888. Additions et corrections au volume II de la faune entomologique du Canada, p. 263). Reference to this name was inadvertantly omitted from the revision. In an earlier publication (1951) it had been listed as a questionable synonym of *Priocnemis cornica* Say. Provancher described the species from a female and male from Hull, Quebec. His "female" is in Quebec and his "male" in Ottawa. Both specimens are males. Gahan and Rohwer (1917. Canad. Ent. 49:305) designated the Quebec specimen as "allotype, ♂". Their designation involves a paradox, however interpreted, but it is accepted here as eliminating the Quebec specimen from the possibility of being the lectotype. The lectotype is then the male in Ottawa. Both the Quebec and the Ottawa specimens are males of *Priocnemis cornica* Say.

Agenia perfecta Provancher, 1882. Type: ♂, Cap Rouge, Que. (Quebec). The type is *Priocnemis scitula*, a specimen rather intermediate between the northern and the southern subspecies but closer to the southern one. The name is hereby synomymized under *Priocnemis scitula scitula* (Cresson), 1867 **(NEW SYNONYMY).** In my revision it was treated as a lost species of *Minagenia* (page 235).

Pseudagenia utilis Cameron (1891. Biologia Centrali-Americana, Hymenoptera 2: 170). Type: ♀, Teapa, Tabasco, Mexico (London). Among the Neotropic types in London, this seems to be the only one which emends the nomenclature of Nearctic Pepsinae or Ceropalinae. The type is an *Ageniella*, of which *Ageniella obscura obscura* Banks (1925) is a synonym **(NEW SYNONYMY).**—Henry Townes, *Museum of Zoology, University of Michigan*

THE TYPE-SPECIES OF AUSTRAPOPHUA GIRAULT

(HYMENOPTERA: ICHNEUMONIDAE)

Girault (1926, Insecutor Inscitiae Menstruus, vol. 14, pp. 135-136) described the genus *Austrapohua* (sic!) from Australia in comparison with *Apophua* Morley, noted it had the habitus of *Xanthopimpla*, and placed in it two new species: *Austrapophua xanthopimploides* and *A. summervillei*. He made no type designation at that time.

H. K. Townes and V. K. Gupta in their Catalogue and Reclassification of Indo-Australian Ichneumonidae, p. 49, place the genus as a new synonym of *Xanthopimpla* Saussure with the statement, "Type: Not yet selected."

Girault, in 1930 (New Pests from Australia, VIII, second page (pages not numbered)) added *A. hirsuta*, new species, by describing in what way it differed "from genotype." The first character cited is "Wing 1 dusky on apical margin." Only *xanthopimploides* has clear wings. *A. summervillei*, like *hirsuta*, is described as having the apical margin of the forewing infuscate.

Austrapophua xanthopimploides Girault, which was surely considered the genotype by Girault, is herewith designated the type-species of *Austrapophua* Girault.

LUELLA M. WALKLEY, *Entomology Research Division, A.R.S., U. S. Department of Agriculture, Washington 25, D. C.*

THE TYPE LOCALITY OF EUSISYROPA VIRILIS (ALDRICH AND WEBBER)

(DIPTERA: TACHINIDAE).

Eusisyropa virilis was described by J. M. Aldrich and R. T. Webber as *Zenillia blanda virilis*, new subspecies (1924, Proc. U. S. Natl. Mus., 63(17):40.) The holotype male, which is deposited in the United States National Museum, was stated to be from Rye, New York. An examination of the labels suggests that this is incorrect and that the type locality should be recorded as Chicago, Illinois. The specimen bears three labels other than the red "Type Number" label and a printed ♂ label, and these pinned below the fly read, top label first, as follows: 1. "H. Bird, Coll./Rye, N. Y." [the "Coll." is hand written, the remainder of the label is printed]; 2. "Ex. *Papaipema harrisii*./Aug. 4-1912./Chicago./E. Beer." [entirely hand written]; 3. "5.". It is probable that an immature stage of the *Papaipema harrisii* (Grote) was collected in Chicago, Illinois by E. Beer and in turn was sent to H. Bird, and the tachinid emerged from the host at Bird's home in Rye, New York. Bird in one of his studies of *Papaipema* species (1917, Canadian Ent., 49(4):124) refers to Mr. E. Beer as a local entomologist who helped him examine *Papaipema* hosts in the flora of the Chicago Plain in 1915. This shows Beer to be a resident and collector in the Chicago area at the approximate time of this rearing and substantiates my belief that the host material from which *Eusisyropa virilis* was reared originated in Chicago, Illinois.—PAUL H. ARNAUD, JR., *Research Fellow, American Museum of Natural History,* and *Research Entomologist, California Academy of Sciences.*

A SYNOPTIC CATALOG OF THE MOSQUITOES OF THE WORLD, SUPPLEMENT II

(DIPTERA: CULICIDAE)[1]

ALAN STONE, *Entomology Research Division, ARS, U. S. Department of Agriculture, Washington, D. C.*

This paper is the second supplement to the *Synoptic Catalog of the Mosquitoes of the World* by Stone, Knight, and Starcke (1959), the first supplement having appeared in Vol. 63 (1961), No. 1, pp. 29-52, of the *Proceedings*. In the present supplement, I have not differentiated between corrections to the original catalog and additions. Corrections to Supplement I, both published and unpublished, are included. The format used here is essentially as in Supplement I. New distribution records are given only when they extend the range of the species considerably over that given in the catalog or Supplement I. Four new names of the genus-group and 111 new names of the species-group are listed. I am particularly indebted to J. Bonne-Wepster, E. I. Coher, D. H. Colless, J. Lane, J. C. Lien, M. Maffi, F. Peus, E. Séguy, and J. S. Wiseman for supplying me with pertinent information.

Introduction

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1. With the additions in this supplement the number of valid genera and subgenera becomes 118, the number of valid species becomes 2,591, and the total number of names of the species-group becomes 4,245.

Systematic Arrangement

6. Belkin, 1962, 1: 117 (recognized the Culicidae, as here treated, as a subfamily and placed in it the tribes Anophelini, Uranotaeniini, Culicini, Aedeomyiini, Hodgesiini, Culisetini, Ficalbiini, Mansoniini, Orthopodomyiini, Aedini, Sabethini, and Toxorhynchitini).

Catalog of the Family Culicidae

9. **Taxonomic Anatomy.**—1962, Belkin, 1: 547-563.

Australian Region.—1962, Belkin, 1: 1-608, 2: 1-412 (South Pacific); 1962, Peters, 168 (anopheline pupal key).

Ethiopian Region.—1960, Rioux, 53-92 (North Chad; keys).

Nearctic Region.—1960, Stojanovich, 1-36 (southeastern U.S.); 1961, Gjullin, Sailer, Stone, and Travis, 1-98 (Alaska); 1961, Breeland, Snow, and Pickard, 249-319 (Tennessee Valley); 1961, Nielsen and Rees, 1-58 (Utah); 1961, Steward and McWade, 121-188 (Ontario); 1961, Stojanovich, 1-49 (northeastern U.S.).

Neotropical Region.—1956, Perez Vigueras, 1-579 (Cuba); 1961, Cova-García, 1-213 (Venezuela; Anophelinae); 1962, Forattini, 303-642 (Anophelinae).

Palaearctic Region.—1960, Sicart and Ruffie, 631-647 (key, pupae).

[1]Reprints are for sale by the Thomas Say Foundation, Entomological Society of America, 4603 Calvert Rd., College Park, Maryland. Correction to Suppl. I: Change "St." to "Rd."

Genus CHAGASIA Cruz

10. **bathana** (Dyar).—Peru.

Genus BIRONELLA Theobald
Subgenus BIRONELLA Theobald

11. **soesiloi** (Strickland and Choudhury).—Peters, 1962, 163 (P*).

Genus ANOPHELES Meigen

Important reference: 1961, Forattini, 169-187 (keys, males, females, larvae, Neotropical).

Subgenus ANOPHELES Meigen

13. *Anopheles*, subgenus *Shannoniella* Fonseca and Ramos.—Change "1939" to "1939 (March 1940)."

Important references: 1961, Reid and Knight, 474-488 (classification); 1962, Reid, 1-57 (keys, *barbirostris* group).

ahomi Choudhury.—Reid, 1962, 37 (to sp. status).

15. **bancrofti** Giles.—Peters, 1962, 164 (P*).

barbirostris Van der Wulp.—Reid, 1962, 7 (♂, ♀*, P*, L, E*).

var. **ahomi** Choudhury.—Transfer to p. 13 as valid sp.

barbumbrosus Strickland and Choudhury.—Reid, 1962, 29 (♂, ♀*, P*. L*)

16. **campestris** Reid.—Malaya.

1962. Bull. ent. Res. 53: 15 (♂*, ♀*, P, L*, E). Type-loc: Rantau Panjang, Klang, Selangor, Malaya (BM).

claviger (Meigen).—Poland.

17. **donaldi** Reid.—Malaya.

1962. Bull. ent. Res. 53: 17 (♂*, ♀*, P, L, E*). Type-loc: 14th mile Puchong-Klang road, Selangor, Malaya (BM).

18. **franciscoi** Reid.—Philippines.

1962. Bull. ent. Res 53: 27 (♂, ♀, P*, L, E*) Type-loc: Iwahig, Palawan, Philippines (BM).

20. **hodgkini** Reid.—Malaya.

1962. Bull. ent. Res. 53: 20 (♂, ♀*, P*, L*, E*). Type-loc: 16th mile Ulu Gombak road, Selangor, Malaya (BM).

21. **labranchiae atroparvus** Van Thiel.—Sicart and Ruffie, 1960, 635 (P).

lesteri Baisas and Hu.—Delete "Borneo, Malaya."

ssp. **paraliae** Sandosham.—Malaya, Borneo.

1959. Malariology, University of Malaya Press, Singapore: 189 (♀, L). Type-locs: Malaya and Borneo (LU).

22. **maculipennis** Meigen.—Sicart and Ruffie, 1960, 635 (P*).

23. **manalangi** Mendoza.—Reid, 1962, ♂, ♀, P*, L, E*). Correction to Suppl. I: Line 5, transpose "2" and "3."

25. **pollicaris** Reid.—Malaya.

1962. Bull. ent. Res 53: 24 (♂, ♀*, P, L, E*). Type-loc: 16th mile Ulu Gombak road, Selangor, Malaya (BM).

28. **sacharovi** Favr'.—Jugoslavia.

29. **vanus** Walker.—Reid, 1962, 33 (♂, ♀, P*, L, E*).

Subgenus NYSSORHYNCHUS Blanchard

34. *bachmanni* Petrocchi.—Transfer to ssp. of *triannulatus* (see below).

perezi Shannon and Del Ponte.—Transfer to synonymy under ssp. *bachmanni* (see below).

ssp. **davisi** Paterson and Shannon.—Transfer to synonymy under **ssp. bachmanni** (see below).

triannulatus (Neiva and Pinto)
ssp. **bachmanni** Petrocchi.—Cova García, 1961, 39, 91, 128 ♂*, ♀*, L*, E*; resurrected from synonymy as ssp., syn.).
davisi Paterson and Shannon.
perezi Shannon and Del Ponte.

Subgenus KERTESZIA Theobald

35. **neivai** Howard, Dyar, and Knab.—Brazil.

Subgenus CELLIA Theobald

38. **annulipes** Walker.—Peters, 1962, 166 (P*).
39. **azaniae** Bailly-Choumara.—British Somaliland, Aden.
1960. Bull. Soc. Pat. exot. 53: 532 (♂* ♀*, P*, L*). Type-loc: British Somaliland (IERT).
balabacensis Baisas.
takasagoensis Morishita. 1946. J. Formosan med. Assoc. 45: 21, 65 (♂, ♀; *leucosphyrus* var.). Type-locs: Dairi, Karenko Prefecture and Kanshirei, Tainan Prefecture Formosa (LU). Colless, *in litt.*, syn.).
broussesi Edwards.—Transfer to p. 53 as spp. of *rufipes*.
40. **caroni** Adam.—Congo.
1961. Bull. Soc. Pat. exot. 54: 714 (♀*). Type-loc: Matouridi (cave) "Moyen-Congo," Congo Republic (IERT).
41. **dthali** Patton.—French Equatorial Africa, Morocco.
42. **faini** Leleup.
ssp. **vanthieli** Laarman.—Leleup and Zaghi, 1960, 925 (to ssp. status).
farauti Laveran.—Belkin, 1962, 1: 138 (♂*, ♀*, P*, L*).
filipinae Manalang.—Nepal.
flavicosta Edwards.—Madagascar. Coz, Grjebine, and Hamon, 1960, 742 (♂*, ♀*, L*, taxonomy).
44. **griveaudi** Grjebine.—Madagascar.
1960 (1961). Bull. Soc. Pat. exot. 53: 940 (♀*). Type-loc: Manjakatompy, Ambahara Forest, Madagascar (IRSM)
hamoni Adam.—Congo.
1962. Bull. Soc. Pat. exot. 55: 154 (♂*, ♀*, P*, L*). Type-loc: Maya-N'Zouari Cave, 3 km. sw. of Maya, Kindamba, Mayama, Congo (IERT).
hispaniola (Theobald).—French Equatorial Africa. Senevet and Rioux, 1960, 530 (? = *cinereus* ssp.).
45. **jebudensis** Froud.—Ivory Coast.
46. **koliensis** Owen.—Belkin, 1962, 1: 144 (♂*, ♀*, P*, L*).
lloreti Gil Collado.—Maffi, 1962, 63 (taxonomy).
47. **longirostris** Brug.—Peters, 1962, 167 (P*).
lungae Belkin.—Delete "New Guinea."
48. **mascarensis** De Meillon.—Grjebine and Chauvet, 1961, 119 (P*, L*).
49. **moucheti** Evans.
ssp. **bervoetsi** D'Haenens.—Congo.
1961. Bull. Ann. Soc. Roy. ent. Belg. 97: 189 (♂*, ♀*, L*). Type-loc: Tsakalakuku, Feshi, Leopoldville, Congo (CMT).

50. **nataliae** Belkin.—Belkin, 1962, 1: 149 (♂*, ♀*, P*, L*).
nili somalicus Rivola and Holstein.—Change "French Somaliland" to "Somalia."
51. **parensis** Gillies.—Tanganyika, Kenya.
1962. Proc. R. ent. Soc. Lond. (B) 31:82 (♂*, ♀*, P, L, E). Type-loc: Kihurio, South Pare district, Tanganyika (BM).
52. **rhodesiensis rupicolus** Lewis.—French Equatorial Africa.
53. **rufipes** (Gough).—Hamon, Taufflieb, and Dyemkouma, 1961, 24 (taxonomy).
spp. **broussesi** Edwards.—Rioux, 1960, 62 (to ssp. status).
ssp. **seneveti** Rioux.—French Equatorial Africa.
1959. Ann Parasit. hum. et comp. 34: 733 (A). Type-loc: Tibesti, North Chad, French Equatorial Africa (LU).
var. **brucechwatti** Hamon, Taufflieb, and Dyemkouma.—French Equatorial Africa, Nigeria.
1961. Bull. Soc. Pat. exot. 54: 25 (♂*, ♀*). Type-loc: Largeau, Chad, French Equatorial Africa (IERT).
54. **solomonis** Belkin, Knight, and Rozeboom.—Belkin, 1962, 1: 150 (♂*, ♀*, P*, L*).
56. **theileri** Edwards.—Nigeria.
58. **vanthieli** Laarman. Transfer to p. 42 as ssp. of *faini*.

Genus TOXORHYNCHITES Theobald
Subgenus ANKYLORHYNCHUS Lutz

59. **Ankylorhynchus** Lutz.—Correction to Suppl. I: Line 4, change "in" to "on."

Subgenus TOXORHYNCHITES Theobald

62. **auriflius** (Edwards)
formosensis Ogasawara. 1939. Ent. World, Tokyo 7(63): 242 (♂; as var.). Type-loc: Ienohate (Shinchiku), Formosa [Chiehtuan, Loswei Village, Tatung Township, Ilan Hsien] (LU). Lien, 1962, 617 (syn.).
brevipalpis Theobald.—Belkin, 1962, 1: 530 (♂*, ♀, P*, L*).
63. **inornatus** (Walker).—Delete "Ellice Islands." Belkin, 1962, 1: 533 (♂*, ♀, P*, L*).
64. **splendens** (Wiedemann).—Rotuma Island, Samoa.

Genus MAORIGOELDIA Edwards

65. **Rachionotomyia**, subgenus **Maorigoeldia** Edwards.—Belkin, 1962, 1: 492 (to generic status).

Genus TRIPTEROIDES Giles
Subgenus TRIPTEROIDES Giles

66. *Rachionotomyia* Theobald.—Transfer to p. 72 as valid subgenus with *Polylepidomyia*, *Skeiromyia*, *Mimeteomyia*, *Squamomyia*, and *Tricholeptomyia* as synonyms.
aranoides (Theobald).—Transfer, with synonyms and subspecies, to p. 72, under subgenus *Rachionotomyia*.
67. **binotatus** Belkin.—Belkin, 1962, 1: 504 (♂*, ♀, P*, L*).
bonneti Belkin.—Santa Cruz Islands.
1962. Mosq. S. Pacific 1: 501 (♂*, P*). Type-loc: Temotu (Malo), Santa Cruz Islands (USNM).

distigma (Edwards).—Belkin, 1962, 1: 502 (♂*, ♀, P*, L*).

68. **nepenthicola** (Banks).—Transfer to p. 72 under subgenus *Rachionotomyia.*

69. **purpuratus** (Edwards).—Belkin, 1962, 1: 498 (♂*, ♀, P*, L*).

Subgenus **RACHISOURA** Theobald

70. *sylvestris* Theobald.—Transfer to p. 71 as valid species.

71. **sylvestris** (Theobald).—Belkin, 1962, 1:520 (to sp. status).

tityae Slooff.—New Guinea.
1961. Ent. Ber. 21: 22 (♀*). Type-loc: Wasirawa River, Arfak Mountains, Vogelkop Peninsula, Netherlands New Guinea (BM).

torokinae Belkin.—Belkin, 1962, 1: 525 (♂*, ♀, P*, L*).

Subgenus **RACHIONOTOMYIA** Theobald

72. Belkin, 1962, 1: 506 (resurrected from synonymy with following synonyms: *Polylepidomyia* Theobald, *Skeiromyia* Leicester, *Squamomyia* Theobald, *Mimeteomyia* Theobald, *Tricholeptiomyia* Dyar and Shannon. Included species those under subgenus *Polylepidomyia, aranoides* from p. 66, *nepenthicola* from p. 68, and perhaps *floridensis* from p. 73.

folicola Belkin.—Belkin, 1962, 1: 517 (♂*, ♀, P*, L*).

melanesiensis Belkin.—Santa Cruz Islands, Banks Islands, Belkin, 1962, 1: 515 (♂*, ♀, P*, L*).

73. **rotumanus** (Edwards).—Belkin, 1962, 1: 513 (♂*, ♀, P*, L*).

Genus **TRICHOPROSOPON** Theobald
Subgenus **TRICHOPROSOPON** Theobald

74. **soaresi** Lane and Cerqueira.—Mexico.

Subgenus **SHANNONIANA** Lane and Cerqueira

fluviatilis (Theobald).—Nicaragua, Guatemala, Mexico. Díaz Nájera, 1961, 201 (L*).

75. **moralesi** (Dyar and Knab).—Díaz Nájera, 1961, 203 (L*).

Subgenus **RUNCHOMYIA** Theobald

76. **longipes** (Fabricius.—Mexico.

Genus **WYEOMYIA** Theobald
Subgenus **WYEOMYIA** Theobald

79. **limai** Lane and Cerqueira.—Forattini, Rabello, and Pattoli, 1960, 95 (P*, L*).

medioalbipes Lutz.—Correction to Suppl. I: Change "**medioalpipes**" to "**medioalbipes.**"

80. **mitchellii** (Theobald).
jamaicensis Theobald. 1905. Mosq. of Jamaica :11 (*Dendromyia;* alternate original spelling).

nigritubus Galindo, Carpenter, and Trapido.—Change "(NE)" to "(USNM)."

Subgenus **DAVISMYIA** Lane and Cerqueira

82. **arborea** Galindo, Carpenter, and Trapido.—Change "(LU)" to "(USNM)."

Subgenus DENDROMYIA Theobald

84. **argenteorostris** (Bonne-Wepster and Bonne).—Brazil. Fauran, 1961, 12 (P*).
circumcincta Dyar and Knab.—Brazil.
86. **personata** (Lutz).—Forattini, Rabello, and Pattoli, 1960, 99 (P*, L*).

Genus PHONIOMYIA Theobald

90. **trinidadensis** (Theobald).—Line 3, change "axonomy" to "taxonomy."

Genus SABETHES Robineau-Desvoidy
Subgenus SABETHES Robineau-Desvoidy

91. **Sabethes** Robineau-Desvoidy. Change "Logotype" to "Haplotype," insert "Robineau-Desvoidy" after *locuples*, and delete "(Coquillett, 1910: 602)."
amazonicus Gordon and Evans.—Forrattini, 1959, 286 (♂).
92. **forattinii** Cerqueira.—Brazil.
1961. Rev. bras. Ent. 10: 37 (♂*, ♀). Type-loc: Estrada Manaus-Caracarai km 23 Manaus, Amazonas, Brazil (FH).
lanei Cerqueira.—Brazil.
1961. Rev. bras. Ent. 10: 46 (♂*, ♀). Type-loc: Estrada Manaus-Caracarai, km 23, Manaus, Amazonas, Brazil (FH).
ortizi Vargas and Díaz Nájera.—Mexico.
1961. Rev. Inst. Salubr. Enferm. trop. Méx. 21: 74 (♂*, ♀). Type-loc: Aldea El Naranjo, Chiapas, Mexico (ISET).
shannoni Cerqueira.—Brazil.
1961. Rev. bras. Ent. 10: 40 (♂*, ♀, P*, L*). Type-loc: Igarapé do Leao, Manaus, Amazonas, Brazil (FH).
spixi Cerqueira.—Brazil.
1961. Rev. bras. Ent. 10: 44 (♂*, ♀). Type-loc: Estrada Manaus-Caracarai, km 23, Manaus, Amazonas (FH).

Subgenus SABETHOIDES Theobald

93. **tridentatus** Cerqueira.—Brazil.
1961. Rev. bras. Ent. 10: 48 (♂*, ♀, P*, L*). Type-loc: Igarapé da Bolivia, Manaus, Amazonas, Brazil (FH).

Genus MALAYA Leicester

94. **solomonis** (Wharton).—Belkin, 1962, 1: 490 (♂*, ♀, P*, L*).

Genus FICALBIA Theobald
Subgenus MIMOMYIA Theobald

98. **gurneyi** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 296 (♂*, ♀, P*, L*). Type-loc: Bougainville, Solomon Islands (USNM).
99. **perplexens** Edwards.—Ivory Coast.

Subgenus ETORLEPTIOMYIA Theobald

bougainvillensis Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 294 (♂*, ♀, P*, L*). Type-loc: Bougainville, Solomon Islands (USNM).

100. **solomonis** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 292 (♂*, ♀, P*, L*). Type-loc: Chacon swamp, Lunga area, Guadalcanal, Solomon Islands (USNM).

Genus **MANSONIA** Blanchard
Subgenus **COQUILLETTIDIA** Dyar

101. **buxtoni** (Edwards).—USSR. Coluzzi and Contini, 1962, 215 (P*, L*).
102. **fijiensis** Belkin.—Fiji, ? Samoa.
1962. Mosq. S. Pacific 1: 308 (♂*, ♀, P*, L*). Type-loc: Koronivia, Viti Levu, Fiji (USNM).
iracunda (Walker).—Belkin, 1962, 1: 306 (♂*, ♀).
lutea Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 309 (♂*, ♀, P*, L*). Type-loc: Burns Creek, Lunga area, Guadalcanal, Solomon Islands (USNM).
103. **microannulata** (Theobald).—Ivory Coast.
104. **pseudoconopas** (Theobald).—Ivory Coast.
tenuipalpis Edwards.—Belkin, 1962, 1: 305 (♂*, ♀).
xanthogaster (Edwards).—Delete "? Solomon Islands." Belkin, 1962, 1: 311 (♂*, ♀, P*, L*).

Subgenus **MANSONIOIDES** Theobald

105. **melanesiensis** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 314 (♂*, ♀*, P*, L*). Type-loc: Doma Cove area, Guadalcanal, Solomon Islands (USNM).

Genus **URANOTAENIA** Lynch Arribálzaga

109. **andreae** Doucet.—Ivory Coast.
1961 (1962). Bull. Soc. Pat. exot. 54: 1157 (♂*, ♀, P*, L). Type-loc: Banco Forest, Abidjan, Ivory Coast (IERT, Adiopodoumé).
111. **candidipes** Edwards.—Ivory Coast.
112. **colocasiae** Edwards.—Belkin, 1962, 1: 157 (♂*, ♀, P*, L*).
113. **gerdae** Slooff.—New Guinea.
1963. Ann ent. Soc. Amer. 56: 84 (♂*, ♀, P*, L*). Type-loc: Sorong, Klademak, West New Guinea (USNM).
henrardi Edwards.—Ivory Coast. Doucet, 1960, 810 (P, L*); Someren, 1962, 25 (♀).
hystera Dyar and Knab.—Brazil.
117. **oteizai** Perez Vigueras.—Cuba.
1956. Ixodidos y Culicidos de Cuba. 443 (♂, ♀, L*). Type-loc: Guanimar, Cuba (LU).
painei Edwards.—Belkin, 1962, 1: 162 (♂*, ♀, P*, L*).
palmeirimi De Meillon and Rebelo.—Add to type-loc: "Pebane, Quelimane District."
118. **quadrimaculata** Edwards.—Delete "and Malaupaina, Olu Malau." Belkin, 1962, 1: 159 (♂*, ♀*, P*, L*; lectotype).

Genus **HODGESIA** Theobald

121. **solomonis** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 280 (♂*, ♀, P*, L*). Type-loc: West Poha swamp, Guadalcanal, Solomon Islands (USNM).

Genus **AEDEOMYIA** Theobald

125. **venustipes** (Skuse).—Douglas, 1961, 262 (♂*, ♀, P*, L*).

Genus **PSOROPHORA** Robineau-Desvoidy
Subgenus **JANTHINOSOMA** Lynch Arribálzaga

128. **longipalpus** Randolph and O'Neill.—Midwestern United States.
1944. Mosq. of Texas: 88. (♀). Type-loc: Texas (USNM).
longipalpis Roth, 1945.
longipalpis Roth.—Transfer to synonymy under *longipalpus* (see above).

Genus **HEIZMANNIA** Ludlow

132. **lii** Wu.—Formosa.

Genus **ERETMAPODITES** Theobald

133. *Important references:* 1961, Hamon, 892-906 (rev. *oedipodeios* ssp.); 1961. Hamon and Someren, 907 (key, *oedipodeios* group).
corbeti Hamon.—Uganda.
1962. Bull. Soc. Pat. exot. 55: 256 (♂*). Type-loc: Nyanga Forest near Kampala, Uganda (IERT).
forcipulatus Edwards.—Ivory Coast. Adam and Hamon, 1961, 198 (P*, L*).
grenieri Hamon and Someren.—Tanganyika.
1961. Bull. Soc. Pat. exot. 54: 907 (♂*). Type-loc: Amani, Tanganyika (IERT).
134. **marcelleae** Adam and Hamon.—Doucet, 1960, 812 (L *oedipodeios* ssp.;) Hamon, 1961, 906 (to sp. status).
mattinglyi Hamon and Someren.—Tanganyika.
1961. Bull. Soc. Pat. exot. 54: 728 (♂*). Type-loc: Amani, Tanganyika (IEHT).
oedipodeios Graham.
stanleyi Edwards.—Hamon, 1961, 898 (♂*; syn.).
ssp. **parvipluma** Edwards.—Transfer to follow *oedipodeios* as valid sp.
ssp. **stanleyi** Edwards.—Transfer to syononymy under *oedipodeios* (see above).
spp. **wansoni** Edwards.—Transfer to p. 135 as valid sp.
ssp. **marcelleae** Adam and Hamon.—Transfer to follow *mahafyi* as valid sp.
spp. **douceti** Adam and Hamon.—Transfer to p. 135 as spp. of *wansoni.*
parvipluma Edwards.—Hamon, 1961, 906 (♂*; to sp. status).
135. **silvestris** Ingram and De Meillon.—Cape Province.
vansomereni Hamon.—Uganda.
1962. Bull. Soc. Pat. exot. 55: 253 (♂*). Type-loc: Zika Forest, near Entebbe, Uganda (IERT).
wansoni Edwards.—Hamon, 1961, 902 (♂*; to sp. status).
spp. **douceti** Adam and Hamon.—Hamon, 1961, 905 (n. relationship).

Genus **AEDES** Meigen

Important references: 1961, Mattingly, 1-62 (keys, subgenera *Mucidus, Ochlerotatus,* and *Neomelaniconion,* Indomalayan Area).

Subgenus MUCIDUS Theobald

Important reference: 1961, Mattingly, 17-37 (keys, Indomalayan area).

aurantius (Theobald).—Mattingly, 1961, 43 (♂*, ♀*, P*, L*).

136. spp. **quadripunctis** (Ludlow).—Transfer to follow *nigerrimus* as valid sp.

ssp. **painei** Knight.—Transfer, with synonym, to precede *quadripunctis* as valid sp.

ferinus Knight.—Mattingly, 1961, 26 (♂*, ♀*, P*, L*).

grahamii (Theobald).—Ivory Coast.

laniger (Wiedemann).—Delete "India, Ceylon." Mattingly, 1961, 26 (♂*, ♀*).

painei Knight.—Belkin, 1962, 1: 405 (♂*, ♀, P*, L*; to sp. status).

quadripunctis (Ludlow).—Mattingly, 1961, 36 (♂*, ♀, P*, L; to sp. status).

quasiferinus Mattingly.—Malaya, Ceylon, Assam, Thailand, Singapore, Indonesia.
1961. Cul. Mosq. Indomalayan Area 5: 32 (♂*, ♀*, P*, L*). Type-loc: Sungei Besi, Kuala Lumpur area, Malaya (BM).

Subgenus OCHLEROTATUS Lynch Arribálzaga

138. **annulipes** (Meigen).—Aken, 1961, 259 (P*).

antipodeus Edwards.—Belkin, 1: 1962, 389 (♂*, ♀, P*, L*).

140. **cacozelus** Marks.—Australia.
1963. J. ent. Soc. Qd. 2: 45 (♀). Type-loc: Darkan (110 miles ssw. of Perth), Western Australia, Australia (CSIR).

camptorhynchus (Thomson).—Change "1868" to "1869."

143. **condolescens** Dyar and Knab.—Perez Vigueras, 1956, 278 (♂*, ♀, L*).

cyprius Ludlow.—Poland.

144. **edgari** Stone and Rosen.—Belkin, 1: 1962, 391 (♂*, ♀, P*, L*).

146. **flavifrons** (Skuse).—Correction to Suppl. I: Place comma after "1960."

148. **kasachstanicus** Gutsevich.—Kazakhstan.
1962. Ent. Obozr. 41: 886 (♂*, ♀). Type-loc: Ili, Alma-Ata Oblast, Kazakhstan, U.S.S.R. (ZIL).

mcdonaldi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 396 (♂*, ♀, P*, L*). Type-loc: West Paha swamp, Guadalcanal, Solomon Islands (USNM).

152. **refiki** Medschid.
stampari Apfelbeck (Peus, *in litt.;* syn.).

154. **spilotus** Marks.—Australia.
1963. J. ent. Soc. Qd. 2: 31 (♂*, ♀*, L*, P*). Type-loc: Cavendish, Victoria, Australia (NMM).

stampari Apfelbeck. Transfer to p. 152 as synonym under *refiki.*

155. *lesnei* Séguy.—Transfer to p. 157 as unrecognized species.

stimulans (Walker).—Correction to Suppl. I: Change "**stimulus**" to "**stimulans.**"

stricklandi (Edwards).—Marks, 1963b, 38 (♂*, ♀*, L*, P*) Marks, 1949 (♂* only) = *turneri* Marks (See p. 156).

flindersi Taylor.—Line 1, delete "R."

156. **turneri** Marks.—Australia.
1963. J. ent. Soc. Qd. 2: 42 (♂*, ♀*). Type-loc: 4 miles w. of Piawaning (80 miles nnw. of Perth), Western Australia (CSIR). Marks, 1949, 38 (♂*; as *stricklandi* Edwards).
157. **vigilax** (Skuse).—Philippines, Solomon Islands, New Hebrides, Fiji Islands. Mattingly, 1961, 39 (♂*, ♀*, P*, L*).
uniformis Strickland.—Delete "and Port River Swamps, Adelaide, South Australia." Belkin, 1962, 393 (lectotype).

Unrecognized Species of Subgenus Ochlerotatus

lesnei Séguy.—Peus (*in litt.*). Removed from synonymy under *stricticus;* related to *annulipes.*

Subgenus FINLAYA Theobald

158. **albilabris** Edwards.—Belkin, 1962, 1: 350 (♂*, ♀, P*, L*).
albolateralis (Theobald).—Formosa.
159. **argyronotum** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 354 (♂*, ♀, P*, L*). Type-loc: Matanikau Valley, Guadalcanal, Solomon Islands (USNM).
160. **burnetti** Belkin.—Fiji Islands.
1962. Mosq. S. Pacific 1: 363 (♂*, ♀, P*, L*). Type-loc: Tholo-i-Suva, Viti Levu, Fiji Islands (USNM).
buxtoni Belkin.—? Solomon Islands.
1962. Mosq. S. Pacific 1: 356 (♀). Type-loc: ? Bougainville, Solomon Islands (US).
162. **fijiensis** Marks.—Belkin, 1962, 1: 365 (♂*, ♀, P*, L*).
fluviatilis (Lutz).—Forattini and Rabello, 1960, 87 (P*, L*).
franclemonti Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 367 (♂*, ♀, P*, L*). Type-loc: Munda, New Georgia, Solomon Islands (USNM).
freycinetiae Laird.—Belkin, 1962, 1: 368 (♂*, ♀, P*, L*).
fuscipalpis Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 371 (♂*, ♀, P*, L*). Type-loc: Poha area, Guadalcanal, Solomon Islands (USNM).
fuscitarsis Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 371 (♂*, ♀, P*, L*). Type-loc: Poha area, Guadalcanal, Solomon Islands (USNM).
163. **hancocki** Someren.—Tanganyika.
1962. Proc. R. ent. Soc. London (B) 31: 21 (♂*, ♀, L*). Type-loc: Amani, Tanganyika (BM).
164. **hollingsheadi** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 372 (♂*, ♀, P*, L*). Type-loc: Poha area, Guadalcanal, Solomon Islands (USNM).
japonicus (Theobald)
ssp. **shintiensis** Tsai and Lien.—Lien, 1962, 623 (to ssp. status).
knighti Stone and Bohart.—Belkin, 1962, 1: 374 (♂*, ♀, P*, L*).
165. **koreicoides** Sasa, Kano, and Hayashi.—Sakakibara and Omori, 1962: 15 (♂*, ♀, P*, L*).
166. **longipalpis** (Grünberg).—Someren, 1962, 19 (♂*).
167. **mediovittatus** (Coquillett).—Perez Vigueras, 1956, 248 (♂*, ♀*, L*).
mzooi Someren.—Tanganyika.
1962. Proc. R. ent. Soc. London (B) 31: 19 (♂*, ♀). Type-loc: Sigi R. bridge, near Amani, Usambara, Tanganyika (BM).

neogeorgianus Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 375 (♂*, ♀, P*, L). Type-loc: Munda, New Georgia, Solomon Islands (USNM).
notoscriptus (Skuse).—Belkin, 1962, 1: 348 (♂*, ♀, P*, L*).
168. **oceanicus** Belkin.—Samoa, ? Horne Islands, ? Wallis Islands.
1962. Mosq. S. Pacific 1: 377 (♂*, ♀, P*, L*). Type-loc: "Amouli, Pango Pango, Tutuila, Samoa" (USNM).
170. **roai** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 353 (♂*, ♀). Type-loc: Wrights Creek, Matanikau Valley, Guadalcanal, Solomon Islands (USNM).
rubiginosus Belkin.—? Solomon Islands.
1962. Mosq. S. Pacific 1: 346 (♂*, ♀). Type-loc: ? Guadalcanal, Solomon Islands (USNM).
samoanus (Grünberg).—Delete "Tonga Islands, Hoorn Islands."
schlosseri Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 382 (♂*, ♀, P*, L*). Type-loc: Poha area, Guadalcanal, Solomon Islands (USNM).
shintiensis Tsai and Lien.—Transfer to p. 164 as ssp. of *japonicus*.
172. **watasei** Yamada.—Omori, 1962, 10 (♂*, P*, L*).

Subgenus HOWARDINA Theobald

173. **albonotatus** (Coquillett).—Delete "Venezuela."
174. **ioliota** Dyar and Knab.—Venezuela. Suarez and Cova García, 1961, 17 (♂*, ♀*, P*, L*).

Subgenus CHAETOCRUIOMYIA Theobald

175. *Important reference:* Marks, 1963a, 189-211 (rev.).
calabyi Marks.—Australia.
1963. Pap. Dep. Ent. Univ. Qd. 1: 204 (♂*). Type-loc: Queen Victoria Spring, Western Australia (CSIR).
elchoensis Taylor.—Marks, 1963a, 207 (♂, ♀*).
humeralis Edwards.—Marks, 1963a, 197 (♀*).
moloiensis Taylor.—Marks, 1963a, 203 (♀*).
spinosipes Edwards.—Marks, 1963a, 194 (♀*).
tulliae Taylor.—Marks, 1963a, 199 (♂*, ♀*, P*, L*).
wattensis Taylor.—Marks, 1963a, 197 (♀*).

Subgenus NOTHOSKUSEA Dumbleton

Aedes, subgenus **Nothoskusea** Dumbleton 1962, N. Z. J. Sci. 5: 20.
Orthotype: *chathamicus* Dumbleton.
chathamicus Dumbleton.—Chatham Island.
1962. N. Z. J. Sci. 5: 20 (♂*, ♀*, P*, L*). Type-loc: s. of Point Weeding, near Waitangi, Chatham Island (DSIR).

Subgenus PSEUDOSKUSEA Theobald

ashworthi Edwards.—Transfer to p. 176 as synonym of *australis*.
australis (Erichson).—Transfer, with synonyms, to p. 176 under subgenus *Halaedes* Belkin.
176. **bancroftianus** Edwards.—Dobrotworsky, 1960 (1961), 257 (♂*, ♀*, P*, L*).

multiplex (Theobald).—Dobrotworsky, 1960 (1961), 264 (♂*, ♀*, P*, L*).
postspiraculosus Dobrotworsky.—Australia.
1960 (1961). Proc. Linn. Soc. N. S. W. 85: 261 (♂*, ♀*, P*, L*). Type-loc: Wattle Glen, Victoria (NMM).

Subgenus HALAEDES Belkin

Aedes, subgenus **Halaedes** Belkin 1962, Mosq. S. Pacific 1: 328. Orthotype: *Culex australis* Erichson.
australis (Erichson).—Belkin, 1962, 1: 329 (♂*, ♀, P*, L*).
ashworthi Edwards.—Belkin, 1962, 1: 329 (syn.).

Subgenus SKUSEA Theobald

Transfer all species except *pembaensis* Theobald and its synonyms to subgenus *Lorrainea* Belkin (see below).
pembaensis Theobald.—Mozambique. Worth, Sousa, and Weinbren, 1961 257 (biology).

Subgenus LORRAINEA Belkin

Aedes, subgenus **Lorrainea** Belkin, 1962, Mosq. S. Pacific 1: 430. Orthotype: *Aedes dasyorrhus* King and Hoogstraal.

Subgenus CHRISTOPHERSIOMYIA Barraud

177. **chionodes** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 434 (♂*, ♀). Type-loc: Torokina, Bougainville, Solomon Islands (US).

Subgenus GEOSKUSEA Edwards

becki Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 334 (♂*, ♀). Type-loc: Roviana, Solomon Islands (USNM).
daggyi Stone and Bohart.—Delete "Solomon Islands." Belkin, 1962, 1: 335 (♂*, ♀, P*, L*).
kabaenensis Brug.—Correction to Suppl. I: Change "**kabaensis**" to "**kabaenensis.**"
longiforceps Edwards.—Belkin, 1962, 1: 337 (♂*, ♀, P*, L*).
perryi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 336 (♂*, ♀). Type-loc: Naro village, Guadalcanal, Solomon Islands (USNM).

Subgenus LEVUA Stone and Bohart

178. *suvae* Stone and Bohart.—Belkin, 1962, 1: 399 (♂*, ♀, P*, L*; treated as valid name in place of *geoskusea*, but this nomenclaturally open to question).

Subgenus STEGOMYIA Theobald

Stegomyia Theobald.—Change "Haplotype" to "Logotype" and after "*Culex fasciatus* Fabricius" insert "(Neveu-Lemaire 1902: 211)."
aegypti (Linnaeus).—Mattingly, Stone, and Knight, 1962, Bull. zool. Nomencl. 19: 208 (nomenclature, taxonomy).
181. **annandalei** (Theobald).
ssp. **horishensis** Yamada.—Lien, 1962, 626 (to spp. status).

aobae Belkin.—Banks Islands, New Hebrides.
1962. Mosq. S. Pacific 1: 452 (♂*, ♀*, P*, L*). Type-loc: Near Crater Lake, Aobae Island, New Hebrides (USNM).

182. **cooki** Belkin.—Niue Island.
1962. Mosq. S. Pacific 1: 454 (♂*, ♀, P*, L*). Type-loc: Niue Island (BM).

183. **dendrophilus** Edwards.—Ivory Coast.

desmotes (Giles).—Formosa.
montana Koidzumi. 1920. Government Inst. Formosa, 8th Rpt. (1): 180 (♂; *Stegomyia*). Type-loc: Chutouchi, Chungpu Township, Chiai Hsien, Formosa (LU). Lien, 1962, 626 (syn.).

var. **tulagiensis** Edwards. Transfer to p. 188 as valid sp.

futunae Belkin.—Horne Islands.
1962. Mosq. S. Pacific 1: 455 (♂*, ♀, P*, L*). Type-loc: Mu'a, Alofi Island, Horne Islands (USNM).

184. **gurneyi** Stone and Bohart.—Belkin, 1962, 1: 456 (♂*, ♀, P*, L*).

hebrideus Edwards.—Wuvulu Island, Nuguria Island, Solomon Islands (outlying), Santa Cruz Islands, Torres Islands, Banks Islands, New Hebrides. Belkin, 1962, 1: 457 (♂*, ♀, P*, L*; resurrected from synonymy).

hoguei Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 460 (♂*, ♀, P*, L*). Type-loc: Hutuna, Rennell Island, Solomon Islands (BM).

horishensis Yamada.—Transfer to p. 181 as ssp. of *annandalei* (Theobald.)

horrescens Edwards.—Belkin, 1962, 1: 461 (♂*, ♀, P*, L*).

185. **marshallensis** Stone and Bohart.—Belkin, 1962, 1: 463 (♂*, ♀, P*, L*).

opok Corbet and Someren.—Uganda.
1962. Ann. trop. Med. and Parasit. 56: 73 (♂*, ♀). Type-loc: Awere, Acholi, Uganda (BM).

186. **patriciae** Mattingly.—Correction to Suppl. I: Line 2, insert "," after "Yamada."

polynesiensis Marks.—Pitcairn Island. Belkin, 1962, 1: 468 (♂*, ♀, P*, L*).

pseudoscutellaris (Theobald).—Belkin, 1962, 1: 469 (♂*, ♀, P*, L*).

187. **quasiscutellaris** Farner and Bohart.—Belkin, 1962, 1: 471 (♂*, ♀, P*, L*).

robinsoni Belkin.—Santa Cruz Islands.
1962. Mosq. S. Pacific 1: 447 (♂*, ♀, P*, L*). Type-loc: Near Government House, Peno, Vanikoro, Santa Cruz Islands (USNM).

rotumae Belkin.—Rotuma Island.
1962. Mosq. S. Pacific 1: 472 (♂*, ♀, P*, L*). Type-loc: Oinafa village, Rotuma Island (USNM).

hebrideus Edwards.—Transfer to p. 184 as valid sp.

188. **tongae** Edwards.—Delete "Solomon Islands, ? Santa Cruz Islands." Belkin, 1: 1962, 475 (♂*, ♀, P*, L*).

tulagiensis Edwards.—Change "Solomon Islands" to "Santa Cruz Islands." Belkin, 1962, 1: 446 (♂*, ♀, P*, L*; to sp. status).

upolensis Marks.—Belkin, 1962, 1: 477 (♂*, ♀, P*, L*).
usambara Mattingly.—Someren, 1962, 25 (♂, ♀).
varuae Belkin.—Solomon Islands, Santa Cruz Islands.
1962. Mosq. S. Pacific 1: 478 (♂*, ♀, P*, L*). Type-loc: Lawaii, Graciosa Bay, Santa Cruz Islands (USNM).
vittatus (Bigot).—Boorman, 1961, 709 (biology).
189. **w-albus** (Theobald).—Delete "Formosa."

Subgenus AEDIMORPHUS Theobald

Important reference: 1961. Hamon, Service, Adam, and Taufflieb. Bull. Soc. Pat. exot. 54: 383-387 (key to males, *tarsalis* group).
190. **albocephalus** (Theobald).—Muspratt, 1961, 100 (biology).
192. **eritreae** Lewis.
ssp. **karooensis** Muspratt.—Cape Province. 1961.
J. ent. Soc. S. Afr. 24: 93 (♂*, ♀, L*). Type-loc: Noupoort, 22 miles n. of Middleburg, Cape Province [Republic of South Africa] (SAIM).
gilliesi Someren.—Tanganyika.
1962. Proc. R. ent. Soc. London (B) 31: 24 (♂, ♀). Type-loc: South Pare Hills, Tonto, Amani, Tanganyika (BM).
grenieri Hamon, Service, Adam, and Taufflieb.—Ivory Coast.
1961. Bull. Soc. Path. exot. 54: 376 (♂*). Type-loc: Dainé, Man, Ivory Coast (IERT).
194. **mattinglyi** Hamon and Rickenbach.—Hamon and Le Berre, 1961, 718 (P*, L*).
195. **nocturnus** (Theobald).—Belkin, 1962, 1: 427 (♂*, ♀, P*, L*); to sp. status).
196. **phyllolabis** Edwards.—Ivory Coast.
pseudotarsalis Someren—Congo. Correction to Suppl. 1: Line 2, delete "Yamada)†."
reali Hamon and Adam.—Liberia.
tricholabis Edwards.—Ivory Coast.
ssp. **bwamba** Someren.—Service, 1960, 230 (L).
198. ssp. **nocturnus** (Theobald).—Transfer to p. 125 as valid sp.
199. **wendyae** Service.—Correction to Suppl. I: Change "Iarodu" to "Ikarodu."
wigglesworthi Edwards.—Ivory Coast.
yangambiensis De Meillon and Lavoipierre.—Nigeria, Ivory Coast.

Subgenus EDWARDSAEDES Belkin

200. **Aedes,** subgenus **Edwardsaedes** Belkin, 1962, Mosq. S. Pacific 1: 408. Orthotype: *Culex imprimens* Walker.
imprimens (Walker).—Mattingly, 1961, 53 (♂*, ♀*, P*, L*); Belkin, 1962, 1: 409 (♂*, ♀, P*, L*).
brugi Edwards.—Mattingly, 1961, 53 (syn.).

Subgenus NEOMELANICONION Newstead

Important references: 1961, Mattingly, 47-57 (key, Indomalayan Area); 1960 (1961), Le Berre and Hamon, 1060-1063 (keys, tropical Africa).
brugi Edwards.—Transfer to synonymy under **imprimens** (see above).
circumluteolus (Theobald).—Ivory Coast.

201. **imprimens** (Walker).—Transfer to p. 200 under subgenus *Edwardsaedes*.
jamoti Hamon and Rickenbach.—Ivory Coast, Ghana. Le Berre and Hamon, 1960 (1961), 1054 (♀, P*, L*).
lineatopennis (Ludlow).—Mattingly, 1961, 49 (♂*, ♀*, P*, L*).
palpalis (Newstead).—Ivory Coast.

Subgenus DICEROMYIA Theobald

202. **franciscoi** Mattingly.—Mattingly, 1961, 59 (♂*, P, L).
iyengari Edwards.—Mattingly, 1961, 59 (♂*).

Subgenus PSEUDARMIGERES Stone and Knight

203. Add "and Knight" to center head.

Subgenus AEDES Meigen

204. *Verrallina* Theobald.—Transfer to p. 209 as valid subgenus.
butleri Theobald.—Transfer to p. 209 under subgenus *Verrallina*.
205. **carmenti** Edwards.—Transfer to p. 209 under subgenus *Verrallina*.
ceramensis Brug.—Transfer to p. 209 under subgenus *Verrallina* as valid sp.
207. **lineatus** (Taylor).—Transfer to p. 209 under subgenus *Verrallina*.

Subgenus VERRALLINA Theobald

209. **Verrallina** Theobald.—Belkin, 1962, 1: 402 (provisionally removed from synonymy for South Pacific species; final decision must rest on thorough revision of the subgenera of *Aedes*). Included species, *butleri* Theobald, *lineatus* (Taylor), and the species mentioned below.
carmenti Edwards.—All but Solomon Islands records questionable. Belkin, 1962, 1: 416 (♂, ♀, P*, L*).
ceramensis Brug.—Moluccas. Belkin, 1962, 1: 417 (resurrected from synonymy).
cuccioi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 414 (♂*, ♀, P*, L*). Type-loc: Matanikau Valley, Guadalcanal, Solomon Islands (USNM).
mccormicki Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 420 (♂*, ♀, P*, L*). Type-loc: Lunga area, Guadalcanal, Solomon Islands (USNM).

Genus ARMIGERES Theobald
Subgenus ARMIGERES Theobald

212. **breinli** (Taylor).—Santa Cruz Islands.
durhami Edwards and **maiae** Edwards (p. 213).—Delete parentheses around authors' name; delete "*Aedes*" in following line.
213. **milnensis** Lee.—*After* "Taylor, 1914" change "217" to "188."

Subgenus LEICESTERIA Theobald

214. **digitatus** (Edwards).—Formosa.
dolichocephalus (Leicester).—Correction to Suppl. 1: Insert ",99" after "1959."

Genus **HAEMAGOGUS** Williston
Subgenus **STEGOCONOPS** Lutz

216. **capricornii** Lutz.—Argentina. Martínez, Carcavallo, and Prosen, 1961, 76 (taxonomy).
ssp. **janthinomys** Dyar.—Brazil, French Guiana, Venezuela, Trinidad. Martínez, Carcavallo, and Prosen, 1961, 76 (to ssp. status).
ssp. **falco** Kumm, Osorno-Mesa, and Boshell-Manrique.—nw. Brazil, Peru, Ecuador, Cent. Amer. to Honduras. Martínez, Carcavallo, and Prosen, 1961, 76 (n. relationship).
spp. **petrocchiae** Martinez, Carcavallo, and Prosen.—ne. Argentina, Bolivia.
1961. An. Inst. Med. reg. 5(2): 79 (♂, ♀). Type-loc: Salvador Mazza (Pocitos), dept. General San Martin, Salta Province, Argentina (BA).
mesodentatus Komp and Kumm.
spp. **gorgasi** Galindo and Trapido.—Change "(GML)" to "(USNM)."
spp. **alticola** Galindo, Trapido, and Boshell-Manrique.—Change "(GML)" to "(USNM)."
speggazzinii Brethes.
uriartei Shannon and Del Ponte. Martinez, Carcavallo, and Prosen 1961, 71 (syn.).
217. *janthinomys* Dyar.—Transfer to p. 216 as ssp. *capricornii.*
ssp. **falco** Kumm, Osorno-Mesa, and Boshell-Manrique.—Transfer to p. 216 as ssp. of *capricornii.*
uriartei Shannon and Del Ponte.—Transfer to p. 216 as synonym of *spegazzinii.*

Genus **CULISETA** Felt
Subgenus **CULISETA** Felt

219. **glaphyroptera** (Schiner).
ssp. **zottae** (Ungureanu).—Rumania.
1956. Acad. Rep. Pop. Rom., Fil. Iasi, Stud. si Cerc. Stiint. Biol. si Stiinte Agric. 7(2): 4 (♂*, ♀*, P*, L*; *Theobaldia*). Neamit, Varatec, Rumania (LU).
incidens (Thomson).—Change "1868" to "1869."

Subgenus **CULICELLA** Felt

220. **fumipennis** (Stephens).—Sicart and Ruffie, 1960, 641 (P).
221. **sylvanensis** (Dobrotworsky.)—Correction to Suppl. I: Place this species after *otwayensis.*

Subgenus **CLIMACURA** Howard, Dyar and Knab

melanura (Coquillett).—Darsie, Tindall, and Barr, 1962, 167 (P*).
tonnoiri (Edwards).—Change "? BM" (and "CSIR" of Suppl. I) to "NSIR."

Genus **CULEX** Linnaeus
Subgenus **NEOCULEX** Dyar

225. **adersianus** Edwards.—Ivory Coast.
arbieeni Salem.—French Equatorial Africa.
226. **deserticola** Kirkpatrick.—French Equatorial Africa.

dumbletoni Belkin.—New Caledonia.
1962. Mosq. S. Pacific 1: 244 (♂, L*). Type-loc: St. Louis, New Caledonia (USNM).
227. **gaufini** Belkin.—New Caledonia.
1962. Mosq. S. Pacific 1: 243 (♂*, ♀, L*). Type-loc: APO 25, New Caledonia (USNM).
228. **kingianus** Edwards.—Ivory Coast.
leonardi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 245 (♂*, ♀, P*, L*). Type-loc. West Poha swamp, Guadalcanal, Solomon Islands (USNM).
martinii Medschid.—Germany.
millironi Belkin.—New Caledonia.
1962. Mosq. S. Pacific 1: 242 (♂*, ♀, L*). Type-loc: Poindimie, New Caledonia (USNM).
229. **salisburiensis** Theobald.
ssp. **naudeanus** Muspratt.—Cape Province.
1961. J. ent. Soc. S. Afr. 24: 97 (♂, ♀, L*). Type-loc: Naudesberg Pass, 40 miles s. of Middleberg, Cape Province [Republic of South Africa] (SIAM).
230. **vinckei** Hamon, Holstein, and Rivola.—Ivory Coast. Doucet, 1961 (1962), 1160 (♂*, P*, L*).

Subgenus **MOCHTHOGENES** Edwards

231. **femineus** Edwards.—Belkin, 1962, 1: 235 (♂*, ♀, P*, L*).
232. **simpliciforceps** Edwards.—Ivory Coast.

Subgenus **LOPHOCERAOMYIA** Theobald

becki Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 265 (♂*, ♀, P*, L*). Type-loc. Sprague swamp, Guadalcanal, Solomon Islands (USNM).
bergi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 258 (♂*, ♀, P*, L*). Type-loc: Poha River about 3 miles from coast, Guadalcanal, Solomon Islands (USNM).
buxtoni Edwards.—New Hebrides. Belkin, 1962, 253 (♂*, ♀, P*, L*; resurrected from synonymy).
233. **franclemonti** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 256 (♂*, ♀, P*, L*). Type-loc: Munda, New Georgia, Solomon Islands (USNM).
buxtoni Edwards.—Transfer to p. 232 as valid sp.
var. **solomonis** Edwards.—Transfer to p. 235 as valid sp.
hurlbuti Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 266 (♂*, ♀, P*, L*). Type-loc: Tenaru Area, Guadalcanal, Solomon Islands (USNM).
234. **laffooni** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 261 (♂*, ♀, L*). Type-loc: Halavo, Florida, Solomon Islands (USNM).
lairdi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 257 (♂*, ♀, P*, L*). Type-loc: Poha swamp, Guadalcanal, Solomon Islands (USNM).
235. **oweni** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 259 (♂*, ♀, P*, L*). Type-loc: Tributary of Matanikau River, Guadalcanal, Solomon Islands (USNM).

perryi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 268 (♂*, ♀, P*, L*). Type-loc: Balasuma area, Guadalcanal, Solomon Islands (USNM).
solomonis Edwards.—Solomon Islands. Belkin, 1962, 1: 282 (♂*, ♀, P*, L*; lectotype selected from Manaba, Malaita, Solomon Islands, a locality not cited for *solomonis* in the original paper; to sp. status).
walukasi Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 264 (♂*, ♀, P*, L*). Type-loc: Sprague swamp, Guadalcanal, Solomon Islands (USNM).
winkleri Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 264 (♂*, ♀, P*, L*). Type-loc: Tributary of Matanikan River, Guadalcanal, Solomon Islands (USNM).

Subgenus CULICIOMYIA Theobald

236. *Important reference:* 1962, Vattier and Hamon, 251-252 (key to L., Africa).
237. **gilliesi** Hamon and Someren.—Tanganyika.
1961. Bull. Soc. Pat. exot. 54: 724 (♂*, ♀). Type-loc: Amani, Tanganyika (IERT). Vattier and Hamon, 1962, 246 (P*, L*).
238. **nigropunctatus** Edwards.—Formosa.
papuensis (Taylor).—Belkin, 1962, 1: 230 (♂*, ♀, P*, L*).
subaequalis Edwards.—Ivory Coast.

Subgenus ACALLYNTRUM Stone and Penn

239. **perkinsi** Stone and Penn.—Belkin, 1962, 1: 226 (♂*, ♀, P*, L*; resurrected from synonymy).

Subgenus CULEX Linnaeus

240. **albinervis** Edwards.—Belkin, 1962, 1: 212 (♂*, ♀, P*, L*).
241. **annulus** Theobald.—Formosa.
242. **atriceps** Edwards.—Belkin, 1962, 1: 198 (♂*, ♀, P*, L*).
australicus Dobrotworsky and Drummond.—? New Hebrides.
Belkin, 1962, 1: 194 (♂*, ♀, L*; to sp. status).
243. **beauperthuyi** Anduze.—Change "(IHC)" to "(USNM, ♂ terminalia only)."
247. **finlayi** Perez Vigueras.—Cuba.
1956. Ixodidos y Culicidos de Cuba: 382 (♂*, ♀*, L*). Type-loc: Casiguas, Barrio de Jaruco, Habana Province, Cuba (LU).
248. **grahamii** Theobald
var. **farakoensis** Hamon.—Nigeria.
250. **kesseli** Belkin.—Society Islands.
1962. Mosq. S. Pacific 1: 200 (L*). Type-loc: Teachupee, Tahiti (USNM).
lahillei Bachmann and Casals.—Argentina.
1962. Physis 23: 267 (♂*, ♀*, P*). Type-loc: Achiras, Córdoba, Argentina (INM).
laticinctus Edwards.—French Equatorial Africa.
251. **marquesensis** Stone and Rosen.—Belkin, 1962, 200 (♂*, ♀, P*, L*).

252. **omani** Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 210 (♂*, ♀, P*, L*). Type-loc: Chacon swamp, Guadalcanal, Solomon Islands (USNM).
253. **pacificus** Edwards.—Banks Islands. Belkin, 1962, 1: 191 (♂*, ♀, P*, L*).
pervigilans Bergroth.—Kermadec Islands. Belkin, 1962, 1: 190 (♂*, ♀, P*, L*).
254. spp. **quinquefasciatus** Say.—Transfer to p. 258 as valid sp.
255. *cubensis* Bigot.—Change "1856" to "1857."
256. ssp. **australicus** Dobrotworsky and Drummond.—Transfer to p. 242 as valid sp.
257. issp. **calloti** Rioux and Pech.—France and Tunisia.
1959. Cahiers des. Nat. 15: 117 (A). Type-locs: France and Tunisia (LU).
258. **pruina eschirasi** Galliard.—Ivory Coast.
quinquefasciatus Say.—Belkin, 1962, 1: 195 (♂*, ♀, P*, L*; to sp. status).
roseni Belkin.—Solomon Islands.
1962. Mosq. S. Pacific 1: 203 (♂*, ♀, P*, L*). Type-loc: Hitiaa, Tahiti (ISNM).
261. **striatipes** Edwards.—Ivory Coast.
262. **terzii** Edwards.—Muspratt, 1961, 98 (L).
thriambus Dyar.—Panama.
torrentium Martini.—Sicart and Ruffie, 1960, 647 (P*).
1962. Mosq. S. Pacific 1: 204 (L*). Type-loc: Munda, New Georgia (USNM).
whittingtoni Belkin.—Solomon Islands.

Subgenus MELANOCONION Theobald

272. **johnsoni** and **keenani**—Correction to Suppl. I: Change "Blanton" to "Mendez."
273. **mesodenticulatus.**—Correction to Suppl. I: Change "Blanton" to "Mendez."
275. **spissipes** (Theobald).—Brazil.
276. **trisetosus** Fauran.—French Guiana.
1961. Arch. Inst. Pasteur Guyane Inini 464: 1 (♂*). Type-loc: confluence of Oyac and Conte rivers, St. Antoine, French Guiana (MNHP).

Subgenus MOCHLOSTYRAX Dyar and Knab

277. **arboricolus**—Correction to Suppl. I: Change "Blanton" to "Mendez."

Subgenus MICROCULEX Theobald

280. **stonei** Lane and Whitman.—Brazil.

Subgenus EUBONNEA Dyar

amazonensis (Lutz).—Fauran, 1961, 8 (P*, L*).

Subgenus AEDINUS Bourroul

282. **originator** Gordon and Evans.—Fauran, 1961, 12 (P*).
bihaicolus Dyar and Nuñez Tovar.—Brazil.

Genus **DEINOCERITES** Theobald

284. *troglodytus* Dyar and Knab.—Correction to Suppl. I: Change *"troglodytes"* to *"troglodytus."* Also p. 285.

Nomina Nuda

287. **bambusae** Dyar.
1922. *In* Alfaro, Mem. Instruccion Publ. Rep. Costa Rica 1921: 419 (*Culex*).

288. **furtivus** Dyar.
1922. *In* Alfaro, Mem. Instruccion Publ. Rep. Costa Rica 1921: 419 (*Culex*).

keybergi Lips.
1960. Riv. di Parassit. 21: 49 (*Anopheles*).

millecampsi Lips.
1960. Riv. di Parasit. 21: 39 (*Anopheles dureni* ssp.).

simplex Baisas and Catipon.
1958. Philippine J. Sci. 87: 54 (*Uranotaenia*).

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318. **Rozeboom and Komp.** 1950b—Change "Cuclidae" to "Culicidae."

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Type Depositories

327. AM. Change from "Rijksmuseum" to "Division of Entomology, Zoological Museum, Amsterdam University."

DSIR. Entomology Division, Department of Scientific and Industrial Research, Christchurch, New Zealand.

329. NSIR. Entomology Division, Department of Scientific and Industrial Research. Nelson, New Zealand.

SPM. Change "Malariologico" to "Malaria."

330. New Zealand (DSIR, NSIR). Correction, line 15: Change "ZMN" to "ZMM."

Index

358. vomerifer Komp.—Change "275" to "276.'

Index to Suppl. I.

For arboricolus, johnsoni, keenani, and mesodentatus change "Blanton" to "Mendez." Also for aurovenatus change "201" to "200." Change "bruecei" to "brucei." For domesticus change "21" to "31."

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AN ANNOTATED LIST OF DIGGER WASPS FROM PRESQUE ISLE STATE PARK, PENNSYLVANIA

(HYMENOPTERA : ACULEATA)

FRANK E. KURCZEWSKI[1] and EDMUND J. KURCZEWSKI[2]

The following list of digger wasps, including dates of collection, flower records, and other notes exclusive of nesting behavior, is a compilation of collections and observations made during periodic visits to Presque Isle State Park, Pennsylvania, during the summers of 1958, 1959, 1960, 1961, and 1962. Many species are recorded herein from Pennsylvania for the first time; new flower records for a number of species are also presented. The dates of collection of several species provide useful information from which the number of generations per year can be derived. Included also in this list is a single record of an uncommon pompilid, *Pompilus* (*Ammosphex*) *imbecillus ojibwae* Evans, recorded from this locality by Evans (1951) in his revision of the tribe Pompilini (Pompilidae).

The "peninsula," a local name given to the Park, is a recurved sandspit about six miles in length which juts out into Lake Erie. Along its entire lake shore are numerous sandy beaches, an extremely favorable habitat for the many psammophilous wasps nesting there. The beaches vary in width from a few to hundreds of yards and many studies and collections were made behind the beaches where stands of bunch and rye grass and sage brush grow. Additional studies and collections were made in areas farther inland where the above named grasses are replaced by a ground cover of very low shrubs of which poison ivy (*Rhus toxicodendron*) is prevalent. Woodland wasps were taken in a moist, mixed deciduous-evergreen forest occupying the inner area of the Park.

This area supports a rich and diversified wasp fauna and is of importance to hymenopterists because many of the Upper Austral wasps reach their northern limits of distribution along the shores of the eastern Great Lakes; a number of these are recorded in this list. It is also in this area which is low in elevation (altitude, 580 feet above sea level) that, surprisingly enough, Canadian forms are also found. As would be expected, transition elements are numerous at this locality.

In order to make this study a total of 1,459 digger wasps were collected. Of this number, 869 are of the family Pompilidae; the remaining 590 wasps are of the families Mutillidae, Tiphiidae, Scoliidae, and Sphecidae. Exactly 123 species and subspecies of the above mentioned families were collected; especially noteworthy was the collection of 43 species and subspecies of Pompilidae.

Numerous Vespidae were collected in addition to the 123 species and subspecies of digger wasps. As these are not of concern in the present study a separate list of species is not included. Some vespids

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taken in large numbers were *Vespula* (*Dolichovespula*) *maculata* (Linnaeus), *Eumenes fraternus* Say, and *Monobia quadridens* (Linnaeus). Many other *Vespula*, *Polistes*, and Eumeninae were also collected in numbers.

We are deeply indebted to Dr. K. V. Krombein for determining most of the Sphecidae, Mutillidae, Tiphiidae, and Scoliidae. Dr. R. M. Bohart is responsible for naming sphecids of the genera *Lyroda*, *Miscophus*, *Tachytes*, and *Tachysphex*. Drs. H. E. Evans and H. W. Allen kindly provided identifications for *Anoplius* (*Pompilinus*) *splendens* (Dreisbach) and *Tiphia arida* Malloch, respectively.

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Family TIPHIIDAE

Tiphia intermedia Malloch. Eight females, 14 males; August 5-September 15; all at edge of woods; 3 females, 2 males on flowers of *Daucus carota.*

Tiphia arida Malloch. Four females; August 8-23; on sandy area behind beach; all on flowers of *Daucus carota.*

Paratiphia algonquina Viereck. Five females, 1 male; July 25; on sandy area along road; all on flowers of *Daucus carota.*

Myrmosa unicolor Say. Fifteen males; July 19-August 17; all at edge of woods.

Family MUTILLIDAE

Timulla vagans (Fabricius). Two males; July 27-August 19; behind beach on flowers of *Daucus carota.*

Family SCOLIIDAE

Campsomeris plumipes confluenta (Say). Six females, 49 males; May 30-September 9; both sexes behind beach on flowers of *Rubus hispidus* (swamp dewberry); males behind beach in sandy areas on flowers of *Arabis lyrata* (rock cress) and *Melilotus alba;* females behind beach in sandy areas on flowers of *Solidago juncea* and *Cephalanthus occidentalis* (buttonbush).

During the first few days of June until the emergence of males of **Episyron q. quinquenotatus** (Say), males of this species were the most numerous in the Park. Males of *Campsomeris plumipes* usually disappeared by the third week of July; after that time only females of this species were evident.

Females were present in the Park from late June until nearly mid-September. This duration corresponds with the life expectancy of females of this genus which is believed to be from two to three months.

Family POMPILIDAE

Priocnessus nebulosus (Dahlbom). One female, 2 males; July 30-August 17; all at edge of woods.

Priocnemis (Priocnemissus) minorata Banks. Twelve females, 6 males; May 24-July 1; in open woods on dead leaves.

The wings of most specimens are not considerably worn but the left hind tibia and tarsus of one female are missing. The collection dates from late June and July 1 are very late for this species which usually disappears shortly after the trees are in full leaf.

Priocnemis (Priocnemis) cornica (Say). Seven females, 1 male; July 28-October 11; in sandy inland blow-out area.

Priocnemis (Priocnemis) germana (Cresson). Forty-nine females, 68 males; July 19-September 6; all in open woods.

This species was the most numerous woodland pompilid during the latter half of July and early August; in mid-August, **Ageniella norata** Banks replaced **P. germana** in abundance in open woods.

Priocnemis (Priocnemis) scitula relicta Banks. Two females; July 20; in open woods.

Calicurgus hyalinatus alienatus (Smith). Twenty females, 2 males; June 11-August 23; in open woods.

The infuscation of the hind femora and tibiae of one female collected on July 6 is intermediate between the subspecies **alienatus** and **borealis** (Banks).

Calicurgus hyalinatus borealis (Banks). One female; July 19; at edge of woods.

Dipogon papago anomalus Dreisbach. One male; August 17; in open woods.

Dipogon sayi sayi Banks. Four females; June 8-July 29; in open woods.

Auplopus mellipes variitarsatus (Dalla Torre). Three females, 10 males; July 19-August 18; all at edge of woods on high foliage.

The series of males shows much variation in the coloration of the femora.

Auplopus nigrellus (Banks). Three females, 1 male; July 6-September 24; in open woods.

Ageniella cupida (Cresson). Two females; July 24-August 19; in open woods.

Ageniella norata Banks. Twenty-one females, 42 males; July 25-August 23; all in open woods.

Nearly all males were collected as they walked slowly over low foliage, their wings being raised and held in a nearly vertical position. One male was found dead, ensnared in an orb-weaving spider's web.

This species was very numerous in open woods during mid-August.

Ceropales bipunctata bipunctata Say. Five males; August 26-28; at edge of woods; all on flowers of *Solidago juncea.*

Ceropales maculata fraterna Smith. Four females, 4 males; July 19-August 28; in open woods.

Evagetes hyacinthinuus (Cresson). Thirty-six females, 3 males; July 19-September 1; in inland blow-out of sand and on sandy beaches; 2 females on flowers of *Daucus carota.*

In either of the above mentioned habitats, females of this species were frequently collected near hunting females of *Anoplius* (*Arachnophroctonus*) *apiculatus autumnalis* (Banks) on which it is possibly parasitic.

Evagetes ingenuus (Cresson). Three females, 3 males; July 28-August 23; 2 females in inland blow-out of sand; all males in sandy areas behind beach on flowers of *Daucus carota.*

Females of **E. ingenuus** were collected near hunting females of *Anoplius* (*Lophopompilus*) *cleora* (Banks) on which they may be parasitic.

Evagetes padrinus minusculus (Banks). Twenty-five females, 1 male; June 19-October 15; in inland blow-out of sand and on sandy areas behind beach.

Females of this species were collected invariably near nesting females of *Episyron q. quinquenotatus* (Say); this fact may be indicative of a parasite-host relationship between the two.

Evagetes parvus (Cresson). Eighteen females, 3 males; July 6-October 17; all at edge of woods; 2 females on flowers of *Daucus carota.*

Agenioideus humilis (Cresson). One male; July 20; in open woods.

Episyron biguttatus biguttatus (Fabricius). Four females, 1 male; August 9-25; at edge of woods and behind beach in sandy area; all on flowers of *Daucus carota.*

Episyron quinquenotatus quinquenotatus (Say). One hundred and fourteen females, 96 males; June 3-August 26; mostly behind beach on sand and in inland sandy areas; occasionally at edge of woods on sand; males and females were taken in numbers visiting flowers of *Cornus* sp., *Solidago juncea, Daucus carota, Rubus hispidus, Melilotus alba,* and *Prunus serotina* (wild black cherry).

Males of this species made their appearance during the first week of June. Females usually emerged from a week to ten days later and throughout the remainder of June and nearly all of July and August this species was the most numerous pompilid in many sandy areas.

Tachypompilus ferrugineus (Say). Eleven females, 8 males; August 1-23; on sand in open woods; 1 male behind beach on flowers of *Daucus carota.*

This series, collected from the same area and presumably representing the same population, shows much variation in color. Some males fall within the color range of the subspecies *nigrescens* and have the vertex, frons, pronotum, mesonotum, scutellum, coxae, trochanters and hind femora heavily infuscated. Others display the characters of the nominate subspecies and have these structures bright ferruginous. Still others are intermediate in color and have the pronotum, mesonotum, head and proximal leg segments partially and/or lightly infuscated.

Females of this series also show considerable variation in the amount of infuscation of the head, pronotum, mesonotum, scutellum, and fore coxae; some have these parts bright ferruginous while others have these structures lightly to heavily infuscated.

Considerable overlap of the subspecies *nigrescens* and *ferrugineus* occurs in northern Virginia, Maryland, southern New Jersey, and southern and northwestern Pennsylvania; this fact coupled with those above seem to substantiate Evans' (1950) belief that the "right of these forms to be considered subspecies is questionable." It seems probable, as Evans (1950) has indicated, that the darker coloration of *ferrugineus* in northeastern United States is due to physical factors involved with colder temperatures.

Anoplius (Lophopompilus) aethiops (Cresson). Nine females, 7 males; August 23-September 23; behind beach in sandy area on flowers of *Daucus carota* and at edge of woods.

Anoplius (Lophopompilus) atrox (Dahlbom). Two females; August 14-26; behind beach in sandy area on flowers of *Daucus carota.*

Anoplius (Lophopompilus) bengtssoni (Regan). Two females, 24 males; July 27-August 28; all behind beach in sandy area on flowers of *Daucus carota.*

Anoplius (Lophopompilus) cleora (Banks). Thirteen females, 12 males; July 6-September 1; in inland blow-out of sand and on sand behind beach; males and females on flowers of *Daucus carota* and *Solidago juncea;* both sexes visiting leaves of *Asclepias syriaca.*

Mydas clavatus Drury (Mydaidae) which superficially resembles *Anoplius bengtssoni* in size and color, both being large and black with a bright red-orange transverse band across the dorsum of the abdomen, was collected on three occasions in sandy areas where females of *Anoplius cleora* were hunting. The relationship of this large Mydas-fly and the latter species of *Anoplius* which lacks red markings is uncertain.

Anoplius (Arachnophroctonus) apiculatus autumnalis (Banks). Twenty-seven females, 9 males; June 8-August 30; in sandy areas behind beaches and in inland blow-out of sand. Though numerous, this species was never collected on flowers.

Females from areas of the "peninsula" farthest from the mainland were larger (10-12 mm. in length) than females collected in sandy areas near the mainland (7.5-9.5 mm. in length).

Anoplius (Arachnophroctonus) marginalis (Banks). Five females, 5 males; June 28-August 23; all behind beach on sand; 4 females, 4 males on flowers of *Daucus carota.*

Anoplius (Arachnophroctonus) relativus (Fox). Ten females, 1 male; June 26-July 3; behind beach on sand and in inland sand blow-out.

Anoplius (Arachnophroctonus) semirufus (Cresson). Thirteen females, 8 males; June 3-August 23; behind beach on sand and in inland sand blow-out; 1 female, 1 male on flowers of *Daucus carota;* 1 female on flowers of *Melilotus alba;* 7 males on foliage of *Rhus toxicodendron.*

Anoplius (Pompilinus) marginatus (Say). Eleven females; June 29-September 12; behind beach on sand, in inland sand blow-out, and on sand at edge of woods; 2 females on flowers of *Daucus carota.*

Anoplius (Pompilinus) splendens (Dreisbach). Six females, 7 males; June 8-August 16; on sandy areas near edge of woods; 2 females, 4 males on flowers of *Daucus carota;* 3 males on foliage of *Rhus toxicodendron.*

Anoplius (Pompilinus) subcylindricus (Banks). Two females; August 9-23; at edge of woods and in inland sand blow-out; 1 female on flowers of *Daucus carota.*

Anoplius (Anoplius) depressipes Banks. Three females, 2 males; June 16-July 25; in open woods near pond.

Anoplius (Anoplius) illinoensis (Robertson). Three females; August 1-23; in field surrounding inland blow-out of sand on flowers of *Solidago juncea.*

Anoplius (Anoplius) ithaca (Banks). Two females, 3 males; July 30-August 23; all on beach in areas of flat rocks.

Anoplius (Anoplius) virginiensis (Cresson). Twenty-one females, 29 males; May 24-August 17; all in open woods.

Pompilus (Ammosphex) imbecillus ojibwae Evans. One female; July 27; on Cranberry Bog Trail; collector, G. E. Wallace (recorded by Evans, 1951).

Pompilus (Arachnospila) arctus Cresson. Nine females, 5 males; July 6-September 23; in open woods.

Pompilus (Arachnospila) scelestus Cresson. One male; August 2; in inland sand blow-out visiting leaves of *Asclepias syriaca.*

Pompilus (Anoplochares) apicatus Provancher. Twelve females, 4 males; July 6-August 1; in open woods.

Aporinellus completus Banks. Two females, 2 males; June 28-August 23; in sandy areas near edge of woods; both males visiting leaves of *Rhus toxicodendron.*

Family SPHECIDAE

Lyroda subita (Say). Thirteen females, 1 male; July 6-August 26; behind beach on sand and in inland sand blow-out; 4 females, 1 male on flowers of *Daucus carota.*

Plenoculus davisi davisi Fox. Nine females, 6 males; July 27-August 17; in inland sand blow-out.

Miscophus americanus Fox. Four females, 4 males; June 8-September 13; on sand behind beach and alongside road in sandy spots; one pair was collected on sand near the edge of a wooded area in copula.

Tachytes harpax Patton. One male; August 23; in inland sand blow-out on flowers of *Solidago juncea.*

Tachytes mandibularis Patton. Two females, 2 males; July 27-28; in inland sand blow-out; 1 male on flowers of *Melilotus alba.*

Larropsis distincta (Smith). Four females, 2 males; August 25-September 23; on gravelly path through field.

Three of these females were of the all-black color form. One female possessed red markings on the first and second abdominal tergites.

Tachysphex tarsatus (Say). Two females, 2 males; June 28-August 17; in inland sand blow-out; 1 female on flowers of *Daucus carota.*

Tachysphex terminatus (Smith). Three females, 2 males; July 27-August 17; in inland sand blow-out.

Motes argentata (Palisot-Beauvois). Fourteen females, 9 males; August 2-October 19; in inland sand blow-out and on loose gravel near the edge of a wooded area.

Trypoxylon backi Sandhouse. Two females, 1 male; June 19-July 25; at edge of woods and in open woods.

Trypoxylon frigidum Smith. Three females, 10 males; June 26-August 23; in open woods and on sand near edge of woods.

Trypoxylon pennsylvanicum Saussure. One female; August 5; in open woods.

Trypoxylon collinum rubrocinctum Packard. Eleven females, 1 male; July 3-August 23; at edge of woods; all on high foliage.

Trypoxylon striatum Provancher. Nine females, 1 male; July 7-August 23; at edge of woods on high foliage and entering holes in a vertical sand bank.

Diodontus atratus parenosas Pate. One female; June 28; at edge of woods.

Psen monticola (Packard). One female; August 23; at edge of woods on high foliage (Cranberry Bog Trail).

Mimesa ezra (Pate). Two females; October 11; at edge of woods.

Mimesa pauper Packard. Five females; August 23-October 13; at edge of woods on high foliage (Cranberry Bog Trail).

Xylocelia atra Mickel. Thirteen females, 13 males; August 23-October 19; entering small holes in a vertical sand bank.

Xylocelia franclemonti Krombein. Twenty females, 16 males; June 29-October 17; at edge of woods and in open woods.

Pemphredon tenax Fox. Three females, 3 males; May 30-August 2; at edge of woods.

Stigmus americanus Packard. One female; July 20; in open woods.

Stigmus fraternus Say. Two females; September 12; in open woods.

Passaloecus gertrudis Krombein. One female; June 29; at edge of woods.

Passaloecus relativus Fox. One female; October 13; in open woods.

Spilomena barberi Krombein. One male; June 28; at edge of woods on high foliage.

Sphex (Sphex) ichneumoneus ichneumoneus (Linnaeus). Four females, 3 males; July 28-August 23; on sand behind beach and in inland sand blow-out; either sex on flowers of *Melilotus alba* and *Solidago juncea.*

Sphex (Sphex) pensylvanicus Linnaeus. Two females, 1 male; August 16-26; in inland blow-out of sand on flowers of *Solidago juncea.*

Sphex (Isodontia) harrisi (Fernald). One female; August 3; behind beach in sandy area on flowers of *Solidago juncea.*

Chlorion aerarium Patton. Eleven females; July 27-August 16; in gravelly area alongside road and in inland sand blow-out; 1 female on flowers of *Melilotus alba.*

Ammophila nigricans Dahlbom. Two females; September 2-23; in field surrounding inland sand blow-out.

Ammophila urnarius Dahlbom. Four females, 6 males; June 29-August 23; in field and in open woods; 1 male on flowers of *Solidago juncea;* 1 female, 1 male on flowers of *Melilotus alba.*

Podalonia violaceipennis (Lepeletier). One female, 1 gynandromorph; August 23-September 1; on sand behind beach.

Sceliphron caementarium (Drury). Two males; July 19-August 23; at edge of woods and behind beach in sandy area; both males on flowers of *Daucus carota.*

Chalybion californicum (Saussure). Three females, 7 males; June 28-August 23; at edge of woods and in sandy area behind beach; all on flowers of *Daucus carota.*

Mellinus bimaculatus Packard. Nine females, 2 males; July 24-August 23; in open woods.

Nysson daeckei Viereck. Ten females, 2 males; June 8-August 2; on sand behind beach; 2 males on foliage of *Rhus toxicodendron* near edge of woods.

This species, a known parasite of *Gorytes canaliculatus,* was observed twice opening and entering nests of the latter. Clearly, the nearly identical early and late collection dates of either species, with one exception (*N. daeckei,* August 2), are indicative of a host-parasite relationship.

Nysson melanopus Pate. Three females; September 23-October 16; on sand containing sparse, upright vegetation near the edge of a wooded area.

Nysson simplicicornis Fox. One male; September 12; on coarse sand near the edge of a wooded area.

Ochleroptera bipunctata (Say). One female; September 12; on coarse sand near the edge of a wooded area.

Sphecius speciosus (Drury). Four females, 9 males; August 12-29; in sandy area behind beach; all on flowers of *Daucus carota.*

Gorytes canaliculatus Packard. Four females; June 8-July 3; in sandy area behind beach.

Gorytes phaleratus Say. One female; September 23; in field surrounding inland sand blow-out.

Gorytes simillimus Smith. Four females, 3 males; July 25-September 15; on sand behind beach and in sandy spots alongside road; all on flowers of *Daucus carota.*

Bicyrtes quadrifasciata (Say). Nine females, 9 males; July 19-August 23; behind beach in sandy area and in inland sand blow-out; males and females on flowers of *Melilotus alba, Daucus carota,* and *Solidago juncea.*

Bicyrtes ventralis (Say). One female; July 29; on coarse sand near edge of woods.

Microbembex monodonta (Say). Six females, 13 males; June 28-August 23; behind beach on sand and in inland sandy areas; males and females on flowers of *Asclepias syriaca, Rubus hispidus,* and *Solidago juncea.*

Bembix spinolae Lepeletier. Three females, 3 males; June 28-August 23; behind beach on sand and in inland sand blow-out; males and females on flowers of *Solidago juncea, Daucus carota, Melilotus alba, Asclepias syriaca, Trifolium* sp., and *Rubus* sp. (not *hispidus*).

Philanthus bilunatus Cresson. Two males; July 30; behind beach in sandy area on flowers of *Solidago juncea.*

Philanthus gibbosus (Fabricius). Five females, 10 males; July 30-September 24; all in inland sand blow-out on flowers of *Solidago juncea.*

Philanthus lepidus Cresson. One male; October 19; in inland sand blow-out area.

Philanthus politus politus Say. One female, 3 males; July 28-August 23; in sandy area behind beach and in inland sand blow-out; all on flowers of *Solidago juncea.*

Aphilanthops frigidus (F. Smith). Four females, 1 male; July 27-August 23; in inland sandy areas; 1 male on flowers of *Daucus carota.*

Lindenius buccadentis Mickel. One male; August 30; on sand near edge of wooded area.

Lindenius columbianus errans (Fox). One female; June 8; at edge of woods.

Crabro advenus Smith. Two females; August 23-September 2; in inland sand blow-out on flowers of *Solidago juncea.*

Euplilis rufigaster (Packard). One female; September 1; in open woods.

Crossocerus (Crossocerus) planipes (Fox). Two females; September 12-October 17; taken while flying near vertical sand bank.

Crossocerus (Crossocerus) sulcus (Fox). Twenty-five females; August 2-October 15; on sand near edge of woods.

Crossocerus (Blepharipus) ambiguus (Dahlbom). Three females; June 30-August 23; in open woods.

Crossocerus (Nothocrabo) nitidiventris (Fox). One female; June 24; in open woods alongside sandy path.

Ectemnius (Clytochrysus) lapidarius (Panzer). Five females, 5 males; June 3-August 23; in open woods and at edge of woods; 1 female on flowers of *Solidago* sp.; 4 males on flowers of *Daucus carota.*

Ectemnius (Lophocrabro) singularis (Smith). Two males; August 8-14; in open woods.

Ectemnius (Hypocrabro) continuus (Fabricius). Four females, 1 male; July 25-August 14; all in sandy spot alongside road on flowers of *Daucus carota.*

Ectemnius (Ectemnius) brunneipes (Packard). Three females; June 8-September 15; at edge of woods.

Ectemnius (Ectemnius) dives (Lepeletier and Brulle). Five females, 6 males; June 6-August 18; at edge of woods; 1 female, 2 males on flowers of *Daucus carota;* 1 male on flowers of *Achillea millefolium* (yarrow).

Oxybelus bipunctatum Olivier. Twenty-two females, 7 males; June 8-October 16; in sandy areas behind beach.

Oxybelus cressonii Robertson. One female; August 30; on sand near edge of woods.

Oxybelus decorosum Mickel. Two females; September 8-October 11; on sand near edge of woods.

Oxybelus emarginatum Say. Five females, 16 males; June 28-September 1; on sand behind beach; 1 female, 1 male on flowers of *Solidago juncea;* 2 females, 4 males on flowers of *Daucus carota.*

Oxybelus inornatum (Robertson). One female; July 3; on sand behind beach. This specimen was taken dead from the clutches of an asilid, *Efferia albibarbis* (Macquart) (det. C. H. Martin).

Oxybelus quadrinotatus Say. One female; July 6; in sandy spot alongside road on flowers of *Asclepias syriaca.*

Oxybelus subcornutum Cockerell. Two males; July 3-August 2; behind beach on sand.

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A NEW PARHOLASPID MITE FROM COSTA RICA[1]

(Acarina: Parholaspidae)

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The genus *Calholaspis* was erected by Berlese (1918) to accommodate a new species of macrochelid mite, *C. superbus.* The genus was characterized as having fused sternal-metasternal shields, elongate sternal shield, more or less contiguous epigynial-ventrianal shields, and fused exopodal and peritrematal shields. *C. superbus* Berl. also possesses a tectum which is produced into a median spine, and has six pairs of preanal setae. Evans (1956) erected the macrochelid subfamily Parholaspinae, into which *Calholaspis* was placed. A second species, *C. berlesei,* was described by Krantz (1960), at which time the subfamily Parholaspinae was raised to a family. *C. berlesei* differs from *C. superbus* primarily in having eight pairs of preanal setae rather than six. A third species recently was sent to the author by Dr. E. W. Baker, U. S. Department of Agriculture, which shares an interesting characteristic with *C. berlesei*—it possesses great numbers of secondary dorsal setae (the dorsum of *C. superbus* has not

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[1]Approved as Technical Paper No. 1534, Oregon Agricultural Experiment Station.

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been seen). These are particularly striking in that most of them are triple-pronged, resembling small tridents. The new species also is peculiar in that the posteromedial portion of the sternal shield is an unsclerotized, longitudinally striate area, rather than reticulated as is the anterior portion. This development probably allows for additional expansion of the genital region during oviposition. Similarities in major structural characteristics between the new and described species, however, indicate that the setal and sternal characteristics should be considered only as specific structures.

The following key will serve to separate the three known species.

Key to Females of the Genus Calholaspis Berlese[3]

1. Ventrianal shield with six pairs of preanal setae; tarsus II with stout spurs distally .... *C. superbus* Berl.
   Ventrianal shield with more than six pairs of preanal setae; tarsus II without spurs distally 2
2. Ventrianal shield with eight pairs of preanal setae; dorsal and ventral setae simple, with less than 75 pairs of dorsal setae; sternal shield without unsclerotized striate region .... *C. berlesei* Krantz
   Ventrianal shield with 32-33 pairs of preanal setae; majority of dorsal and ventral setae trident-like, with more than 150 pairs of dorsal setae; sternal shield with longitudinally striate region posteromedially .... *C. trianothrix* n. sp.

Calholaspis trianothrix n. sp.
(Fig. 1-4)

Female.—Length of idiosoma = 714 μ; width of idiosoma at level of coxae IV = 437 μ. Dorsal shield (fig. 1) truncate anteriorly, weakly crenulate-reticulate laterally, weakly punctate medially, and with at least 160 pairs of trident-like setae, of which some are asymmetrically inserted; setae D_1 appear to be simple; medial portion of dorsal shield showing strong muscle attachment pattern, without setal insertions in this area. Tritosternum with two pectinate lacinae, its base flanked by a pair of narrow presternal shields. Sternal shield (fig. 3) strongly reticulate anteriorly, with a distinct longitudinally striate pattern medially and posteriorly, and extending beyond the anterior angles of coxae IV; with three pairs of sternal setae plus the metasternal setae, the metasternal shields being fused to the sternal. Epigynial shield (fig. 3) strongly reticulate and

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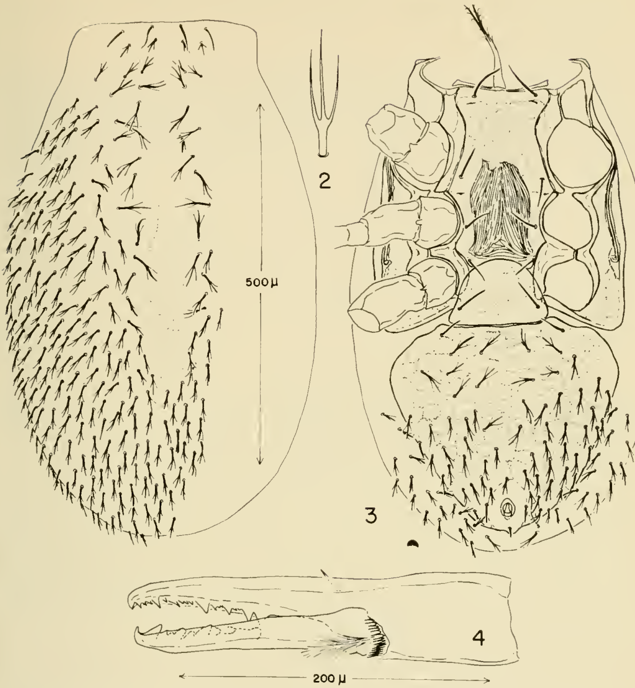
[3]Examination of the Berlese specimens of *C. superbus* at Florence reveals that the number of preanal setae may exceed six on either one or both sides of the shield. This character should, therefore, be considered as unreliable. The dorsum of this species possesses numerous pairs of secondary setae, similar to those of *C. berlesei*, but considerably longer. Satisfactory separation of *C. superbus* and *C. berlesei* may be achieved as follows:

Dorsal setae very long, distinctly exceeding the insertions of the setae behind them; sternal shield with arch-like lines forming the basis of ornamentation .... *superbus*
Dorsal setae shorter, barely reaching the insertions of the setae behind them; sternal shield generally reticulate, without arch-like pattern .... *berlesei*



Calholaspis trianothrix n. sp., female; fig. 1, Dorsum, fig. 2, Typical dorsal seta; fig. 3, Venter; fig. 4, Lateroventral aspect of chelicera.

punctate, slightly wider than long, and with a pair of simple setae on the posterolateral angles. Ventrianal shield triangular, crenulate-reticulate; with at least 30 pairs of setae in addition to the usual adanal and postanal setae; with most of the preanal setae trident-like (fig. 2); integumental setae adjacent to shield also trident-like. Peritrematal and exopodal shields fused, extending slightly posterior to coxae IV; stigmata between coxae III-IV; peritremes extending anteriorly beyond coxae II. Hypostome with a pair of simple duetosternal setae and three pairs of simple hypostomal setae, of which the most anterior pair is longest. Corniculi long, narrow, and acuminate distally. Palp with five free segments; palpal claw 3-tined, the empodial element being spatulate distally. Chelicerae (fig. 4) narrow and approximately the length of the corniculi; fixed cheliceral digit multidentate and with a strong simple dorsal seta; movable digit also multidentate, basally with a setal brush and a setal coronet. Legs I longer than legs II-IV, slender and with simple setae; without ambulacra or claws. Legs II-IV armed with simple setae, ambulacra and claws; lateral pretarsal elements undivided distally.

Male.—Unknown.

Type Material.—A single holotype female with the following data: In soil with miscellaneous plants; Costa Rica (intercepted at Miami); Jan. 20, 1958; coll. E. Okasaka; Lot 58-3180, U.S.N.M. The holotype female will be deposited at the U. S. National Museum, Washington, D. C.

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BOOK REVIEW

MOSQUITOES OF THE SOUTH PACIFIC, 2 VOLS., by John N. Belkin (illustrations by Charles D. Hogue). University of California Press, Berkeley, Calif. 1056 pages, 412 plates, 1962. Price, $20.00.

Little systematic collection of mosquitoes had ever been undertaken in the South Pacific area prior to 1940. Most of the available records resulted from mere samples of the fauna, principally of the better-known islands. A wide interest in arthropod-borne disease in the area was awakened by the arrival and establishment of Allied troops during World War II; their various epidemiological units eventually combed the islands and collected probably several hundred thousand specimens of all stages of mosquitoes, over 100,000 of which are now preserved in institutional and private collections.

In the present two volumes the author has sought to describe, illustrate, and key out all the species of mosquitoes now known from the South Pacific, and to present the readily available information on their bionomics, disease relationships, and distribution. He has not only succeeded admirably in this task, but has laid a foundation for future studies on the derivation of the mosquito fauna of the area as a whole and of its various parts. The 82-page introduction makes fascinating reading for one whose interests lie in the general faunistic problems of the area. Dr. Belkin's tentative conclusions about the movement of people and populations within the area, based on mosquito distribution, promise to provide a stepping stone to additional investigations of possible value to anthropology.

Of principal importance to alpha taxonomists is the section on systematic treatment, comprising most of the pages of the first volume and all of the second (the illustrations). The genera are grouped by tribe, and each species is discussed from the standpoint of synonymy; descriptive taxonomic characters; systematics in the broadest sense, to include discussions of variations and relationships; bionomics; disease relationships and economic importance; and distribution, for the most part by individual island or island group. The subfamlies, tribes, and genera are characterized in much the same way.—RICHARD H. FOOTE, *Entmology Research Division Agric. Res. Serv., U.S.D.A., Washington, D. C.*

STUDIES ON NORTH AMERICAN APION: THE APION PECULIARE GROUP

(COLEOPTERA: CURCULIONIDAE)[1]

D. G. KISSINGER, *Atlantic Union College, South Lancaster, Mass.*

This paper is a continuation of a series in which revision will be completed of the 260 species of *Apion* occurring in North America. Kissinger (1959a) presents a key to 29 species groups known from this region. Explanation of abbreviations and measurements is given by Kissinger (1957, 1959b).

Eight species of the *peculiare* group range from Southern Texas to Brazil, one additional species occurs in Puerto Rico. The larvae of *A. xanthoxyli* Fall and *A. martinezi* Marshall, the latter from Puerto Rico, develop in the seeds of *Xanthoxylum* spp. No hosts are known for the other species.

Five distinctive characteristics of the *peculiare* group are the short, robust body form which in side view is strongly convex to acutely gibbose; the stout tarsi have the first segment nearly as wide as long; the wide frons which, with the exception of *A. peculiare* Wagner, is much wider than the tip of the beak in dorsal view; the prominent eyes; and the oblique dorsal margin of the antennal scrobe. Additional characters are antenna inserted close to eye usually at a distance less than width of frons; beak strongly expanded laterally at insertion of antenna, in some cases short basal segment behind antennal insertion is very stout while distad of same is slender and cylindrical especially in case of female; frons flat, at most slightly sulcate; prothorax conical in shape, not expanded laterally at base, may be slightly constricted apically, in side view nearly flat from base to apex; femora and tibiae stout, generally compressed; claws with basal tooth; and legs of male lacking secondary sexual modification.

The members of the *herculanum* group, which occur mostly north of the 38th parallel, are apparently closely related to the *peculiare* group, but may be distinguished by their more elongate form and nonconvex appearance in side view. The *peculiare* group is quite similar to the subgenus *Coelopterapion* Wagner but differs in having more robust tarsi, a wider frons, and more basally inserted antennae. *Coelopterapion* has slender tarsi, the first segment distinctly longer than wide; the frons slightly wider than the tip of the beak in dorsal view; and the antennae inserted at a distance from the eye much greater than the width of the frons. One species of the subgenus *Trichapion*, *A. rostrum* Say, has stout tarsi but the males have tibiae 2 and 3 mucronate and both sexes have a strongly sulcate frons.

In the following key, *A. matricum* Sharp is placed using information contained in the original description; I have not seen this species.

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[1]This study was aided by Grant G 19600 from the National Science Foundation.

KEY TO SPECIES OF **Apion peculiare** GROUP

1. Vestiture of elytra composed only of light colored scales ... 2
   Vestiture of elytra composed of light and dark colored scales ... 6
2. Pubescence of elytra not conspicuous ... 3
   Pubescence of elytra in part dense, conspicuous; elytral intervals in part with two or more rows of punctures bearing scales ... 4
3. Prothorax on dorsal surface with coarse deep punctures; femur and tibia dark red, coxa black ... **matricum** Sharp[2]
   Prothorax on dorsal surface with fine, shallow punctures; femur and tibia yellow, coxa 1 dark reddish yellow ... **basirostre** Sharp
4. Elytral intervals 2 and 4 with scales denser and coarser, appearing as vittae, dense spot of scales apparent along suture immediately behind scutellum ... **cretaceicolle** Sharp
   Elytral intervals with scales arranged uniformly ... 5
5. Integument brown in color; scales in striae and on intervals (except sutural) of elytra nearly of the same width; length less than 2.0 mm. ... **americanum** Wagner
   Integument black with faint bluish luster; scales in striae more than twice as wide as scales on elytral intervals; length more than 2.25 mm ...
   wide as scales on elytral intervals; length more than 2.25 mm ...
   ... **coeruleosquamosum** Wagner
6. Scutellum ovate, not much longer than wide; elytra in profile very convex ... 7
   Scutellum more than twice as long as wide, produced posteriorly into a slender, awl-shaped structure about as long as basal portion; elytra in profile acutely gibbose ... **peculiare** Wagner
7. Frons abruptly interrupted above posterior margin of eye; elytra with median band of dark scales extending laterally from suture to interval 8, dark band bordered anteriorly and posteriorly with dense whitish scales ... **xanthoxyli** Fall
   Frons not interrupted above posterior margin of eye; median band of dark scales, if present on elytra, not extending beyond interval 4 ... 8
8. Intervals 2 and 4 of elytra with dense, elongate spots of white scales at basal third and behind middle ... **lebasi** Gyllenhal
   Intervals 1-4 of elytra with small spots of white scales at basal third, intervals 2-4 behind middle more or less uniformly clothed with sparse whitish scales ... **martinezi** Marshall

Apion matricum Sharp

Apion matricum Sharp, 1890, Biol. Centralia-Americana, Coleoptera, 4(3): 66.

The placement of this species in the *peculiare* group is in question because I have not seen specimens of *matricum*. Sharp's statement concerning the sexual dimorphism of the beak leads me to place the species here. The form is based on a pair of specimens from "San Feliz," Panama.

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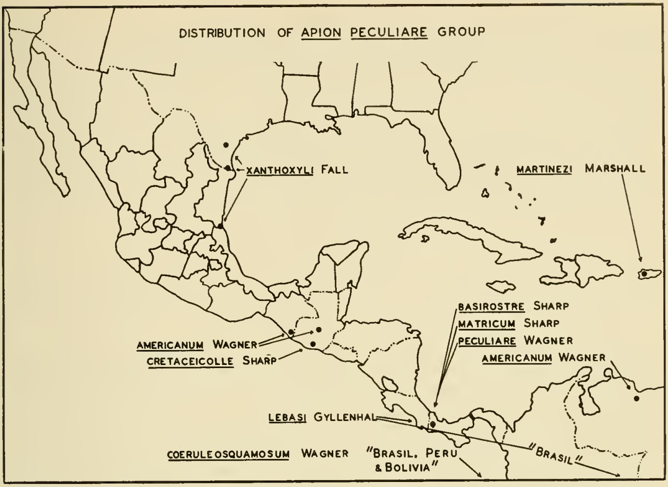
[2]Placed from original description.



Apion basirostre Sharp

(Figure 3)

Apion basirostre Sharp, 1890, Biol. Centrali-Americana, Coleoptera 4(3): 66, pl. 3, fig. 12.

Length: 2.25 mm.; width: 1.20 mm. Robust; black, femur and tibia except apex yellow, first two or three antennal segments and coxa 1 dark reddish yellow; pubescence conspicuous, white, on dorsum of prothorax and elytra moderately coarse, sparse, very coarse and dense on sides of pro, meso, and metathorax. Beak of female one-fourth longer than head and prothorax combined, two-thirds longer than prothorax, slightly curved; in dorsal view basal area 0.125 mm. long, 0.25 mm. wide, abruptly constricted to 0.09 mm. in width and parallel sided to apex; in side view thick at base, slender and cylindrical beyond insertion of antenna; basal robust portion punctured, scaly, dull, remainder of beak polished with very fine, sparse punctures, pubescence inconspicuous consisting of fine scales in basal half, apex glabrous. Antenna inserted in front of eye at distance from eye one-third as great as width of frons; first segment equal in length to next three, second equals third but stouter, club 0.32 by 0.09 mm., elongate and slender. Eyes moderate, very prominent; frons wide, twice as wide as dorsal tip of beak, with two lateral irregular rows of fine punctures and an indistinct median sulcus. Prothorax one-third wider at base than long, middle narrower than base, apex, three-fifths as wide as base; sides conical, nearly straight to apex, no apical constriction; in profile nearly flat; punctation shallow, 0.02-0.03 mm. in diameter, moderately sparse, interspaces as wide or wider than diameter of punctures; basal fovea minute. Elytra at humeri one-fourth wider than prothorax at base, 2.7 times as long as prothorax, length to width as 11:10; intervals flat, slightly wider than striae, with a single, irregular row of fine punctures bearing fine scales; striae deep, with a single row of fine scales. Scutellum flat, 0.12 long by 0.09 mm. wide. Anterior femur three times as long as wide. Claws with blunt basal tooth. Male unknown.

Material examined: one female compared with type by Sharp.

Known distribution: PANAMA: Tolé (BMNH).

The very sparse, inconspicuous pubescence of the dorsal surface will distinguish this species from its allies.

Apion cretaceicolle Sharp

(Figure 2 and 4)

Apion cretaceicolle Sharp, 1890, Biol. Centrali-Americana, Coleoptera, 4(3): 65, pl. 2, fig. 25.

Length: 1.92 to 2.00 mm.; width: 1.00 mm. Robust, profile gibbose; dark reddish brown, eyes blackish, femur and tibia reddish yellow, tarsus dark; pubescence conspicuous, creamy, prothorax densely clothed, on elytra scales denser on intervals 2, 4, 6, and 8 and base of all intervals, sides of meso and metathorax densely clothed. Beak of male as long as head and prothorax combined, one-half longer than prothorax, slightly curved, more strongly so in apical third; in dorsal view at base slightly wider than frons, expanding to widest point at basal one-eighth where it is one-fourth wider than frons, abruptly narrowed, beyond basal fourth slightly attenuate to apex which is two-thirds as wide as frons; in lateral view attenuate from insertion of antenna to tip, more strongly so in apical third; dull, finely punctured, with dense scales, tip shining, bare. Antenna inserted at basal ninth at distance from eye one-half as great as width of frons; first segment as long as next three, second slightly longer than third, club 0.20 by 0.08 mm. Eyes prominent; frons wide, with two or three lateral rows of fine punctures on either side of a fine, shallow median sulcus. Prothorax at base slightly wider than long, middle noticeably narrower than base, apex two-thirds as wide as base; sides evenly converging from base to apex; in profile nearly flat; punctation 0.02 mm. in diameter, moderately deep, dense, interspaces less than diameter of punctures; basal fovea absent. Elytra at humeri one-fifth wider than prothorax at base, twice as long as prothorax, length to width as 6.5:6.0; intervals flat beyond basal area; intervals 2 and 4 with one row of punctures; striae deep, coarse, with one row of coarse scales. Scutellum oval with basal median depression, 0.10 mm. long by 0.08 mm. wide. Anterior femur three times as long as wide, compressed. Claws with acute basal tooth. Female unknown.

Material examined: Two males compared with type by Sharp.

Known distribution: GUATEMALA: Zapote.

The dense scales on the prothorax and elytral intervals 2 and 4 give this species a distinctive appearance.

Apion americanum Wagner

Apion americanum Wagner, 1908, Mém. Soc. Ent. Belgique, 16: 5. [New name for *Apion conicicolle* Sharp, 1890, Biol. Centrali-Americana, Coleoptera, 4(3): 65, *nec* Gerstaecker, 1854.]

Length: 1.83 to 1.92 mm.; width: 1.00 to 1.06 mm. Robust; dark reddish brown, femur and tibia light reddish yellow, eye black; pubescence conspicuous, creamy, coarse, moderately dense on dorsum of prothorax and elytra, denser on sides of pro, meso and metathorax. Beak of male slightly shorter than head and prothorax, one-fourth longer than prothorax, slightly curved; in dorsal view base slightly wider than frons, expanding to widest point at basal one-seventh, there one-fourth wider than frons, strongly attenuate to basal fourth, thence feebly attenuate to tip; in lateral view attenuate to tip; dull, finely, sparsely punctured in rows, with scales to near tip, apex smooth, more shining, bare. Beak of female as long as head and prothorax combined, one-half longer than prothorax, slightly evenly curved; in dorsal view expanded slightly to basal one-ninth, strongly narrowed, apical seventh-eighths nearly parallel sided, slightly expanded at apex; in lateral view attenuate beyond insertion of antenna, apical two-thirds nearly parallel sided; basal ninth dull, scaly, apical eight-ninths polished, minutely punctured, glabrous. Antenna inserted at distance from eye one-half as great as width of frons, of male at basal eighth, of female at basal ninth of beak; first segment of female equals next three, of male next two; second segment slightly longer than third; club 0.22 by 0.08 mm. Eyes prominent; frons wide, about twice as wide as dorsal tip of beak, with three rows of fine punctures and a fine, shallow median sulcus. Prothorax slightly wider at base than long, middle narrower than base, apex three-fifths as wide as base; sides evenly converging from base to apex; profile nearly flat; punctation shallow, minute, 0.01 mm. in diameter, sparse, interspaces two to four times diameter of punctures; basal fovea absent. Elytra at humeri one-fourth wider than prothorax at base, twice as long as prothorax, length to width as 13:12; intervals flat, about twice as wide as striae, with one or two rows of fine punctures bearing coarse scales; striae deep, coarse. Scutellum 0.12 mm. long by 0.08 mm wide. Anterior femur slightly more than three times as long as wide, compressed. Claws with rather broad basal tooth.

Material examined: two females determined by Sharp, one male determined by Wagner.

Known distribution: GUATEMALA: S. Geronimo (BMNH): MEXICO: Chiapis: Tapachula (BMNH). VENEZUELA: Akuiman (DGK).

The uniform, coarse, conspicuous pubescence distinguishes this species from its allies.

Apion coeruleosquamosum Wagner

Apion coeruleosquamosum Wagner, 1912, Arch. Naturg. 78 (Abt. A, Heft 2):131.

Length: 2.44 mm.; width: 1.44 mm.; Wagner gives length as 1.9-2.2 mm.

Robust, in profile elytra gibbose. Black with faint bluish luster, femur and tibia pale yellow, tarsus and antenna slightly darker, trochanter and coxa 1 and 2 dark brownish yellow. Pubescence conspicuous, white, on dorsal surface with faint bluish tinge, scales on dorsum of prothorax and on base of dorsal elytral intervals similar in size and shape, becoming finer toward middle of intervals 1-3; scales on dorsal part of head and beak stouter, somewhat shorter and wider toward the apex than scales on parts mentioned above, prothorax and elytra, where the scales tend to be linear; scales in elytral striae two to three times as wide as scales on intervals, on sides of elytra and on pro, meso, and metathorax scales shorter and slightly wider than scales in striae, dense, overlapping. Beak of male shorter than head and prothorax combined, one-fifth longer than prothorax, stout, somewhat curved, in side view strongly, evenly attenuate from base to apex, apex two-fifths as wide as beak immediately distad of eye; in dorsal view widening from base to insertion of antenna, where beak is expanded laterally, then strongly, evenly attenuate to apex, apex 0.45 mm. as wide as beak at insertion of antenna; apical third bare, polished, impunctate, remainder of beak with coarse, close shallow punctures bearing scales. Antenna inserted at basal one-fourth of beak at distance from eye equal to width of frons; first segment as long as next three, second segment as long as next two; club 0.24 by 0.12 mm., of male uniformly clothed with long fine hairlike scales. Eyes prominent; frons one-half wider than dorsal tip of beak; with four rows of confused punctures, in profile not interrupted above posterior margin of eye. Prothorax at base one-sixth wider than long, middle distinctly narrower than base, apex three-fourths as wide as base; sides with slight basal lateral expansion, evenly converging from base to apical third, thence rounded into apical constriction, extreme anterior margin flared out laterally; in profile dorsal margin slightly convex; punctures 0.02 to 0.03 mm. in diameter, deep, interspaces less than one-third as wide to wider than diameter of punctures, punctures shallower and finer and interspaces wider in basal lateral region than in apical one-third; basal fovea shallow, linear, about one-fifth length of prothorax at base; 2.3 times as long as prothorax, length to width as 7:6; intervals flat, one-half wider than striae, with two or three rows of scales; striae deep, coarse, scales in striae much coarser than those on intervals. Scutellum elongate triangular, 0.15 by 0.08 mm., smooth. Anterior femur 3.5 times as long as wide. Claws with acute basal tooth. Female not seen.

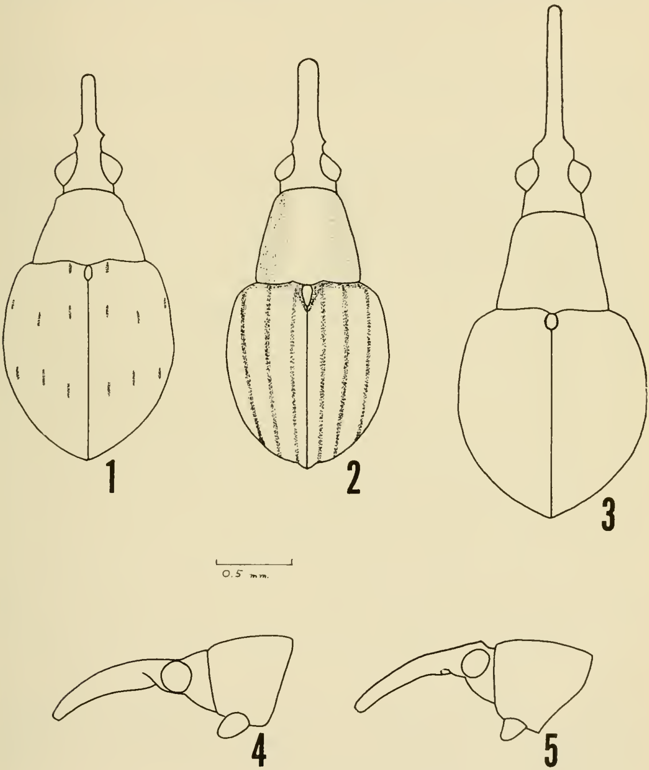
Material examined: one male determined by Wagner.

Known distribution: BRASIL: unspecified locality and Amazonas: Obidas. PERU: unspecified locality. BOLIVIA: unspecified locality.

Apion peculiare Wagner

Apion peculiare Wagner, 1909, Deutsche Ent. Zeitschr., p. 766. [New name for *Apion gibbosum* Sharp, 1891, Biol. Centrali-Americana, Coleoptera, 4(3): 82, pl. 3, fig. 21 and 21a, *nec* Herbst, 1797.]

Length: 2.75 mm.; width: 1.50 mm. Robust, in profile elytra acutely gibbose. Black, femur and tibia light brownish red, tarsus darker; pubescence conspicuous, moderately coarse, on dorsum of prothorax light brownish, on elytra a large median discal spot of fine, dark brown scales inclosed by a circle of fine, lighter scales, remainder of elytra with fine, moderately dark scales, sides of elytra and pro, meso, and metathorax clothed with dense, coarse, cream colored scales. Beak of male slightly longer than prothorax, robust, subulate; in dorsal view strongly dilated at insertion of antenna, attenuate to tip; in lateral view dorsal line slightly arcuate, ventral line nearly straight, strongly attenuating from insertion of antenna to apex; dull, finely, moderately, closely punctured, with coarse scales, tip smooth, bare, shining. Beak of female described as being more glabrous than male. Antenna inserted at distance from eye equal to width of frons, immediately behind basal third of beak; first segment as long as next three, second longer than third, shorter than next two, club 0.27 x 0.12 mm. Eyes prominent; frons moderately wide, wider than dorsal tip of beak. Prothorax at base two-fifths wider than long, middle seven-tenths as wide as base, apex five-eighths as wide as base; sides straight, converging in basal one-half, rounding to constricted apex, sides at apex slightly expanded; in profile slightly arcuate, sinuate before apex; punctation 0.03-0.04 mm. in diameter, dense, deep, interspace narrow, moderately shining; basal fovea fine, shallow. Elytra at humeri three-eighths wider than base of prothorax, 2.7 times as long as prothorax, length to width as 5:4 intervals slightly wider than striae, nearly flat, with three irregular rows of close, fine



Apion lebasi Gyllenhal. Fig. 1, entire dorsal view of female, stippled areas represent spots of dense white scales. *Apion cretaceicolle* Sharp. Fig. 2, entire dorsal view of male, stippled areas represent dense white scales; Fig. 4, lateral view of head and prothorax of male. *Apion basirostre* Sharp. Fig. 3, entire dorsal view of female. *Apion xanthoxyli* Fall. Fig. 5, lateral view of head and prothorax of female. Scale represents 0.5 mm. in all figures.

punctures; on disc striae coarse, moderately deep, with deep, large pits. Scutellum awl shaped, 0.24 mm. long, width at base 0.09 mm., at middle 0.03 mm. Anterior femur three times as long as wide, compressed. Claws with acute basal tooth. Female not seen.

Material examined: two males determined by Sharp.

Known distribution: PANAMA: Tolé (BMNH).

The large size and acutely gibbose appearance in side view easily distinguish this species.

Apion xanthoxyli Fall

(Figure 5)

Apion xanthoxyli Fall, 1898, Trans. American Ent. Soc., 25: 176, pl. 5, fig. 14 and 14a.

Length: 1.87 to 2.12 mm.; width; 1.12 to 1.25 mm. Robust, in profile elytra gibbose. Dark brown; vestiture conspicuous, dense, of moderately coarse scales; intervals 1-6 in basal fourth with fairly light scales, toward middle with dark brown scales and in apical third with pale brown scales giving the appearance of a median dark spot bounded anteriorly and posteriorly with light scales. In both sexes beak shorter than head and prothorax combined, about one-tenth longer than prothorax, slightly curved, in side view attenuate to tip from antennal insertion; in dorsal view moderately expanded at antennal insertion, abruptly attenuate to width two-thirds as great as dilated portion, apical two-thirds nearly parallel sided; basal two-thirds punctured and moderately densely scaly, apical fourth, bare, impunctate. Antenna inserted behind basal sixth of beak at distance from eye two-thirds as great as width of frons; first segment longer than next two but shorter than next three combined; club 0.21 mm. long by 0.12 mm. wide. Eyes prominent, somewhat transverse; frons slightly wider than dorsal tip of beak, with fine, shallow median sulcus and two lateral rows of fine punctures, in profile frons prominent above posterior margin of eye. Prothorax conical, sides slightly constricted at apex, at base about one-third wider than long, apex two-thirds as wide as base; in profile dorsal surface slightly convex; punctures fine and shallow, 0.02 to 0.03 mm. in diameter, interspaces about as wide as diameter of punctures, no basal fovea. Elytra at humeri about one-third wider than prothorax at base; about 2.5 times as long as prothorax, length to width about as 10: 9; intervals narrow, slightly convex, with two or three rows of punctures bearing scales; striae coarse, deep, scales in striae about as coarse as adjacent scales on interval. Scutellum oval triangular in shape, 0.08 by 0.08 mm. with slight median impression. Anterior femur three times as long as wide. Claw with basal tooth.

I hereby designate the lectotype of this species as the specimen in the Fall Collection labeled "Brnsville, Tex., 1013-17, Twnsend, M. C. Z. #25130", the specimen seems to be a female. A lectoparatype is in the U. S. National Museum labeled, "San Diego, Tex., 27.10, E. A. Schwarz," it seems to be a male.

Material examined: lectotype and 50 specimens.

Known distribution: Texas: Brownsville, from February through July; San Diego, June, July, and October. MEXICO: Veracruz: Tampico, December.

Fall (1898) records that the species was reared from the seeds of *Xanthoxylum pterota.*

Apion lebasi Gyllenhal

(Figure 1)

Apion lebasi Gyllenhal, 1839, *In* Schoenherr, Gen. et sp. curculionidum, 5 (pt. 1): 377; Wagner, 1911, Mém. Soc. Ent. Belgique 19: 31.

Apion picturatum Sharp, 1890, Biol. Centrali-Americana, Coleoptera, 4(3): 65, pl. 3, fig. 11; Wagner, 1911, Mém. Soc. Ent. Belgique, 19: 31.

Length: 2.00 mm.; width: 1.15 mm. Robust, elytra gibbose in profile; dark reddish brown, femur, tibia and tarsus pale reddish yellow, claw and eye nearly black; pubescence conspicuous, dorsum of prothorax and elytra with cream colored broad scales and yellowish, very fine scales; broad scales denser at base of elytra on elytral intervals 2 and 4 at basal one-fourth and three-fourths, and in apical region of elytra; finer, yellowish scales arranged so these appear as median discal dark spot, sides of pro, meso, and metathorax with coarse, moderately dense scales. Beak of female as long as head and prothorax, one-third longer than prothorax, moderately evenly curved; in dorsal view broad in basal fourth, slender and parallel in apical three-fourths, base slightly wider than frons, strongly expanded laterally over insertion of antenna, nearly parallel to tip; basal fourth dull, clothed with broad scales, apical three-fourths shining, minutely punctured, beyond middle glabrous. Beak of male described by Sharp as rather stout, anterior portion not so abruptly separated from basal part, not polished but feebly sculptured, setose except tip. Antenna of female inserted at basal one-seventh of beak at distance from eye one-half as great as width of frons; first segment as long as next three, second slightly shorter than next two, club 0.17 by 0.08 mm. Eyes prominent; frons wide, twice as wide as dorsal tip of beak, at least in female; flat, dull, vaguely punctured, alutaceous, clothed with broad scales. Prothorax at base two-fifths wider than long, middle four-fifths as wide as base, apex three-fifths as wide as base; sides evenly converging to apical fourth, constricted before apex; in profile dorsal surface nearly flat; punctation moderately shallow, about 0.03 mm. in diameter, interspaces about equal to diameter of punctures; basal fovea very shallow, linear, short. Elytra at humeri one-fourth wider than prothorax at base, 2.6 times as long as prothorax, length to width as 15: 14; intervals flat, narrow at base, wider at middle, at middle about twice as wide as striae, with two or three irregular rows of fine, shallow punctures; striae coarse, deep. Scutellum 0.06 by 0.06 mm., flat, ovate. Anterior femur about three times as long as wide, compressed. Claws with acute basal tooth. Male not seen.

Material examined: two females compared with type of *A. picturatum* Sharp by Sharp .

Known distribution: BRAZIL: unspecified locality. PANAMA: David, Chiriquí (BMNH).

The pattern of dense white scales on the elytra will distinguish this species.

Apion martinezi Marshall

Apion martinezi Marshall, 1935, Ann. Mag. Nat. Hist., ser. 10, 15: 516. [New name for *Apion xanthoxyli* Marshall, 1934, Ann. Mag. Nat. Hist. ser. 10, 14: 629, *nec* Fall, 1898.]

Length: 2.06 to 2.18 mm.; width: 1.25 mm. Robust, in profile elytra gibbose. Brown; vestiture conspicuous, of dense, moderately coarse scales; those on elytra predominantly off-white or light brown except for central discal spot of fine, slightly darker scales, darker discal spot extends laterally to interval 4 and is surrounded by whitish scales; laterally elytra and prothorax clothed with coarse, dense, whitish scales. In both sexes beak about one-tenth longer than prothorax, slightly curved, in side view attenuate from antennal insertion to apex; in dorsal view slightly expanded laterally at antennal insertion, apical half of beak nearly parallel sided; scaly to near tip; beak of female slightly more slender and with fewer scales in apical third than beak of male. Antenna inserted near basal sixth of beak at distance from eye slightly less than width of frons; first segment slightly longer than next two, second segment slightly shorter than next two; club 0.20 mm. long by 0.09 mm. wide. Eye prominent, somewhat transverse; frons about as wide as dorsal tip of beak, with two rows of fine punctures, flat medially, not prominent over posterior margin of eye. Prothorax at base between two-fifths and one-half wider than long, conical in shape with broad constriction apically, apex about three-fifths as wide as base; in profile dorsal margin slightly convex; punctures fine 0.01 to 0.02 mm. in diameter, shallow, sparse, interspaces mostly greater than diameter of punctures; basal fovea lacking. Elytra at humeri about two-fifths wider than prothorax at base, about three times as long as prothorax, length to width as 6: 5; intervals slightly convex, about twice as wide as striae, with three or four rows of scales; striae moderately coarse, with scales of similar coarseness as scales on adjacent intervals. Scutellum oval triangular, 0.09 by 0.09 mm., with slight median impression. Front femur about three times as long as wide. Claw with basal tooth.

Material examined: twenty-two specimens determined by L. L. Buchanan labeled "Maricao, P. R., VII-8-41, J. G. Scarff, on seed heads of West Indian satin wood."

Known distribution: recorded only from Puerto Rico.

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A NEW SPECIES OF HYADESIA

(Acarina: Carpoglyphidae)

D. C. M. Manson, *Department of Agriculture, Levin, New Zealand*

Mites of the genus *Hyadesia* are unusual in that they normally feed on algae in salt or fresh water. Recently, specimens were received from Dr. P. Glynn of the Hopkins Marine Station, Pacific Grove, California, U.S.A. and they are described here as a new species. Dr. Glynn states that the habitat niche of this mite is within the interstices of the intertidal barnacle, *Balanus glandula*, which is covered by sea water about fifty per cent of the time.

The genus and first known species of *Hyadesia*, *H. uncinifer*, was described by Mégnin (1889), from immature forms found at Tierra del Fuego. Michael (1893), described a second species which he called *Lentungula algivorans*, and placed in the family Tyroglyphidae. *Lentungula* was later synonymised with *Hyadesia*. Lohmann (1894), described *H. fusca*, a species which was found at Heligoland in the North Sea and in 1907 described *H. kerguelensis* from the Kerguelen Islands. Halbert (1915) erected the family Hyadesidae for species of the genus *Hyadesia* (= Lentungulidae, Berlese 1897). André (1931) described *H. chelopus* from the Indian Ocean. Viets (1936) described the species *H. curassaviensis* from the Antillan Islands and in 1937 described *H. sellai* from the Adriatic sea. Womersley (1961) described *H. vietsi* from Netherlands New Guinea.

Zachvatkin (1940) included the genus *Hyadesia* under the subfamily Carpoglyphinae of the family Glycyphagidae. One of Zachvatkin's characters for the genus was the presence of a transverse suture which separates the propodosoma and hysterosoma. But, according to Michael (1901) and Hughes (1955), *H. uncinifer*, the type species does not possess a transverse suture. Reviews of the family are given by André (1931) and Hughes (1955). Womersley includes a key to all previously described species. Hughes agrees with Zachvatkin's classification. Baker and Cunliffe (1960) proposed the raising of the subfamily Carpoglyphinae to family rank, Carpoglyphidae, and this classification is followed here.

Hyadesia glynni n. sp.

The distinctive feature of this species is the large dorsal shield which covers the greater part of the hysterosoma and extends over the posterior portion of the ventral surface. The only other species which appears to have a similar structure is *H. sellai*, but *H. sellai* can be distinguished by the much longer ventral spines on tibia I and II of the female, as well as the differing lengths and arrangements of the dorsal body setae.

Male.—Length of idiosoma 385μ; greatest width of idiosoma 242μ. Body almost oval in shape. Colour whitish; legs, gnathosoma, dorsal and propodosomal shields and sclerotised areas on ventral surface pale brown. Cuticle mainly smooth, with a few wrinkles; pitted areas on dorsal and ventral body surfaces as shown by dotted areas in figs. 1 and 2. Dorsal propodosomal shield situated just posterior to anterior vertical setae; about twice as long as broad. Suture between propodosoma and hysterosoma distinct. Three pairs of propodosomal setae; anterior verticals (v.a.), external and internal scapulars (sc.e. and sc.i); pair of "fat glands" posterior to propodosomal shield. Dorsal hysterosomal shield extending complete length of hysterosoma; anterior portion of shield colourless. Dorsal setae present include four pairs of dorsals (d_1, d_2, d_3, d_4), two pairs of laterals (l_1, l_2), two pairs of humerals (h.e., h.i.), inner and outer sacrals (sa.i., sa.e.), and one pair of post anals (p.a.l); pair of "fat glands" midway between setae l_1 and l_2, and one pair opposite setae d_3. Ventrally, the dorsal shield continues on to the ventral surface, covering much of the area posterior to legs III and IV. Two pairs of coxal setae present (on legs I and III), three pairs of genitals (g), one pair of pre-anals (pr.a.) and a second pair of para-anals (p.a.$_2$). Apodemes I join with the sternum which extends posteriorly, but does not quite meet apodemes II. Apodemes III and IV joined. Pair of "fat glands" situated near posterior lateral margins of ventral surface of hysterosoma. Legs short and stout. Tarsi I and II terminating in a large claw formation and bearing a small spine. Arising from the base of the "claw" is a long flexible pretarsus, broadened distally, and to which is attached an empodial claw. Pretarsi III and IV shorter and broader and empodial claw larger. A number of setae, either seven or eight, varying in thickness and length encircle the distal portion of tarsus 1. Tarsus II similar to I with seven setae; tarsi III and IV each with five setae. Tibiae I and II, ventrally with a stout conical spine about as long as one quarter the width of the tibia. On tibia III and IV this "spine" is more slender and elongate.

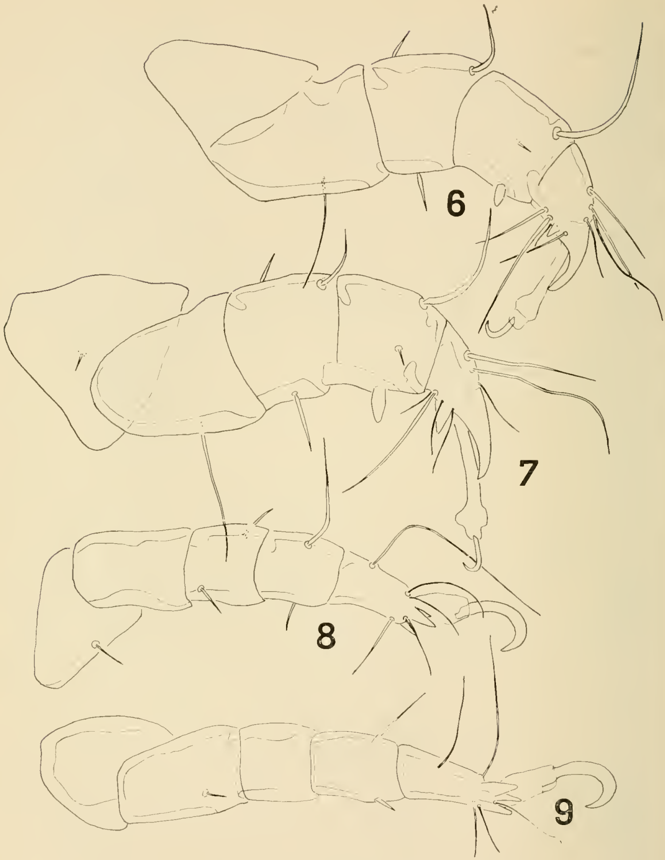
Female.—Length of idiosoma 412μ; greatest width of idiosoma 269μ; Dorsal surface similar to male. Ventral surface as in male except for genitalia and anterior pitted areas which are not as extensive; also, distance between posterior extremity of sternum and apodemes II greater than in male. Legs I and II much broader than those of male; terminal claw somewhat longer. Tarsi very similar to those of male except tarsi III and IV with three equal sized spines at distal extremity, in contrast to the single spine of the male. Tarsus I with eight setae; tarsus II with seven setae; tarsi III and IV with five setae. Tibia I with stout conical spine about as long as one quarter the width of the tibia; tibia II with stout conical spine about as long as one third the width of the tibia.

Holotype, Male.—(USNM No. 2853) collected within the interstices of the intertidal barnacle, *Balanus glandula*, Pacific Grove, California, U.S.A., by P. Glynn.

Paratypes.—Five males, seven females, with same data as holotype. The species is named after the collector, P. Glynn.

Hyadesia glynni n. sp.

Fig. 1, dorsum of male; Fig. 2, venter of male; Fig. 3, venter of female; Fig. 4, leg I of male; Fig. 5, leg II of male.



Hyadesia glynni n. sp.

Fig. 6, leg I of female; Fig. 7, leg II of female; Fig. 8, leg III of female; Fig. 9, leg IV of female.

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THE MALE OF DIALICTUS HETEROGNATHUS MITCHELL

(Hymenoptera: Halictidae)[1]

A collection of Halictidae received for determination from Dr. R. A. Morse, Cornell University, contained a large series of *Dialictus heterognathus* Mitchell. The previously unknown male is herewith described.

Dialictus heterognathus Mitchell

Dialictus heterognathus Mitchell, 1960. N. C. Agr. Exp. Sta. Tech. Bull. 141: 397.

Male.—Length 5 mm.; *wing* length 4 mm.; *head* and *thorax* dark green, abdomen piceous with strong greenish reflections; *pubescence* short, white; *head* slightly broader than long; *clypeus* polished, sparsely punctate, projecting one-third below suborbital line; *eyes* convergent below; *antennae* nearer eyes than to each other, rather prominent for size of insect, basal segment of flagellum about as broad as long, following segments nearly twice as long as broad, flagellum ferruginous beneath, piceous above, scape piceous and shining; *cheeks* subequal to eyes, shining, with shallow but distinct punctures; *hypostomal area* finely striate, hypostomal carinae slightly divergent; *scutum* and *scutellum* shining, punctures minute, sparse in centre of discs, becoming somewhat closer laterally;

pleura shining, obscurely punctate; *dorsal area of propodeum* rather coarsely striate, apical margin often smooth and more or less rounded, lateral surfaces smooth and shining; *wings* hyaline, veins and pterostigma brownish; *tegulae* yellowish hyaline; *femora* piceous; *tibiae* yellowish at base and apex; *tarsi* yellowish; *abdominal terga* polished, minutely and sparsely punctate, apical margins narrowly impressed, impunctate.

Material examined.—New Hampshire: 14 ♂♂, Meredith Center, August 22, 23, 26 and 27, 1960 (on *Solidago* sp.); 9 ♂♂, Meredith Center, August 28 and 29, 1960 (on *Aster lateriflorus*); 1 ♂, Belknap Co., August 30, 1960 (on *Aster lateriflorus*). New York: 1 ♂, Tompkins Co., July 25, 1960 (on *Melilotus alba*). All specimens were collected by R. A. Morse.

G. Knerer, *University of Maryland, College Park* and C. E. Atwood, *University of Toronto, Ontario.*

[1]The research on which this study is based was supported by a grant from the National Research Council, Ottawa.

NOTES ON THE LARVAL HABITAT OF TABANUS MONOENSIS HINE

(Diptera: Tabanidae)

Tabanus monoensis was described from adults obtained from larvae collected along mountain rivulets near Topaz, Mono County, California (Webb and Wells 1924, USDA Dept. Bull. 1218, p. 29). Apparently no additional information on the habitat preferences of the immature stages has been published.

On several occasions during the spring and fall of 1959-60 tabanid larvae were found to be abundant in the wet soil of a small waterfall located along State Highway 42 approximately three miles south of Juliaetta, Latah County, Idaho. Adults reared from these larvae were determined as *T. monoensis* by L. L. Pechuman. The waterfall has a height of some 20 feet, has a southeast exposure, is partially shaded by overhanging vegetation, and flows throughout the year. It is situated on the nearly vertical face of a lava bed exposed by a road cut along Potlatch Creek.

Other invertebrates abundant in the saturated soil and mats of vegetation included earthworms, crane-fly larvae (mostly *Tipula* sp.) and stratiomyid larvae (*Euparyphus* sp.). The larvae of *monoensis* fed voraciously on all of these in laboratory rearing dishes.

No *monoensis* adults were ever collected, although the waterfall was visited repeatedly during the summer months.

The discovery of this species in northern Idaho extends its range considerably to the north and east. It has been reported previously only from California (Brentwood, Claremont, Downieville, Los Angeles, Pollock Pines, Potwisha, Sequoia Nat. Pk.) and Oregon (Ashland, Breitenbush Lake). Middlekauff (1950, Bull. Calif. Ins. Surv. 1(1): 1-24) gives certain California records, and I am indebted to C. B. Philip for other distributional data.—B. A. Foote, *Dept. of Biological Science, Kent State University, Kent, Ohio.*

DONALD JOHN CAFFREY

1886-1960

Donald John Caffrey, retired entomologist in the U. S. Department of Agriculture, died of a heart attack on June 22, 1960, while vacationing with his wife at their summer home at Traverse City, Michigan. Mr. Caffrey had retired on November 30, 1956, after serving the Entomology Research Division, Agricultural Research Service, and its predecessor organizations for more than 43 years.

Don Caffrey was born in Brooklyn, New York, on November 17, 1886. He attended high school in Gardner, Massachusetts. In 1919 he received the B.S. degree from Massachusetts Agricultural College (now the University of Massachusetts) and in the same year was the recipient of an honorary degree of B.S. from Boston University. From 1910 to 1913 he worked as an entomological assistant in the Connecticut Agricultural Experiment Station. He joined the entomological staff of the U. S. Department of Agriculture in 1913 and was assigned to work on the western range caterpillar in New Mexico. From then until 1934, he was engaged in investigations of the Department on cereal and forage insects. Following his assignment in New Mexico he was stationed in a laboratory in Hagerstown, Maryland, from 1917 to 1919.

When the accidental introduction of the European corn borer was recognized as a serious threat to the corn production of this country, large funds were appropriated for a study of the insect and Don was selected to head up an extensive research program. In this capacity he directed investigations at the Arlington, Massachusetts, European Corn Borer Laboratory from 1919 to 1931 and coordinated it with other investigations on the insect at Silver Creek, New York; Sandusky, Ohio; Toledo, Ohio; and Monroe, Michigan. In 1931 he was transferred with the corn borer headquarters to Toledo, Ohio, where he remained until 1934. During his administration of European corn borer research, Don was in close contact with investigations on the insect under way by Canadian entomologists, and worked closely with regulatory and control personnel of the U. S. Department of Agriculture and infested States in their efforts to control the insect as it moved westward toward the main Corn Belt. Many of today's senior entomologists began their working careers on the European corn borer project under Don Caffrey.

In 1934 Don was moved into Washington, D. C., to become Assistant Chief of the Truck Crop and Garden Insects Section of the old Bureau of Entomology and Plant Quarantine, which position he held for the next 22 years, with the exception of one year (1940-41) when he was detailed to the field to coordinate the research program on the beet leafhopper, an important pest of sugar beets and certain truck crops in the West.

Don Caffrey throughout his career was a faithful public servant. He was extremely conscientious in every task that came to hand and gave his attention to the smallest details in reaching sound decisions. No matter how busy he might be or how insignificant the request for information that reached his desk, it was always his practice to provide promptly the best and most complete answer possible. Numerous younger entomologists can recall having received helpful and friendly advice from him.

Don was the author or co-author of 59 publications. His bulletins and articles on the European corn borer and its control were unusually valuable contributions and are still the most important references on this insect.

Don's professional affiliations included membership in the Entomological Society of America and the Entomological Society of Washington. While serving as corresponding secretary of the latter organization, he voluntarily spent many long hours of his own time putting in order the Society's stock of reprints and back numbers of its proceedings. He served as general chairman of the Thirteenth Tobacco Workers' Conference, held at Richmond, Virginia, in January 1955, and for a number of years he had the task of editing and distributing the "Suggestions for the Control of Tobacco Insects" approved by the Recommendations Committee of the Tobacco Insect Section of the Conference.

Don Caffrey is survived by his wife, the former Laura Mae Couture, Washington, D. C.; a son, John G. Caffrey, Palo Alto, California; and a brother and sister.

L. B. REED AND A. M. VANCE

SOCIETY MEETINGS

712th Regular Meeting, Dec. 13, 1962

The 712th meeting of the Society was called to order by the President, Dr. H. H. Shepard, on December 13, 1962, at 8 p.m. in room 43 of the U. S. National Museum. Thirty one members and sixteen guests were in attendance. Minutes of the previous meeting were accepted as read.

Prsident Shepard thanked the officers and committee members for their support and presented excerpts from their reports.

The corresponding secretary reported a slight drop in membership to 493 from 500 a year ago. The Proceedings go to 745 members and subscribers in 50 states, D. C., 2 territories, and 50 foreign countries.

The treasurer reported a balance in the General Fund of $7,194.19 and $8,228.36 in the Special Publication Fund.

The membership committee reported that 26 names had been presented during the year.

The custodian reported sales of $812.39.

W. W. Wirth moved that the nominations for offices be accepted; the motion was seconded and carried. (See inside front cover.)

Eight candidates to membership were announced: *Robert Shell*, *Jon L. Herring*, *Margaret A. Parsons*, *Lloyd V. Knutson*, *Gerhard A. Knerer*, *S. S. Kumar*, *Cornelius Barry*, *Virginia S. Wolf*. Three candidates were accepted to membership: *Wallace T. Garrett*, *H. Irving Brigham*, *Dale W. Parrish*.

R. H. Arnett presented to the Society a mounted collection of program announcements the oldest of which was the 246th meeting on Jan. 5, 1911.

A. B. Gurney noted the deaths of the following entomologists: *Arthur Robinson Brooks*, on Aug. 13, 1962, at Saskatoon, Canada, in his mid-forties; he was active in the preparation of guides to the insects of the Prairie Provinces. *Walter Douglas Hincks* (1906-1961), Keeper of Entomology, Manchester Museum, England; he was well known for his world-wide studies of Dermaptera, for work on beetles, and for comprehensive studies of the British insect fauna. *C. J. M. Willemse*, in the Netherlands, at the age of 73, in April 1962; he was a physician who studied insects as a hobby and produced important works on East Indian Orthoptera. *Herbert Womersley* (1889-1962) of Adelaide, Australia, an authority on apterygotan insects and mites.

Reports on the recent meeting of the Entomological Society of America in Phoenix were presented by R. H. Nelson, F. W. Poos, R. F. Smith, and H. H. Shepard.

A panel discussion on the Amateur Entomologist was presented by T. J. Spilman, moderator, J. F. Gates Clarke, R. H. Nelson, and R. H. Arnett. The subject proved to be an interesting one as evidenced by the discussion from the floor.

Past President Shepard presented the gavel to President Bickley who adjourned the meeting at 10:15.

OLIVER S. FLINT, JR., *Recording Secretary*

713th Regular Meeting, Jan. 3, 1963

The 713th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on January 3, 1963 at 8 p.m. in the regular meeting room in the U. S. National Museum. Eighteen members and 6 guests were in attendance. Minutes of the previous meeting were accepted.

Eight candidates were accepted to membership: *Robert Shell, Jon L. Herring, Margaret A. Parsons, Lloyd V. Knutson, Gerhard A. Knerer, S. S. Kumar, Cornelius Barry,* and *Virginia S. Wolf*. No new candidates for membership were announced.

Dr. Frank L. Campbell was announced as the delegate from the Society to the Washington Academy of Sciences.

R. G. Barker showed the first publication of the Junior Academy of Sciences. This contains papers by students through the high school level. None of the papers, however, were on insects. He also had a box of larvae of the cabbage butterfly, the cabbage webworm, syrphid flies, and cabbage aphids. These were living individuals that had been collected outdoors in mid-winter.

W. H. Anderson reported on the large numbers of galls made by a species of the cynipid genus *Neuroterus* (det. L. H. Weld) that were observed at College Heights Estates on October 1962. The galls were loose on the ground as well as on fallen leaves under a white oak tree and on leaves still attached to the tree. There was an average of 5 galls per square inch of soil surface, for a total of approximately 325,000 galls on the ground. The number of galls on the leaves ranged from 0 to 48, with an average of 11 per leaf. The number of leaves was estimated at 19,000. There were thus some 210,000 galls on the leaves. The total number of individuals of the *Neuroterus* from the one tree exceeded 500,000.

O. S. Flint showed the last issue of "Status of Zoological Research in the Caribbean." This gives the name, address, and research problem of the zoologists working on the Caribbean fauna.

W. E. Bickley showed a color photo of Gray's stick insect, an inhabitant of Malaya.

Dr. Leo Levenbook gave the evening talk on "Some recent advances in insect biochemistry." He discussed blood sugar metabolism, the high level of organic acids in the haemolymph, and the presence of certain proteins in muscles. The talk was illustrated with slides.

After the introduction of visitors, the meeting was adjourned at 9:30.—OLIVER S. FLINT, JR., *Recording Secretary.*

714th Regular Meeting, Feb. 7, 1963

The 714th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on February 7, 1963, at 8 p.m. in room 43 of the U. S. National

Museum. Twenty-five members and 24 guests were in attendance. Minutes of the previous meeting were accepted as read.

Three candidates to membership were announced: *John M. Kingsolver, Frank R. Cole,* and *Jean R. Adams.*

W. E. Bickley reported that the executive committee had agreed to accept R. H. Arnett's invitation to hold the May meeting at Catholic University.

F. L. Campbell reported that the Annual Meeting of the Washington Academy of Sciences will be held on February 21, and that Dr. Van Evera will serve a second term as president because of the resignation of the president-elect.

R. H. Nelson read an obituary of Mr. *M. P. Jones* who died on February 1, 1963. He had served as entomologist with the extension service in the U.S.D.A. for 30 years before his retirement, and been president of the Entomological Society of America in 1960.

W. E. Bickley showed two toothbrushes purchased from the Fuller Brush Co. that had nits of hog lice still attached to the bristles.

J. C. Hitchcock showed some dolichopodid larvae (*Aphrosylus*) that live as commensals with hermit crabs on the Pacific Coast.

Dr. Harold H. Shepard presented the evening talk on "The public image of insecticides." He traced the history of the use of insecticides, and the concomitant opposition to their use. Rather surprisingly this opposition has existed since the beginning of the use of insecticides, in spite of the constant effort by entomologists to counteract it.

After the introduction of visitors, the meeting was adjourned at 10 p.m.—Oliver S. Flint, Jr., *Recording Secretary.*

PUBLICATION DATE

The date of publication of Vol. 65, No. 1 was April 29, 1963. The date of publication of Vol. 65, No. 2, will be found in Vol. 65, No. 3.

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

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REVISION OF THE GENUS HADROBREGMUS OF NORTH AMERICA

(COLEOPTERA: ANOBIIDAE)[1]

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The genus *Hadrobregmus* has not been treated taxonomically since H. C. Fall published his "Revision of the Ptinidae of Boreal America" in 1905. At that time, Fall recognized seven species; two additional species have been described since the revision. The previous taxonomic studies have been based on characters of the superficial external anatomy. In the present investigation, the wing venation and the male genitalia have proved to be of taxonomic value.

Hadrobregmus was described by C. G. Thomson in 1859. *Anobium denticollis* Panzer, 1796 was the only included species and was designated as the type-species. Fall (1905) included the following North American species in *Hadrobregmus:*

Anobium carinatum Say, 1823
  Anobium errans Melsheimer, 1845
Anobium gibbicolle LeConte, 1859
Hadrobregmus linearis LeConte, 1865
Hadrobregmus defectus Fall, 1905
Hadrobregmus pusillus Fall, 1905
Hadrobregmus laticollis Fall, 1905
Hadrobregmus umbrosus Fall, 1905

Hadrobregmus subconnatus was described by Fall in 1920, and *Hadrobregmus destructor* was described by Fisher in 1938, making a total of nine species referred to this genus.

None of the species included in *Hadrobregmus* Thoms. by Fall and other North American workers are congeneric with the type-species. Furthermore, the species should be contained in three genera.

Pic (1912) placed *Hadrobregmus denticollis* (Panz.), 1796 in the genus *Coelostethus* LeC., 1861. I have compared *H. denticollis* (Panz.) with *Coelostethus notatus* (Say), 1825, the type-species of *Coelostethus* LeC. designated by LeConte), and have found the two

[1]Modified from a thesis submitted to the Graduate School, Cornell University, in partial fulfilment of the requirements for the M.S. Degree, September, 1959.

species to be congeneric. Therefore, *Hadrobregmus* Thoms. should be the valid generic name of those species which have been included in *Coelostethus* LeC. and *Coelostethus* LeC. should be considered as a junior synonym of *Hadrobregmus* Thoms.

Cacotemnus LeConte, 1861, until now regarded as a junior synonym of *Hadrobregmus* Thoms., is a valid generic name and includes *Anobium carinatum* Say, *Hadrobregmus defectus* Fall, *H. laticollis* Fall, and *H. umbrosus* Fall. LeConte (1861) designated *Anobium errans* Melsh. as type-species of *Cacotemnus. Anobium errans* is presently considered as a junior synonym of *Anobium carinatum* Say.

Hemicoelus LeConte, 1861, until now regarded as a junior synonym of *Hadrobregmus* Thoms., includes *Anobium gibbicolle* LeC. and *Hadrobregmus pusillus* Fall. The type-species of *Hemicoelus* LeC. is *Anobium gibbicole* LeC. [= *Hemicoelus gibbicollis* (LeC.)], present designation.

Desmatogaster is proposed in the present paper as a new generic name for *Hadrobregmus subconnatus* Fall.

Key to Genera and Species Formerly Referred to HADROBREGMUS

1. Visible abdominal sternites 2, 3, 4, and 5 connate medially ..... **Desmatogaster subconnatus**
   All visible abdominal sternites separated by distinct sutures 2
2. Prothoracic disc strongly gibbous; veins 1A, 2A, and $2A_2$ absent (Fig. 19); lateral lobe of male genitalia widest posteriorly (Fig. 5) ..... **HEMICOELUS, 3**
   Prothoracic disc slightly gibbous; veins 1A, 2A, and $2A_2$ present (Fig. 22); lateral lobe of male genitalia widest anteriorly (Fig. 6) ..... **CACOTEMNUS, 4**
3. Prothorax much narrower than base of elytra; lateral margin of prothoracic disc dissected (Fig. 13, 16, 17, 18); lateral margin of lateral lobe straight, teeth approximate (Fig. 5) ..... **Hemicoelus gibbicollis**
   Prothorax slightly narrower than base of elytra; lateral margin of prothoracic disc entire (Fig. 12); lateral margin of lateral lobe bisinuate, teeth not as approximate (Fig. 11) ..... **Hemicoelus pusillus**
4. Prothorax equal in width to base of elytra ..... **Cacotemnus laticollis**
   Prothorax narrower than base of elytra 5
5. Prothorax much narrower than base of elytra; lateral margin of prothoracic disc dissected anteriorly (Fig. 14); median lobe strongly bisinuate anterodorsally (Fig. 21) ..... **Cacotemnus defectus**
   Prothorax only slightly narrower than base of elytra; lateral margin of prothoracic disc entire; median lobe straight anterodorsally (Fig. 2, 4) 6
6. Lateral margin of prothoracic disc with short sinus at anterior angle ..... **Cacotemnus carinatus**
   Lateral margin of prothoracic disc without short sinus at anterior angle 7

7. Lateral margins of prothoracic disc very wide, straight and parallel from posterior angle to just before anterior angle, then sharply converging to anterior margin .... **Cacotemnus umbrosus**
   Not as above 8
8. Posterior part of median lobe spatulate (Fig. 6) .... **Cacotemnus umbrosus**
   Posterior part of median lobe straight (Fig. 20) .... **Cacotemnus carinatus**

Cacotemnus LeConte, 1861

Type-species: *Anobium errans* Melsheimer, Proc. Acad. Nat. Sci. Philadelphia, vol. *2*, p. 309, 1845; original designation.

Description.—Elongate, parallel, subcylindrical, opaque, light brown to black. Eyes strongly convex, slightly ovate with longer axis parallel to front; somewhat larger in male. Strongly carinate and gibbous around antennal bases. Antennae generally ten or eleven segmented, stem not serrate, last three segments forming an elongate club. Head finely, densely granulose, sparsely clothed with short, fine, recumbent, yellowish pubescence. Surface of proximal half of mandible clothed with long pubescence; distal margin of labrum with thick brush of long pubescence. Pronotum narrower than or equal in width to elytra. When viewed dorsally, normal to plane of lateral margin, pronotum slightly wider than long. Disc slightly to moderately gibbous and compressed posteriorly; surface granulose, clothed with recumbent, yellowish pubescence. Elytra slightly more than twice as long as 1; width at base; sides nearly parallel from bases to apical fifths, narrowed to apexes; margin bisinuate. Disc hemispherical in cross-section at middle; ten elytral striae at middle. Anterior coxae moderately separated. Prosternum flat, truncate behind. Metasternum with shallow, median depression posteriorly; not excavated anteriorly. Abdominal sternites free, sutures distinct, first suture generally straight. Tibiae not produced externally at apex. Tarsi slender, almost three-fourths as long as tibiae. Tarsal segment 1 longest; 2 and 5 subequal, half as long as 1; 3 and 4 subequl, shortest. Tarsi clothed with long, semi-erect and recumbent pubescence. Body beneath finely, densely granulose and punctulate, densely clothed with moderately long, fine, recumbent pubescence.

Male genitalia.—(Figs. 2, 4, 6, 20, 21, 23) Sternite IX heavily sclerotized, but somewhat lighter than in *Hemicoelus;* U-shaped, curved dorsally at either end. Struts of sternite IX of consistent diameter, not flattened medially at any point on their length. Tegmenite membranous, two-lobed, lying within sternite IX and covering most of ventral surface of genitalia. Tergite IX rather membranous, connecting struts of sternite IX posteriorly and extending past its posterior margin. Basal piece (BP) lightly sclerotized, curved, hood-like, enveloping antero-ventral portion of median lobe. Anterior edge of basal piece bearing short, ventrally curved, basal manubrium (Mb) medially. Basal piece membranously attached to lateral and ventral surface of lateral lobes near their anterior margin. Lateral lobes (LL) moderately sclerotized, symmetrical, elongate-triangular with broad basal portions overlying mid-ventrolateral portion of median lobe; attenuated portion extending ventrodorsally across median lobe, reaching almost to posterodorsal apex of median lobe. A membranous, setiferous lobe (SL) (end-rod, Lyngnes, 1958) attached to outer posterior margin of attenuated extension of each lateral lobe. Rather narrow lateral lobe struts branching off laterally from broad basal part of lateral lobe, extend dorsally to fuse with compressed, dorsally directed base of median lobe. Lateral, triangular portion of basal piece approaches lateral lobe but does not fuse with it. Median lobe (ML) bilaterally symmetrical; anterior two-fifths lightly sclerotized, tapered anteriorly, gradually broadened posteriorly to form a more heavily sclerotized tube. Anterior and posterior portions of median lobe open ventrally. No additional arm is present on dorsal surface of median lobe.

Wings.—(Figs. 19, 22) The venation of the metathoracic wings of the anobiids studied exhibit very distinctive characters which I have utilized in defining the genera. However, within a genus there is a great deal of variation and it is unlikely that venation can be used in defining species.

Forbes (1926, p. 129, fig. 76) presented a figure of the wing-folding pattern of an anobiid, *Sitodrepa panicea* L. Kempers (1923, p. 93, fig. 402-407) figured the wing venation of the following anobiids: DRYOPHILINI, *Priobium castaneum* F., *Ernobius mollis* L.; XYLETININI, *Ochina hederae* Mull., *Ptilinus pectinicornis* L.; HEDOBIINI, *Hedobia imperialis* L.; DORCATOMINI, *Coenocara bovistae* Hoff.

Alar expanse, 3.67 to 5.99 mm. Costa (C) (Fig. 22) present for a short distance proximally. Subcosta (Sc) moderately sclerotized, fused with Radius (R) at proximal third of wing. Radius heavily sclerotized, distal portion broadened, curved posteriorly, then branched to form a Y-shaped system, one arm of which extends distally, the other arm proximally. Media (M) absent proximally, heavily sclerotized distal portion joined to Cubitus (Cu). A short cross-vein extending from union of Cubitus and Media towards Radius. Cubitus heavily sclerotized, directed posteriorly and diagonally for about one-half length of wing. M_4 + Cu heavily sclerotized, extending to posterior margin of wing. First Anal (1A) connected at proximal end to Cubitus by short cross-vein. Second Anal (2A) with three branches: $2A_1$ connecting to 1A, $2A_2$ extending to posterior margin, $2A_3$ forming distal margin of wedge cell (W). Third Anal (3A) with two branches: $3A_1$ forming posterior margin of wedge cell and then united with $2A_3$ and extending to margin, $3A_2$ reaching anterior edge of axillary excision.

Diagnosis.—*Cacotemnus* differs from *Anobium* in not having the deeply, anteriorly excavated metasternal cavity which is characterisitc of the latter. The visible abdominal sternites are not connate medially as in *Desmatogaster*. The prothoracic gibbosity is not as pronounced as in *Hemicoelus*, the wing venation is not as reduced as in *Hemicoelus*, and the lateral lobes of the male genitalia are widest anteriorly, not posteriorly, as in *Hemicoelus*.

Cacotemnus carinatus (Say), 1823

Anobium carinatum Say, Journ. Acad. Nat. Sci., Philadelphia, vol. *3*, p. 187, 1823.
Anobium errans Melsheimer, Proceed. Acad. Nat. Sci., Philadelphia, vol. *2*, p. 309, 1845.

Hadrobregmus carinatus (Say) LeConte, Proceed. Acad. Nat. Sci., Philadelphia, vol. *17*, p. 232, 1865.

Hadrobregmus linearis LeConte, *ibid.*, p. 232, 1865. *New Synonymy.*

Description.—Light brown to piceous brown. Eyes separated on front by slightly less than three times their diameter (as measured normal to long axis) in female, somewhat larger in male, and separated on front by slightly less than

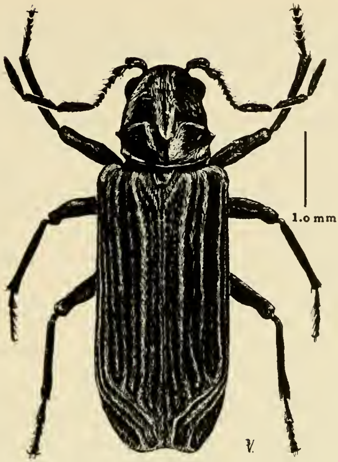

Fig. 1, *Hemicoelus gibbicollis* (LeC.), male, Mill Valley, California.

twice their diameter. Antennae slightly less than half length of body; nine, ten, or eleven segmented, most commonly ten. Specimens have been seen in which one of the segments is partially divided, in which case segmentation is superficially ten but actually nine, or superficially eleven but actually ten. In some cases, the corresponding right and left segments have the same apparent division, in other cases just one of the corresponding right and left segments are so divided. Segment 1 robust, arcuate, rectangular, largest of all stem segments; 2 shorter, narrower, elongate, globose apically; 3 equal in length to 2, sides parallel; remaining segments, exclusive of club, short and transverse; 4 may be similar to 3 and is the segment usually involved in aberrant subdivision. Segments 1 and 2 of club elongate-triangular, wider and subparallel in male, shorter and triangular in female; segment 3 of club longer than either two preceeding, linear, parallel, pointed apically. Pubescence denser, shorter, and more recumbent on club segments than on stem segments. Palpi and antennae concolorous with head or somewhat lighter. Pronotum slightly narrower than elytra. Posterior angle broadly rounded, margined; sides broadly rounded *or* more or less straight and emarginate medially on one or both sides *or* rounded posteriorly with anterior third straight and convergent on one or both sides; with or without a short sinus at either or both anterior angles. Disc slightly to moderately gibbous and compressed posteriorly. Surface finely, densely granulose, clothed with short, fine, recumbent, yellowish pubescence. Elytral apexes conjointly rounded and slightly emarginate medially. Intervals of elytral striae finely rugulose, wider than punctures. Surface densely and evenly clothed with short, fine, recumbent, yellowish pubescence. Anterior coxae moderately separated. Prosternum flat, smooth or finely granulose, bearing several long hairs on posterior margin. Posterior third of metasternum with narrow, shallow, median depression. First abdominal suture straight, slightly bisinuate in some; sutures 2 to 4 straight. Sternite 5 longer than 2 in most specimens. Body beneath clothed with yellowish pubescence. Alar expanse, 5.33 to 3.67 mm. Venation, Fig. 22.

Male genitalia.—(Fig. 2) Posterior portion of median lobe straight, not spatulate. Dorsal margin of median lobe straight, not curved ventrally before dorsal extension which is compressed to fuse with ends of lateral lobe struts.

Diagnosis.—This species differs from *C. defectus* in possessing an entire lateral margin of the prothorax. The distal portion of the median lobe of the male genitalia is not expanded as it is in *C. umbrosus* and *C. defectus.* The prothorax of *C. carinatus* is somewhat narrower than the base of the elytra, while it is fully equal in width in *C. laticollis.*

Variation.—While the male genitalia of this species are quite constant, practically all the characters of the external anatomy appear to overlap to a great extent with those of *C. umbrosus.* These variations will be discussed under *umbrosus.*

I have placed *Hadrobregmus linearis* LeC. in synonymy with *Cacotemnus carinatus* Say. LeConte (1865) described *linearis,* from a specimen taken in the Saskatchewan region, Canada, as being distinct from *carinatus* by having a more strongly gibbous pronotum with the pronotal side margins straight and parallel for a greater distance. These characters do not appear to be of specific value and no other characters have been found in such specimens which might be identified as *linearis* on LeConte's criteria. In the specimens observed, every seemingly possible combination and intermediate form from strongly to weakly gibbous pronota and rounded to straight pronotal side margins is present. In some specimens, the pronotal side margin is straight on one side and rounded on the other; in some it is emarginate on one or both sides; in some the margins converge anteriorly and in others they diverge anteriorly. Most of the specimens at hand which bear identification labels of *linearis* are actually specimens of *umbrosus,* not *carinatus.* The pronotal side margin of *carinatus* is never as greatly developed in such a linear fashion as it is in *umbrosus.*

Measurements of Holotype.—(from original description) "Length more than one-fourth of an inch."

Holotype.—Deposited in the Say Collection; presumably destroyed.

Type Locality.—(from original description) "Found on the Mississippi above the mouth of the Ohio."

Geographical Distribution.—From New Brunswick to North Carolina, west to Missouri and Manitoba.

Hosts.—*Pinus* sp., *Tilia americana* L., *Castanea dentata* (Marsh.) Borkh., *Quercus alba* L., maple and elm furniture, light trap. Simeone (1960), in his extensive study of the ecology of *C. carinatus,* cited twelve hardwood and softwood hosts.

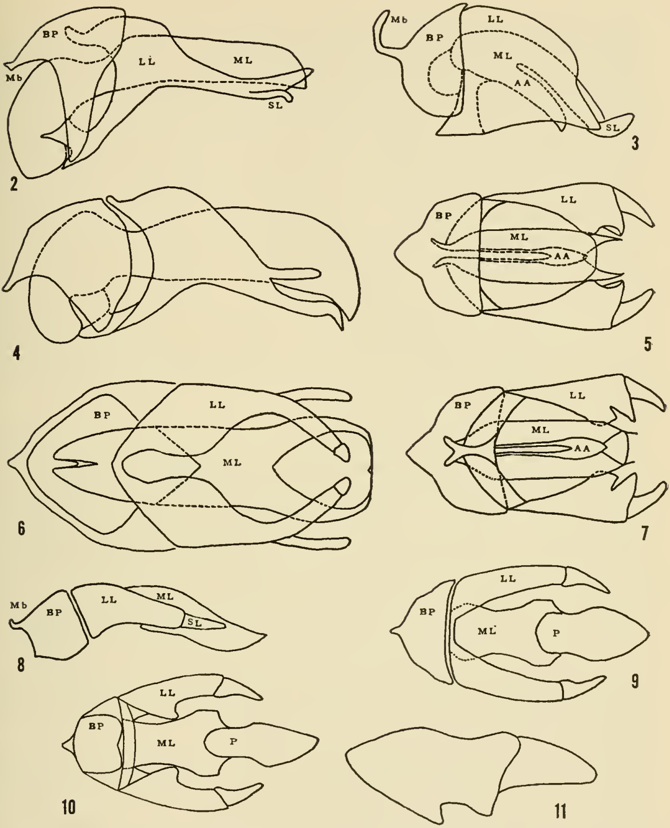

Fig. 2, *C. carinatus,* aedeagus, lateral; Fig. 3, *H. gibbicollis,* aedeagus, lateral; Fig. 4, *C. umbrosus,* aedeagus, lateral; Fig. 5, *H. gibbicollis,* aedeagus, ventral; Fig. 6, *C. umbrosus,* aedeagus, ventral; Fig. 7, *H. gibbicollis,* aedeagus, dorsal; Fig. 8, *D. subconnatus,* aedeagus, lateral; Fig. 9, *D. subconnatus,* aedeagus, ventral; Fig. 10, *D. subconnatus,* aedeagus, dorsal; Fig. 11, *H. pusillus,* right lateral lobe. (AA, accessory arm; BP, basal piece; LL, lateral lobe; Mb, manubrium; ML, median lobe; P, plate; SL, setiferous lobe).

Material Examined.—469 specimens.

A complete list of the dates and localities of the material examined of all the species, with a list of biological data appearing on labels, is included in the thesis from which this paper has been modified.

Cacotemnus umbrosus (Fall), 1905

Hadrobregmus umbrosus Fall, Trans. Amer. Ent. Soc., vol. 31, p. 184, 1905.

Description.—The external anatomical characters of *C. umbrosus* are so much like those of *C. carinatus* that only those of somewhat diagnostic value will be given here. Other than the male genitalia, there is no single character which enables separation of *C. umbrosus* from *C. carinatus*. The wings and female genitalia, as usual, afford no specific characters. *Cacotemnus umbrosus,* in general, is larger and darker than *carinatus*. The antennal segmentation is unstable: no nine segmented antennae have been seen, the majority are ten or eleven segmented, combinations of 10-11 and 11-12 segments occur, and in some specimens the segmentation is apparently eleven but actually ten. Segments 1 and 2 of the female club are a little more elongate than the corresponding segments in *carinatus.* Two characters of the pronotum will aid somewhat in the identification of these two species. A short sinuation at the anterior angle of the side margin has been observed only in some specimens of *carinatus.* A very highly developed linear configuration of the side margin has been observed only in some specimens of *umbrosus.* Abdominal suture 1 is generally straight, occasionally slightly arcuate as in *carinatus.* Abdominal sternite 5 is usually shorter than abdominal sternite 2. Alar expanse, 4.80 to 5.99 mm.

Diagnosis.—*Cacotemnus umbrosus* differs from *defectus* in having an entire lateral prothoracic margin. The prothorax is slightly narrower than the base of the elytra, while in *lacticollis* the prothorax is fully equal in width to the base of the elytra. The species most easily confused with *umbrosus* is *carinatus.* The only definitive character separating the two species is the shape of the distal end of the median lobe of the male genitalia, which is spatulate in *umbrosus* but not spatulate in *carinatus.* The ranges of *carinatus* and *umbrosus* are coincident in northeastern United States and southeastern Canada.

Measurements of Holotype.—Length, 4.64 mm.; width of elytra at base, 2.45 mm.; greatest width of pronotum, 1.55 mm.

Holotype, Male; labeled "(White Fish Point L. S.) (Coll. Hubbard and Schwarz) (*umbrosus* type) (M.C.Z. type 24657)"; Fall Collection, Museum of Comparative Zoology.

Geographical Distribution.—From Rampart, Alaska south along Pacific coast to Carado, California; through northern United States and Canada to Bathhurst, New Brunswick.

Hosts.—*Abies balsamea* (L.) M. H., reared from *Betula occidentalis* (Hook) and *Fagus* sp., at light.

Material Examined.—46 specimens.

Cacotemnus defectus (Fall), 1905

Hadrobregmus defectus Fall, Trans. Amer. Ent. Soc., vol. *31,* p. 182, 1905.

Description.—Dark brown. Front evenly declivious from vertex to clypeus, when viewed from side. Eyes separate on front by slightly more or less than twice their vertical diameter. Antennae ten segmented, from a third to slightly less than a half the length of the body. First segment robust, globular; second three-fourths as wide as first and slightly longer than wide; third similar to second but smaller;

4 to 7 subequal, rectangular, shorter than third; eighth triangular, twice as wide as 2 to 7 and as long as 2 to 7 united; ninth similar to eighth, slightly longer; tenth linear, pointed at both ends, somewhat thicker distally, longer than ninth. Pubescence sparse, long and semi-erect on first to seventh, denser, shorter, and appressed on eighth to tenth. Palpi brown to yellowish. Antennae somewhat lighter than body. Pronotum (Fig. 14) much narrower than elytra. Posterior

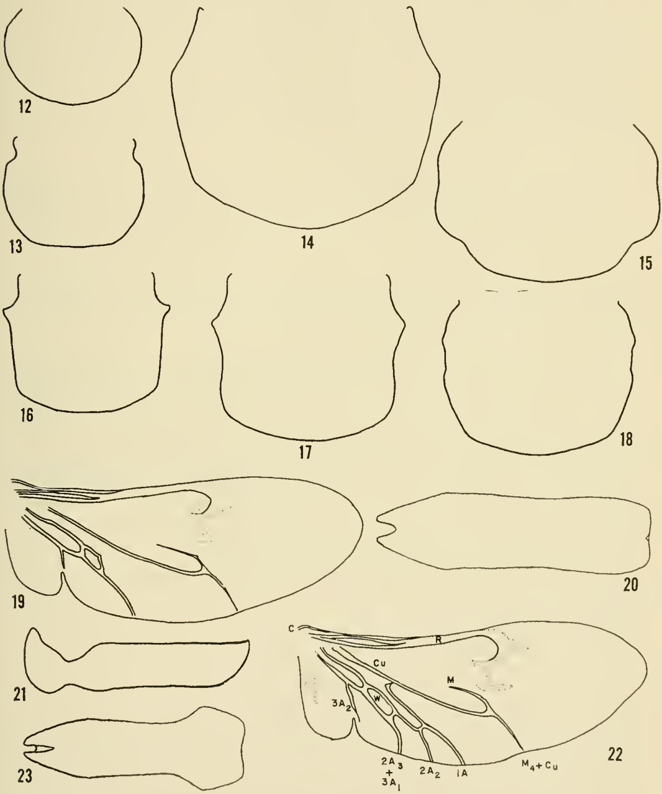

Fig. 12, *H. pusillus*, pronotum, dorsal; Fig. 13, *H. gibbicollis*, pronotum, dorsal; Fig. 14, *C. defectus*, pronotum, dorsal; Fig. 15, *D. subconnatus*, pronotum, dorsal; Figs. 16, 17, 18, *H. gibbicollis*, pronotum, dorsal; Fig. 19, *H. gibbicollis*, wing; Fig. 20, *C. carinatus*, median lobe, dorsal; Fig. 21, *C. defectus*, median lobe, lateral; Fig. 22, *C. carinatus*, wing; Fig. 23, *C. defectus*, median lobe, dorsal.

angle broadly rounded, margined; sides convergent anteriorly, margin obliterated or greatly reduced; anterior margin only very slightly produced anteriorly near its juncture with the obliterated side margin. Disc strongly gibbous and moderately compressed posteriorly; anterior angles impressed; posterior margin impressed on each side of median line; median line impressed anteriorly in some. Surface finely, densely granulose, clothed with moderately long, recumbent, whitish-yellow pubescence. Elytral apexes conjointly rounded. Intervals of elytral striae finely rugose, wider than punctures. Surface densely and evenly clothed with rather short, recumbent yellowish-white pubescence. Anterior coxae moderately separated. Prosternum flat, smooth, bearing several long hairs posteriorly. Posterior half of metasternum with a narrow, bare, shallow, median depression. First abdominal suture slightly bisinuate, sutures 2, 3, and 4 straight. Sternite 1 shortest, 5 longest, 2 to 4 subequal. (Sternites measured along mid-line, intercoxal process not included). Body beneath clothed with whitish to yellowish pubescence.

Male Genitalia.—(Figs. 21, 23) Posterior portion of median lobe spatulate. Dorsal margin of median lobe straight for most of its length, curved ventrally at the struts of the lateral lobes and extended dorsally where the base of the median lobe flattens laterally to fuse with the ends of the struts of the lateral lobes.

Variation.—Observed size range: 5.49 mm. long by 2.07 mm. wide to 3.33 m. long by 0.92 mm. wide. Difference between width of pronotum and anterior width of elytra, 0.28 mm. to 0.65 mm. Alar expanse, 3.67 mm. to 5.33 mm.

Diagnosis.—*Cacotemnus defectus* differs from other members of the genus in possessing a partially dissected lateral prothoracic margin.

Measurements of Holotype.—Length, 4.95 mm.; width of elytra at base, 1.68 mm.; greatest width of pronotum, 1.18 mm.

Holotype, Female; labeled "(Mass.) (*defectus* type) (M.C.Z. Holotype 22544) (M.C.Z. type 24653) (*Hadrobregmus defectus* Fall)"; Blanchard Collection, Museum of Comparative Zoology.

Type Locality.—Tyngsboro, Massachusetts.

Geographical Distribution.—From La Trappe, Quebec south to Port Huron, Michigan; west to Merrit, British Columbia and the Blue Mountains of Oregon.

Host.—*Pinus ponderosa* Laws.

Material Examined.—19 specimens.

Cacotemnus laticollis (Fall), 1905

Hadrobregmus laticollis Fall, Trans. Amer. Ent. Soc., vol. *31*, p. 184, 1905.

Description.—Medium brown. Eyes separated on front by twice their diameter. Antennae eleven segmented; segment 1 robust, arcuate, rectangular, largest of 1 to 8; 2 narrower, shorter, elongate, globose apically; 3 equal in length to 2, sides parallel; 4 to 8 transverse, each three-fourths as large as 3; 9 and 10 each equal to 4 to 8 united, apexes angled, sides parallel in male, one side somewhat arched in female; 11 slightly longer, sides parallel, apex bluntly pointed. Pubescence sparse, long and semi-erect on 1 to 8, denser, shorter and recumbent on 9 to 11. Palpi and antennae concolorous with head. Pronotum equal in width to elytra at base. Sides moderately convergent in front, posterior angles broadly rounded, posterior margin ill-defined. In the holotype, a male, the lateral margin is absent for a short distance near the anterior angle. In the only other specimen seen, a female, the lateral margin is continuous from the posterior to the anterior angles. Anterior margin straight, not produced anteriorly near its juncture with the lateral margin. Disc slightly more gibbous and compressed posteriorly than in *C. carinatus;* sub-obsolete impressed, median line from anterior margin to summit of gibbosity. Surface granulate, decidedly more so than in other species of the genus, sparsely clothed with very short, fine, recumbent, yellowish pubescence. Elytral apexes conjointly narrowly truncate. Surface not nearly as granulose as surface of pronotum, pubescence like that of pronotum. Anterior coxae somewhat more approximate than in *C. carinatus;* prosternum flat, finely granulose, rather narrowly truncate behind. Posterior half of metasternum with very shallow, median depression. First abdominal suture bisinuate, sutures 2 to 4 straight. Sternites 1, 2, and 5 sub-equal, slightly longer than 3 and 4, which are sub-equal. Body beneath clothed with yellowish pubescence. Alar expanse, 5.99 mm.

Male Genitalia.—The only male observed was the holotype and the genitalia of this specimen were not examined.

Diagnosis.—*Cacotemnus laticollis* is the only species in this genus in which the prothorax is fully equal in width to the base of the elytra. The surface of the pronotum is more granulate in *C. laticollis* than in the other species.

Measurements of Holotype.—Length, 4.65 mm.; width of elytra at base, 1.60 mm.; greatest width of pronotum, 1.55 mm.

Holotype Male; labeled "(Castle Crag, Calif.) (July 27-28) (type *laticollis*) (M.C.Z. type 24654)"; Fall Collection, Museum of Comparative Zoology.

Geographical Distribution.—Castle Crag and Sonoma County, California.

Material Examined.—2 specimens.

Hemicoelus LeConte, 1861

Type-species: *Anobium gibbicolle* Le Conte, Proc. Acad. Nat. Sci. Philadelphia, vol. *11*, p. 284; present designation.

Description.—Elongate, parallel, subcylindrical, opaque, light brown to black. Eyes strongly convex, separated on front by less than twice their longest diameter. Strongly carinate and gibbous around antennal bases. Antennae ten or eleven segmented, stem not serrate, last three segments forming an elongate club. Palpi light brown to yellowish. Head clothed with fine, recumbent pubescence. Surface of proximal half of mandibles clothed with long pubescence; distal margin of labrum with thick brush of long pubescence. Pronotum narrower than elytra, as wide as or slightly wider than long. Disc strongly gibbous and compressed behind. Surface finely, densely granulose; clothed with recumbent pubescence. Elytra about twice as long as basal width; sides nearly parallel from bases to apical fifths, narrowed to apexes; margin bisinuate. Disc hemispherical in cross-section at middle, ten elytral striae at middle. Anterior coxae moderately separated. Prosternum flat, smooth, truncate behind, bearing long hairs on distal margin. Metasternum with shallow, median depression posteriorly; not excavated anteriorly. Abdominal sternites free. Sutures distinct, first suture bisinuate. Tibiae not produced externally at apex. Tarsi slender, about three-fourths as long as tibiae. Body beneath finely, densely granulose; densely clothed with moderately long, fine, recumbent, whitish to yellowish pubescence.

Male Genitalia.—Figs. 3, 5, 7, 11) Tergite VIII broad, heavily sclerotized, overlying tergite IX and posterior ends of sternite IX. Sternite VIII more membranous, lying under tergite IX and posterior ends of sternite IX. Sternite IX heavily sclerotized, V-shaped, dorsally curved at posterior end, where it connects with tergite IX. Anterior ends of sternite IX straight or dorsally curved. Ventral margin of struts of sternite IX flattened medially. Basal piece (BP) moderately sclerotized, curved, hood-like, enveloping anterior two-fifths of median lobe ventrally. Anterior edge of basal piece bearing short, ventrally curved basal manubrium (Mb) medially. Lateral lobes symmetrical, sclerotized portions forming two broad plates which extend posteriorly from their rather weak articulation with basal piece to apex of median lobe. Lateral lobe (LL) with two heavily sclerotized teeth on mesal side, proximal tooth always obtuse, distal tooth obtuse or pointed. Membranous, heavily setiferous lobe (SL), as long as greatest width of sclerotized plate, attached to outer margin of lateral lobe near apex. Non-sclerotized portion of lateral lobes attached to entire posterior margin of basal piece, continuous with sclerotized portion and forming a curved envelope ventrally and laterally about median lobe. Median lobe (ML) bilaterally symmetrical, slender, fusiform, heavily sclerotized, trough-like, ventral side open. Slender, curved, pointed, heavily sclerotized additional arm (AA) (Gardiner, 1958) (= chitinous hook, Lyngnes, 1958; = median lobe of penis, Cymorek, 1957) extending along dorsal surface of anterior half of median lobe, separating from median lobe at the mid-point, then extending dorsally at an angle for remainder of length of median lobe. Median lobe lightly sclerotized along its dorsal fusion with additional arm. Posterior end of median lobe slightly constricted, anterior end flattened and curved dorsally into arms which articulate with lateral lobe struts.

Wings.—(Fig. 19) Alar expanse, 3.20 to 6.33 mm. Except for the absence of 1A, $2A_1$ and $2A_2$ the venation is essentially like that of *Cacotemnus*.

Diagnosis.—The genus *Hemicoelus* differs from *Cacotemnus* in having a more pronounced prothoracic gibbosity, a reduction in wing venation, and lateral lobes of male genitalia widest posteriorly, not anteriorly, as in *Cacotemnus*. The visible abdominal sternites are not connate medially as in *Desmatogaster*. The metasternum is not deeply grooved anteriorly as in *Anobium*.

Hemicoelus gibbicollis (LeConte), 1859

Anobium gibbicolle Le Conte, Proc. Acad. Nat. Sci. Philadelphia, vol. *11*, p. 284, 1859.

Hemicoelus gibbicollis (Le Conte), Smithsonian Misc. Coll., No. 136, p. 205, 1861.

Hadrobregmus gibbicollis (Le Conte), Fall, Trans. Amer. Ent. Soc., vol *31*, p. 184-185, 1905.

Hadrobregmus destructor Fisher, Journ. Washington Acad. Sci., vol. *28*, p. 26, 1938. **New Synonymy.**

Description.—(Fig. 1) Front not as evenly and roundly declivious from vertex to clypeus as it is in *H. pusillus*, when viewed from side; faint to strong medial gibbosity above clypeal and antennal bases to dorsal margins of eyes; dorsal angle of head sharper than in *H. pusillus*. Antennae eleven segmented, half to third length of body. First segment robust, globular; second smaller and more oblong; 3 slightly longer than 4, 5, 6, 7, and 8; 4 to 8 subequal; 9 and 10 narrowly triangular or half-ovoid, equal to all preceding; 11 slightly longer than 3 to 8. Pubescence sparse, long and semi-erect on segments 2 to 8; dense, short, and mainly recumbent on 9 to 11. Palpi light brown to yellow. Head moderately clothed with fairly long, recumbent, whitish-yellow to golden-yellow pubescence. Pronotum (Figs. 13, 16, 17, 18) much narrower than elytra. When viewed dorsally, normal to plane of lateral margin, pronotum as wide as or slightly wider than long. Posterior angle broadly rounded; lateral margin extremely variable, always dissected to some extent, never continuous; anterior margin straight, sinuate or slightly emarginate medially, expanded anteriorly near its juncture with lateral margin. Disc strongly gibbous and compressed behind, strongly impressed obliquely on both sides from before middle to posterior gibbosity, anterior angles and median line impressed. Surface finely, densely granulose, clothed with moderately long, recumbent, whitish to yellowish pubescence. Elytra slightly more than twice as long as wide; sides nearly parallel from bases to apical fifths, narrowed to apexes which are conjointly rounded as in *H. pusillus;* lateral edge bisinuate. Elytral intervals wider than punctures, more strongly elevated posteriorly than anteriorly, especially in those specimens in which the pubescence is markedly vittate; surface densely and evenly clothed with short to moderately long, recumbent, yellowish-white pubescence or densely clothed with moderately long, recumbent, golden-yellow pubescence which forms more or less distinct vittae between most of the alternate rows of punctures. Metasternum with broad, shallow, bare or sparsely pubescent median depression at posterior margin, this bare area extending medially the length of the metasternum in some specimens. First ventral abdominal suture bisinuate, broadly posteriorly arcuate at middle; sutures 2, 3, and 4 straight. Sternites 1, 3, and 5 subequal in some. Fifth abdominal sternite foveate apically in male. Tarsi slender, almost three-fourths as long as tibiae; tarsal segment 1 longest; 2 and 5 subequal, half as long as 1; 3 and 4 subequal, shortest. Tarsi with long, erect and semi-erect pubescence. Body beneath clothed with whitish to yellowish pubescence.

Male Genitalia.—(Figs. 3, 5, 7) Sternite IX V-shaped, anterior ends curved dorsally. Sclerotized portion of lateral lobe forming a triangular plate which has its broadest angle at the outer, posterior edge. Lateral lobe straight. Teeth more approximate than in *H. pusillus*, distal tooth acuminate. Additional arm of median lobe broader than in *H. pusillus*. In specimens with a distinct lateral prothoracic margin, the distal tooth of the lateral lobe is slightly more acuminate and slightly more heavily sclerotized than in those specimens with a greatly reduced lateral prothoracic margin.

Variation.—Observed size range—2.66 mm. long by 0.92 mm. wide to 5.59 mm. long by 2.17 mm. wide. Difference between greatest width of pronotum and width of elytra, 0.23 to 0.60 mm. Alar expanse, 4.58 to 7.33 mm. The lateral margin of the prothorax, the color of the pubescence, and the disposition of the pubescence on the elytra are extremely variable in this species. The most common variants of the lateral prothoracic margin are shown in figures 13, 16, 17, and 18. The most common form is shown in figure 16; the holotype possesses this form of margin. In a few of the specimens examined, the margin is complete on one side and dissected on the other. The color of the pubescence varies from white to brilliant golden-yellow, and from short to long. The variation of the disposition of the pubescence on the elytra includes those in which the hairs are evenly dispersed on the elytral intervals, forming no vittae; those in which there are a few rows of vittate pubescence on the dorsal and anterior surfaces only; and those in which the hairs form distinct vittae between the alternate rows of punctures over the entire surface of the elytra.

I have placed *Hadrobregmus destructor* Fisher in synonymy with *Hemicoelus gibbicollis* (Le Conte). Fisher described *H. destructor* as being different from other known species of *Hemicoelus* and *Cacotemnus, olim Hadrobregmus,* in "having the pubescence on the elytra forming more or less distinct vittae." In the 289 specimens before me, which range from Carmel, California, to Sitka, Alaska, the disposition of the pubescence on the elytra appears to be an individually variable character and not a valid specific character. Although most of the paratypes of *H. destructor* possess vittate pubescence, some have vittae on only part of the elytral surface. Some specimens from California, Oregon, Washington, and British Columbia have distinct vittate pubescence and other specimens from the same geographical range are of the non-vittate form and of intermediate forms between vittate and non-vittate. The Sitka, Alaska specimens are darker in color than most of the specimens from further south. This darker color, combined with the brighter and longer hairs on the Sitka specimens, might give the appearance of a more vittate pubescence. Although Fisher did not mention it in his description, the lateral prothoracic margins are greatly reduced in the Sitka specimens. Greatly reduced lateral margins occur in combination with vittate and non-vittate specimens of all color forms, taken from California to Sitka, Alaska.

Diagnosis.—In *H. gibbicollis,* the prothorax is much narrower than the base of the elytra and the lateral margin is dissected whereas in *H. pusillus* the prothorax is only slightly narrower than the base of the elytra and the lateral margin is entire. The lateral margin of the lateral lobe of *gibbicollis* is straight, not slightly sinuate as it is in *pusillus.* The mesal teeth of the lateral lobe are situated very close together in *gibbicollis* but are somewhat separated in *pusillus.*

Measurements of Holotype.—Length, 5.20 mm.; width of elytra at base, 1.88 mm.; greatest width of pronotum, 1.38 mm.

Holotype, Female; labeled "(*H. gibbicollis* Lec.) (M.C.Z. type 3609)"; LeConte Collection, Museum of Comparative Zoology.

Type Locality.—Punto de los Reyes, Marin County, California.

Geographical Distribution.—Pacific coast from southern California to Sitka, Alaska.

Hosts.—*Abies concolor* Lindl. and Gord., *A. grandis* Lindl., *Acer macrophyllum* Pursh., *Alnus rubra* Bong., *Ceanothus thyrsiflorus* Esch., *Corylus californica* (DC.) Rose., *Prunus emarginata* (Dougl.) Walp., *Pseudotsuga taxifolia* (Lam.) Britt., *Quercus wislizensii* DC., *Salix lasiandra* Benth., *Taxus brevifolia* Nutt., *Tsuga heterophylla* (Raf.) Sarg.

Material Examined.—289 specimens.

Hemicoelus pusillus (Fall), 1905

Hadrobregmus pusillus Fall, Trans. Amer. Ent. Soc., vol. *31*, p. 183-184, 1905.

Description.—Reddish brown. Front evenly, roundly declivious from vertex to clypeus when viewed from side. Antennae ten segmented, slightly less than half length of body. First segment robust, globular; second smaller and globular; 3 slightly longer than 4, 5, 6, or 7; 4 to 7 subequal; 8 and 9 half-ovoid and equal to all preceeding; 10 narrow, oblong, one and one-half times as long as 9; 8 and 9 more rectangular in male. Pubescence sparse, moderately long on 1 and 2, long and erect on 3 to 7, shorter, denser, and semi-erect on 8 to 10. Palpi light brown to yellowish. Head very sparsely clothed with recumbent, whitish-yellow pubescence; finely, densely granulose. Pronotum (Fig. 12) slightly narrower than elytra. When viewed dorsally, normal to plane of side margin, pronotum slightly wider than long and sides evenly rounded. Posterior angle rounded; lateral margin entire and distinct; anterior margin expanded anteriorly near its juncture with lateral margin. Disc strongly gibbous and compressed behind, somewhat impressed at anterior angles and postero-lateral curvature, no subobsolete impressed line. Surface finely, densely granulose, sparsely clothed with short, recumbent, whitish-yellow pubescence. Elytra twice as long as wide, slightly wider behind middle; sides nearly parallel from bases to apical fifths, acutely narrowed to apexes which are conjointly broadly rounded; lateral edge bisinuate. Elytral intervals two to three times as wide as punctures; surface densely and evenly clothed with moderately long, recumbent, whitish-yellow pubescence which is never alternately condensed. Metasternum with broad, shallow, more or less bare median depression near posterior margin. First ventral suture bisinuate, broadly posteriorly arcuate at middle; sutures 2 to 4 straight. Sternites 1 and 2 subequal, slightly longer than 5; 5 longer than 3; 4 shortest. Tarsi slender, three-fourths as long as tibiae; tarsal segments 1 and 2 subequal in length, each as long as 3 to 5 united; 3 and 4 subequal; 5 longer. Body beneath clothed with whitish-yellow pubescence.

Male Genitalia.—Anterior ends of sternite IX straight, not curved dorsally as in *H. gibbicollis.* Sternite IX more U-shaped than V-shaped. Lateral lobes more rectangular than in *gibbicollis.* Lateral margin of lateral lobe sinuate (Fig. 11). Teeth not as approximate as in *gibbicollis* and distal tooth not as acuminate. Additional arm of median lobe fused for most of its length with dorsal surface of median lobe, its free end much narrower than in *gibbicollis.*

Variation.—Observed size range—2.80 mm. long by 1.06 mm. wide to 2.13 mm. long by 0.78 mm. wide. Difference between width of pronotum and anterior width of elytra, 0.09 to 0.14 mm. Alar expanse, 2.80 to 3.20 mm.

Diagnosis.—In *H. pusillus* the prothorax is only slightly narrower than the base of the elytra and the lateral margin is not dissected. The lateral margin of the lateral lobe of *pusillus* is slightly sinuate, not straight as in *gibbicollis*. The mesal teeth of the lateral lobe are separated somewhat in *pusillus* and approximate in *gibbicollis*.

Measurements of Holotype.—Length, 3.0 mm.; width of elytra at base, 1.0 mm.; greatest width of pronotum 0.85 mm.

Holotype.—Labeled "Toronto, Ont., 6-7-95) (*pusillus* type) (M.C.Z. type 24655)"; Fall Collection, Museum of Comparative Zoology.

Geographical Distribution.—From Toronto, Canada and Wisconsin south to Tennessee and North Carolina.

Material Examined.—11 specimens.

Desmatogaster, gen. nov.

Type-species: *Hadrobregmus subconnatus* Fall, Canadian Ent., vol. *52*, p. 214, 1920; present designation.

Description.—Elongate, parallel, subcylindrical, medium brown, opaque. Front evenly and roundly declivious from vertex to a line drawn between middle of antennal bases, concave above labrum. Eyes strongly convex, separated on front by twice or slightly more than twice their longest diameter. Antennae from fourth to third length of body, eleven segmented, stem not serrate, last three segments forming an elongate club. First segment robust, as long as 2 and 3; 2 and 3 smallest, 2 globular, 3 narrow; 4 to 8 subequal, not quite as wide as long; 9 to 11 subequal to all preceeding in male, somewhat shorter than all preceeding in female; 9 about twice as long as wide and slightly longer than the two preceeding, somewhat triangular; 10 more rectangular than 9 and scarcely as long; 11 elongate-oval, three times as long as wide. Mandibles not carinate on upper surface, surface of proximal half with very long pubescence. Distal margin of labrum with thick brush of long pubescence. Palpi light brown to yellow. Head sparsely clothed with short, fine, recumbent, whitish-yellow pubescence. Pronotum (Fig. 15) slightly narrower than elytra. When viewed dorsally, normal to plane of lateral margin, pronotum slightly wider than long, suboctagonal in outline; sides straight and nearly parallel medially, obliquely narrowed before and behind, posterior obliquity sinuate; posterior margin evenly and gently curved; anterior margin with slight median sinuation; anterior angles strongly impressed; anterior margin expanded slightly anteriorly near juncture with lateral margin. Postmedian dorsal compression of disc absent. Surface finely rugulose and feebly granulose, clothed like head. Elytra slightly more than twice as long as width at base, slightly wider at posterior three-fourths than at prothorax; narrowed from posterior three-fourths to apexes which are conjointly rather narrowly truncate. Disc hemispherical in cross-section at middle. Disc punctate-striate, ten elytral striae at middle; interspaces finely rugulose, wider than punctures, nearly flat toward suture, more convex laterally. Surface moderately clothed with short, fine, whitish-yellow, appressed, non-vittate pubescence. Anterior coxae moderately separated. Prosternum flat, truncate behind, with faint median carina anteriorly in some specimens. Metasternum not excavated anteriorly, with shallow, sparsely pubescent, median depression posteriorly. Abdominal sternites 2 to 5 connate medially; first suture straight and entire; second straight and obsolescent medially; last two obsolescent medially, straight or curved anteriorly; last suture strongly curved anteriorly in some. First sternite shortest, 2 to 5 subequal, 5 longest. Tarsi slender, three-fourths as long as tibiae; segment 1 slightly shorter than 2 or 3; 2 to 4 subequal; 5 as long as 3 and 4. Body beneath finely, densely granulose; densely clothed with moderately long, recumbent, whitish-yellow pubescence.

Male Genitalia.—(Figs. 8, 9, 10) Tergite VIII broad, heavily sclerotized, overlying tergite IX and posterior ends of sternite IX. Sternite VIII more membranous, lying under tergite IX and posterior ends of sternite IX. Sternite IX heavily sclerotized, U-shaped, not curved dorsally or ventrally at either end. Tergite IX V-shaped, more heavily sclerotized strap-like portion connecting posterior ends of sternite IX, membranous vertex directed posteriorly. Basal piece (BP) moderately sclerotized, curved, hood-like, not enveloping base of median lobe. Anterior margin of basal piece bearing short, ventrally curved manubrium (Mb) medially. Basal piece with more heavily sclerotized medial line from manubrium to posterior margin. Lateral lobes (LL) symmetrical, elongate, heavily and continuously sclerotized except for narrow membranous area posterior to heavily sclerotized anterior margin; broadly and weakly connected to basal piece; broad, sclerotized tooth on mesal anterodorsal margin of lateral lobe. Membranous, heavily setiferous lobe (SL) as long as greatest width of median lobe, attached to apex of lateral lobe. Median lobe (ML) tubular, bilaterally symmetrical, lightly sclerotized dorsally and ventrally, heavily sclerotized laterally; constricted anteriorly, widest posteriorly. Lightly sclerotized posterodorsal surface bearing heavily sclerotized plate (P) which extends membranously past apex of lateral lobes. This plate-like structure may be modified additional arm of median lobe. Struts of lateral lobes extend horizontally from anterodorsal margin to anterior edge of lateral lobe.

Wings.—Alar expanse, 4.13 to 5.33 mm. Venation reduced, very similar to *Hemicoelus*. Axillary excision not as deep as in *Hemicoelus*.

Variation.—Observed size range—3.06 mm long by 1.20 mm wide to 4.53 mm long by 1.75 mm wide. Difference between width of pronotum and anterior width of elytra, 0.14 to 0.24 mm.

Diagnosis.—As Fall stated in the original description, *subconnatus*, the type of *Desmatogaster*, differs quite markedly from *Hemicoelus* and *Cacotemnus*, *olim Hadrobregmus*, in having partially connate visible abdominal sternites and a different configuration of the pronotal disc. *Desmatogaster* is distinct from the other related genera which also have connate visible abdominal sternites, *Trypopitys* and *Hadrobregmus*, in that the metasternum is not excavate. The median lobe of the male genitalia is symmetrical in *Desmatogaster*, but asymmetrical in *Trypopitys* and *Hadrobregmus*.

Desmatogaster subconnatus (Fall), 1920
New Combination

Hadrobregmus subconnatus Fall, Canadian Ent., vol. 52, p. 214-215, 1920.

Description.—With the characters of the genus.

Measurements of Holotype.—Length, 4.05 mm.; width of elytra at base, 1.50 mm; greatest width of pronotum, 1.25 mm.

Holotype.—Male; labeled "(Aweme, Man., N. Criddle, 7-June-1919) (rotten spruce) (944) (♂) (type *subconnatus*) (M. C. Z. type 24656)"; Fall Collection, Museum of Comparative Zoology.

Type Locality.—Aweme, Manitoba, Canada.

Geographical Distribution.—Aweme, Manitoba and Mt. Lyall, Quebec, Canada.

Hosts.—Rotten spruce and dead aspen.

Material Examined.—16 specimens.

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THE GENUS NOTOGRAMMA LOEW

(DIPTERA ACALYPTRATAE, OTITIDAE)

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The genus *Notogramma* was founded by Loew in 1867 with the sole included species *N. cimiciformis*[1] Loew. In 1873 Loew synonymized his species with *N. stigma* (Fabricius, 1798). Curran in 1934 pointed out that the two species were abundantly distinct, but meanwhile Cole in 1923 had described another species, *N. purpuratum*, which is very much like *N. stigma*. There has been much confusion of these three species. It is hoped that this review of the genus, which occurs in tropical and subtropical parts of the New World and in one species, *N. cimiciforme*, on several Pacific Islands as well, will correct misunderstandings of long duration and broaden our knowledge of the group. A new species from Peru in the collections of the U. S. National Museum is also described in a new subgenus as *Notogramma* (*Euacaina*) *cactipeodes*, sp. nov.

In 1961, I published a figure of the postabdomen of the male of *N. cimiciforme* and pointed out characters which align the genus with the Otitinae rather than with the Ulidiinae, where it had previously been placed. The characters of the new species, *N.* (*E.*) *cactipeodes*, still more definitely than those of the previously described species, show relationships with the Otitinae and indicate that the generic distinctions in the "Ulidiinae," especially between the genera *Notogramma* Loew, *Acrosticta* Loew, *Euxesta* Loew, *Oedopa* Loew, *Paroedopa* Coquillett, *Stictomyia* Bigot, etc., should be reviewed. *Notogramma* has many of the characters of the more typical Otitinae, such as the genera *Tetanops* Fallen, *Curranops* Harriot, and *Tujunga* Steyskal.

Genus *Notogramma* Loew

1867, Berlin. Entomol. Z. 11: 289, type by monotypy, *N. cimiciforme* Loew; 1873, Smithsn. Inst. Misc. Collect. 256: 148; Aldrich, 1905, Smithsn. Inst. Misc. Collect. 46: 594; Williston, 1908, Man. N.

[1]The generic name is obviously a Greek compound of neuter gender. The specific name should therefore be spelled *cimiciforme*.

Am. Dipt., 3d ed.: 278; Hendel, 1910, Gen. Ins., fasc. 106: 58; Curran, 1934, Fam. Gen. N. Am. Dipt.: 275; 1934, Bull. Am. Mus. Nat. Hist. 66 (3): 429; Steyskal, 1952, Occas. Papers Bishop Mus. 20 (15): 278; 1961, Ann. Entomol. Soc. Am. 54: 404.

KEY TO KNOWN SPECIES OF NOTOGRAMMA LOEW

1 (6). Vertex and tip of scutellum acute in profile; pattern of disc of mesonotum tending to longitudinal stripes ..... Subgenus **Notogramma** s.s.

2 (3). Mesopleura pale pruinose with pattern of dark dots; brown costal border of wing not interrupted; *male*: aedeagus with a few small teeth in midsection; aedeagal apodeme simple, without apical arms or anterior shelf ..... **N. cimiciforme** Loew

3 (2). Mesopleura unpatterned, with pale pruinosity thin or absent; brown costal border of wing interrupted beyond tip of R_1; *male:* aedeagus with very small teeth in midsection; aedeagal apodeme forked apically and with anterior shelf.

4 (5). Interantennal area sloping on each side down to antennal sockets, bright white pruinosity narrow (fig. 2*a*); *male:* apical arms of aedeagal apodeme pointed, lancelike; projections of epandrium simple, pointed (fig. 2) ..... **N. stigma** (Fabr.)

5 (4). Interantennal area broader, with rectangular lateral margins, white pruinosity divided medially by duller gray to brownish portion when viewed anteriorly (fig. 1*a*); *male:* apical arms of aedeagal apodeme expanded, blunt; projections of epandrium blunt, appearing two-toothed in anterior view (fig. 1) **N. purpuratum** Cole

6 (1). Vertex and tip of scutellum rounded in profile; disc of mesonotum with pattern of spots which do not coalesce to form stripes; *male:* aedeagus with several long and strong retrorse teeth in midsection; aedeagal apodeme cuneiform, without apical arms or anterior shelf (fig. 3) ..... Subgenus **Euacaina** nov.; **N. (E.) cactipeodes**, sp. nov.

Subgenus **Notogramma** s. s.

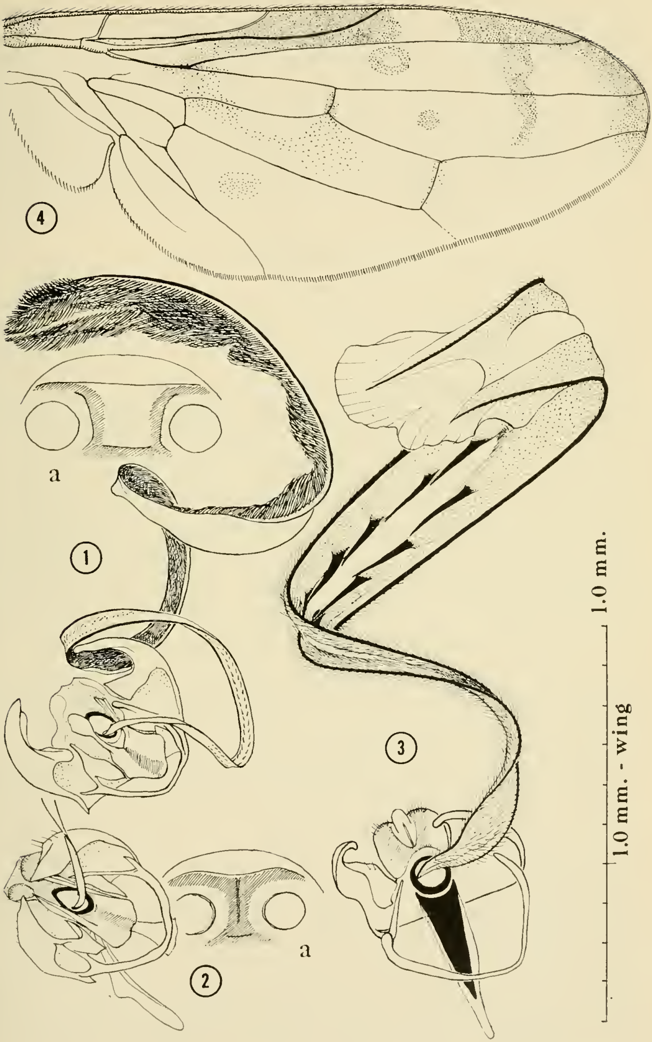
N. (N.) cimiciforme Loew

1867, Berlin. Entomol. Z. 11: 289; Steyskal, 1961, Ann. Entomol. Soc. Am. 54: 409.

N. stigma auctt. pro parte, nec Fabr.: Loew, 1873, Smithsn. Inst. Misc. Collect. 256: 148; Aldrich, 1905, Smithsn. Inst. Misc. Collect. 46: 595; Severin and Hartung, 1912, J. Econ. Entomol. 5: 448; Swezey, 1913, Proc. Hawaiian Entomol. Soc. 3: 4; Knab, 1916, Bull. Brooklyn Entomol. Soc. 11: 41; Johnson, 1919, Bull. Am. Mus. Nat. Hist. 41: 444; Gowdey, 1927, Cat. Ins. Jamaica: 86; Swezey, 1946, Bishop Mus. Bull. 189: 199; Bohart and Gressitt, 1951, Bishop. Mus. Bull. 204: 104; Steyskal, 1952, Occas. Papers Bishop Mus. 20 (15): 283; Joyce, 1953, Proc. Hawaiian Entomol. Soc. 15: 374.

The characters cited in the preceding key and my figure of the male postabdomen (Steyskal, 1961, p. 409, fig. 16) should make this species

Fig. 1. **Notogramma purpuratum** Cole, Saguaro Natl. Mon., Ariz.—oblique anteroventral view of andrium; *a*—interantennal area. Fig. 2. **N. stigma** (Fabr.), Santiago, Cuba—oblique anteroventral view of andrium, less most of aedeagus; *a*—interantennal area. Figs. 3, 4. **N. (Euacaina) cactipeodes** Steyskal, sp. nov., Santa Eulalia, Peru—3, anteroventral view of andrium; 4, right wing.


4
a
1
3
1.0 mm.
1.0 mm. - wing
2
a

easy to recognize. The type was from Cuba. I have seen material from Texas (Harlingen; Brownsville), Cuba (El Gabriel; Havana), Jamaica, Mexico (Piaxtla, Sin.; Quintana Roo; Sta. Engracia, Tam.); Honduras (Tegucigalpa), Costa Rica, Panama (Canal Zone; Jaque R.; Darien Prov.; La Jolla; Panama), Venezuela (Carapito), Colombia (Cali District), Ecuador, Peru (Iquitos), Brazil (Campinas, São Paulo; nr. Pará; Manaos) Hawaii, Marianas Is. (Guam; Saipan; Tinian), Palau Is. (Arakabesan I.), and Wake I. Some of the records in the literature may refer to *N. stigma* (West Indies) and *N. purpuratum* (Texas). The species has been reared from rotting tomatoes, immature coconuts, bananas, liver, wild tuber, *Solanum* fruits, and fruits of *Attalea* palms.

N. (N.) purpuratum Cole
(Fig. 1)

1923, Proc. Calif. Acad. Sci. 12: 474.
? *N. stigma* (F.) Hunter, Pratt, and Mitchell, 1912, U. S. Dept. Agr. Bur. Entomol. Tech. Bull. 113: 53.

The type was from Monserrate Island, Baja California. I have seen many specimens from Texas (Dallas; Beeville; Starr Co.), Arizona (Lowell Ranger Sta. and Saguaro Natl. Mon., both in Pima Co.), California (Loma Linda, San Bernardino Co.; 5 mi. s. Loma Linda, Riverside Co.; Los Angeles), Mexico (54 mi. n. San Luis Potosi; San Geronimo, Oax.; San Jose del Cabo, Baja Calif.). Ryckman (unpublished data) has reared the species from several genera of cacti.

The characters cited in the key are the only reliable ones I have found to separate *N. purpuratum* from *N. stigma*. Both have the same type of aedeagus. The spots on the wing and the body color are quite variable.

N. (N.) stigma (Fabricius)
(Fig. 2)

Musca stigma, 1798, Ent. Syst., suppl.: 593; 1805, Syst. Antl.: 303.
Dacus obtusus Fabricius, 1805, Syst. Antl.: 278; Wiedemann, 1830, Auss. Zweifl.: 565.
Ulidia stigma (F.) Wiedemann, 1830, Auss. Zweifl.: 565.
Notogramma stigma (F.) Loew, 1873, Smithsn. Inst. Misc. Collect. 256: 148, pro parte; Hendel, 1910, Gen. Inst., fasc. 106: pl. 3, fig. 75, pro parte; Curran, 1928, Sci. Surv. Porto Rico (N. Y. Acad. Sci.) 11 (1): 78; Wolcott, 1936, J. Agr. Puerto Rico 20 (1): 374.
N. purpurata (Cole) Foote, 1960, J. N. Y. Entomol. Soc. 68: 99, *misidentification.*

Most citations subsequent to those of Fabricius are doubtful and have been cited under *N. cimiciforme*. Even Hendel's figure of the wing in Genera Insectorum (1910) looks much like an attempt to show the hyaline costal mark of *N. stigma* on a wing of *N. cimiciforme*.

The type was collected "in Americae Insulis." A note in J. M. Aldrich's card catalogue in the U. S. National Museum indicates that the type could not be found in Copenhagen in 1929. The lack of mention of spots on the pleura, together with the statement in the Fabrician description "alae albae punctis quinque fuscis costaque fusca puncto distincto hyalino," is sufficient to identify the species in the West Indies. No specimen of *N. purpuratum* has been seen from "American Islands" east of Mexico. I have seen 34 specimens of *N. stigma*, all from the West Indies: one each from Santiago, Cuba, and Ensenada, Puerto Rico; 6 from Virgin Is. (Desecheo Id.; Mona Id.); 3 from the Bahamas (San Salvador Id.; Exuma Cays; St. Inagua Id.); 5 from Jamaica; and 18 from Antigua.

Subgenus **Euacaina** Steyskal, nov.

The most conspicuous structural characters of *Notogramma*, the acute vertex and tip of scutellum, are not developed here, the front is only moderately pitted, and the cheek wrinkles are not strong, but all other external characters of shape, color, type of wing pattern and venation are those of *Notogramma*. The male postabdomen has a simple aedeagal apodeme, lacking either fork or anterior shelf, and the aedeagus bears a double row of 4 or 5 strong retrorse spines in the middle part and many hairs in the basal three-fourths or more. Type of subgenus, the following species.

N. (Euacaina) cactipeodes Steyskal, sp. nov.
(Figs. 3, 4)

Male. Length of wing, 4.1 to 4.7 mm. Color mostly pitchy dark brown to black, with moderate bluish-green metallic reflections and four longitudinal purplish metallic stripes on mesonotum. Reddish: front, except ocellar triangle and vertical plates; parafacials; cheeks; anterior face of humerus; lower basal part of third antennal segment; basal ¾ of swollen basal part of arista. Yellowish: anterior basitarsi, basal two segments of middle and hind legs. Nearly whole body covered with whitish pruinosity, which is definitely absent only on sides of 4th and all of 5th abdominal tergites and on anterior cheeks, very thin on mesopleura, face, clypeus, and scutellum, and quite dense on anterior coxae, propleura, central mesonotum (where it is of yellowish cast and broken by shining spots at bases of hairs and bristles), stripe from lower posterior orbits to oral margin, and dorsum of abdominal segments 1 to 4. All hairs and bristles black, except those of labellae, fore and hind basitarsal brushes, which are yellowish, and squamal cilia, which are white.

Head with front moderately pitted, parallel-sided, 0.34 of total width of head; ocelli in triangle almost twice as long as wide, with a pair of small divergent ocellars placed midway between anterior and posterior ocelli; fronto-orbitals 2, the anterior of which is approximately ⅔ as long as the posterior and placed a little farther anterad of anterior ocellus than the ocellars are placed posterad therefrom; frontal hairs coarse, in 8 irregular longitudinal rows in anterior part of front. Parafacials at narrowest part half as wide as third antennal segment. Cheeks 0.6 as high as eye, anteriorly with a few shallow wrinkles running vertically and posteriorly with strong hairs but without distinct bristles. Face strongly broadened below and deeply arcuate, so that lower margin of clypeus is a little higher than lower lateral edges of face, in profile concave, interantennal space 0.4 as wide as front, subshining, wrinkled. Antennae extending to upper margin of clypeus, third segment ovate, 1.8 times as long as wide; arista bare, 2.5 times as long as third antennal segment, swollen basal part 0.12 of total length. Palpi flat and broad, dull black with narrow apical yellow border.

Thorax quadrate, a little narrower than head; scutellum convex, smooth, 0.6 as long as wide. Chaetotaxy: 1 *h;* 2 *ntpl;* 1 *sa;* 2 *pa;* 2 *dc* (anterior half as long as posterior); 1 *prsc* in line with posterior *dc;* 2 *sc;* 1 fine *ppl,* 1 strong and 2 or 3 weak *mspl,* 1 posterior *stpl.* Intradorsocentral hairs anteriorly in 8 irregular rows; posternum haired laterally; propleura with a few black hairs; mesopleura with coarse scattered hairs; scutellum with 2 or 3 coarse laterdorsal hairs on each side.

Legs of shape and length normal in *Notogramma, Acrosticta,* and *Euxesta;* middle basitarsi with short spinules below.

Wings as in figure 4, hyaline, with dark-brown pattern in which there is a tendency for central part of spots to be pale; veins brown, yellowish at root of wing.

Abdomen flattened, approximately as long as thorax and of same width as length; fifth tergite lightly transversely wrinkled; tergite 2 three-fourths as long as 3, 4 of the same length as 3, 5 half again as long as 4; all segments with scattered short hairs. Postabdomen as in figure 3, in repose completely withdrawn into segment 5.

Female. Length of wing, 4.5 to 4.8 mm. Similar to male, except in sexual characters; dorsum of preabdomen wholly densely pruinose, whitish marginally and pale brownish centrally; ovipositor nearly shining black, basal segment approximately as long as wide, tip very slender.

Holotype (male), allotype, and 28 paratypes (14 of each sex), PERU, Santa Eulalia, em.(erged) XI-25-36, bred from rotton *Cereus* (cactus), no. 335-36 (Dr. J. E. Wille), in U. S. National Museum (Type No. 66419), except one pair of paratypes in American Museum of Natural History. The locality is northwest of Chosica, in the Department of Lima.

I wish to thank Dr. Paul Arnaud, Jr., and the authorities of the American Museum of Natural History for the loan of an important series of specimens.

NOTICE

Due to the constantly rising printing costs and the ever-increasing number of manuscripts being received for publication in the proceedings, authors are urgently requested to limit their contributions to a maximum of 30 manuscript pages including illustrations, and to condense all technical matter as much as possible. However, this does not apply to "paid" papers which are published out of turn and in addition to the normal number of pages per issue. Short scientific articles not exceeding one printed page, with or without small illustrations, are still welcome and usually will be published promptly.—Editor.

NEW NEOTROPICAL NEOBALINAE WITH KEYS TO THE GENERA AND TO THE SPECIES OF CONALA
(HOMOPTERA: CICADELLIDAE)

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The subfamily Neobalinae was erected by Linnavuori (1959: 17-32) to receive a group of tropical American leafhoppers whose members had been variably placed in several different subfamilies by past workers. Linnavuori provided excellent keys to genera and species of the then known members of the subfamily.

This paper contains descriptions of ten new species as follows: Two *Conala*, two *Calliscarta*, one *Perubala*, three *Neobala*, and two representing two new genera, *Rhobala* and *Psibala*. Keys to the genera and species of *Conala* are provided. All of the material reported upon is in the collection of the United States National Museum.

A brief diagnosis of the Neobalinae is difficult, but members of the subfamily can usually be distinguished by the following combination of characters: Ocelli on anterior margin of crown, crown without dense microsculpturing, anterior branch of tentorium simple, male pygofer without a membranous fold laterally. For a complete definition of the Neobalinae, see Linnavuori (1959: 17).

Neobalinae: KEY TO GENERA

1. Crown strongly produced triangularly beyond eyes 2
   Crown of uniform length or only slightly produced at middle 3
2. Pronotum with distinct transverse rugulae for entire width, posterior margin sharply indented .... **Conala** Oman
   Pronotum smooth or with weakly defined mesal rugulae, posterior margin not sharply indented .... **Benala** Oman
3. Forewing truncated at apex 4
   Forewing rounded at apex 5
4. Forewing with three closed preapical cells .... **Calliscarta** Stål
   Forewing with one closed preapical cell .... **Exolidia** Osborn
5. Ocellocular area without a distinct ledge; aedeagus slender with a pair of apical appendages .... **Perubala** Linnavuori
   Ocellocular area with a distinct ledge; aedeagus, usually stout, simple or variously modified with appendages 6
6. Anterior margin of crown with a fine but distinct transverse carina between ocelli; forewing with three closed preapical cells .... **Rhobala** n.g.
   Anterior margin of crown without a carina of any sort; forewing with three or less closed preapical cells 7
7. Crown bluntly angular in dorsal view; aedeagus with a single asymmetrical apical appendage .... **Psibala** n.g.
   Crown rounded in dorsal view; aedeagus simple or with paired symmetrical basal or lateral appendages .... **Neobala** Oman[1]

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[1]The generic definition of *Neobala* (Linnavuori 1959: 23) is expanded here to include species with aedeagal appendages and setae on pygofer present or absent, and with one to three closed preapical cells in the forewing.

Conala: Key to Species[2]

1. Pronotum with four orange-red longitudinal stripes; forewings grayish hyaline; apex of style with two or more prongs (Fig. 10) 2
   Pronotum with five orange-red longitudinal stripes; forewings brown hyaline; apex of style without prongs (Fig. 4) .... **tijucata** n. sp.
2. Length of male less than 5 mm.; pygofer with macrosetae (Fig. 9); stylar apex with three prongs and a preapical hyaline lobe (Fig. 8) .... **corumbana** n. sp.
   Length of male 5.5 mm.; pygofer without macrosetae; stylar apex with two prongs (Fig. 10) .... **fasciata** (Osborn)

Conala tijucata, new species

(Figs. 1-5)

Length: Male 5.25 mm. Female 5.75 mm.

Coloration: Ground color of venter including legs and face stramineous to yellow. Female without additional dark markings. Male with proximal half of all femora dark brown to black, sides of thorax touched with black, middle of face including clypellus, lora, and most of clypeus black. Both sexes with an orange-red transverse stripe between eyes on uppermost portion of clypeus, stripe follows angular curvature of head. Dorsum of both sexes alike. Ground color of crown, pronotum, and scutellum sordid stramineous to yellow. Crown with four orange-red longitudinal stripes, two of which converge on each side at apex producing two V-shaped markings. Pronotum with five orange-red longitudinal stripes, the outermost two on each side, extensions of coronal markings. Scutellum with three orange-red longitudinal stripes, extensions of three central pronotal stripes. Forewings brown hyaline with veins slightly darker.

Male Genitalia: Genital capsule in lateral view with apical setae and lobe on ventral margin of pygofer (Fig. 2). In ventral view connective Y-shaped and aedeagus constricted at middle, very finely serrated distally and with a pair of slender lateral processes (Fig. 3). Aedeagus in lateral view robust, curving dorsally toward apex, and with a distinct, pointed ventral portion between the pair of slender straight lateral processes (Fig. 1). Style long, slender, and with apex somewhat avicephaliform, but simple (Figs. 4 and 5).

Female Genitalia: Posterior margin of pregenital sternum trilobed, central lobe most strongly produced and notched mesally.

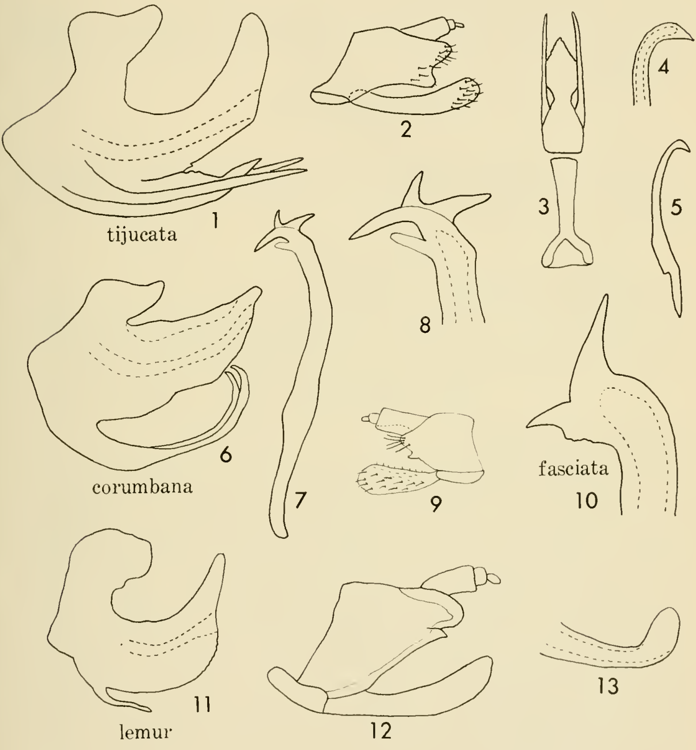
Types: Holotype male (USNM Type No. 34867) Floresta da Tijuca, D. Federal, Brazil, July, 1957, M. Alvarenga. Allotype female and one paratype male with the same data.

Discussion: The characters used in the key will separate *tijucata* from the other members of *Conala*. Although only the style is mentioned in the key, other genital structures afford many features which will further differentiate this species.

[2] The generic definition of *Conala* (Linnavuori 1959: 18) is modified here to include species with or without macrosetae on the pygofer. All of the known species are Brazilian.

Conala corumbana, new species
(Figs. 6-9)

Length: Male 4.80 mm.
Coloration: As in *fasciata* (Osborn) except as follows: Dark markings of face less extensive; orange-red markings of dorsum finer and more sharply delineated.
Male Genitalia: Genital capsule in lateral view with apical setae and an acute



Conala tijucata n. sp. Fig. 1, lateral view of aedeagus; fig. 2, lateral view of genital capsule; fig. 3, ventral view of connective and aedeagus; fig. 4, stylar apex ventrally; fig. 5, ventral view of style. **C. corumbana** n. sp Fig. 6, lateral view of aedeagus; fig. 7, lateral view of style; fig. 8, stylar apex laterally; fig. 9, lateral view of genital capsule. **C. fasciata** (Osborn) Fig. 10, stylar apex laterally. **Rhobala lemur** n. sp. Fig. 11, lateral view of aedeagus; fig. 12, lateral view of genital capsule (setae of plate omitted); fig. 13, stylar apex laterally. Note: Drawings made at various magnifications.

lobe on ventral margin (Fig. 9). Connective Y-shaped. Aedeagus in lateral view robust, narrowed at extreme apex, and with a pair of slender lateral processes gradually recurving toward apex (Fig. 6). Style long, slender, with three distinct apical prongs and a preapical hyaline lobe (Figs. 7 & 8).

Female Genitalia: Female unknown.

Types: Holotype male (USNM Type No. 34868) Corumba, Brazil, April, no year, Carl F. Baker.

Discussion: As in the preceding species, there are additional differences in the male genital structures which could be used in keying *corumbana*.

Conala fasciata (Osborn)
(Fig. 10)

This species was fully treated by Linnavuori (1959: 18-19). Only the stylar apex has been redrawn here (Fig. 10) for ease in running the key. Linnavouri's work should be consulted for a description and figures of other parts of the male genitalia.

Rhobala, new genus

Type of genus: *Rhobala lemur,* new species.

Characters as in *Calliscarta* (Linnavuori 1959: 27) with the following exceptions. Apex of forewing rounded; crown with a fine but distinct transverse carina between ocelli; male plates with macrosetae but without long hairs.

Rhobala lemur, new species
(Figs. 11-13)

Length: Male 6.5-7.00 mm.

Coloration: Venter including legs and face stramineous to pale brown, venter of thorax touched with dark brown or black, clypeus with numerous dark brown to black vermiculate short stripes or irregular spots, each lorum with a small dark brown to black spot next to clypeus, three or four dark brown to black spots flanking inner margin of each eye. Ground color of crown, pronotum, and scutellum same as venter, crown lightly marked with irregular pale brown to black spots and lines, pronotum with extensive markings in form of irregular vermiculate pale brown to black lines, scutellum with anterior angles and midline variably darkened. Forewings milky hyaline with all veins dark brown.

Male Genitalia: Genital capsule in lateral view quite simple with a small but distinct notch ventrally near apex of pygofer (Fig. 12). Macrosetae of plates in disorder. Connective more or less T-shaped. Aedeagus in lateral view stout with ventral margin finely serrated below gonopore, narrowed distally, and with a single short slender basal appendage (Fig. 11). Style slender with apex bluntly oval in lateral view (Fig. 13).

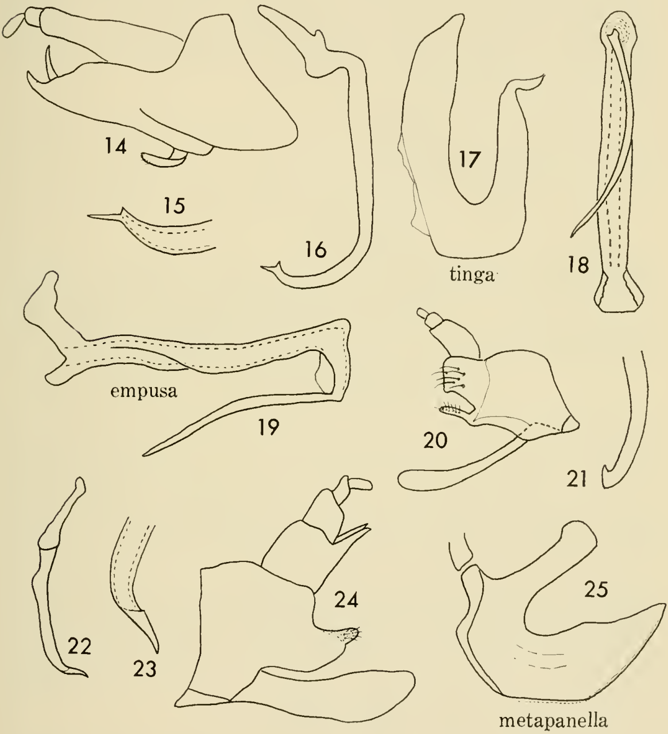
Female Genitalia: Female unknown.

Types: Holotype male (USNM Type No. 34876) Huachi Beni, Bolivia, September, 1921. Mulford Biol. Expedition. Wm. M. Mann. One paratype male Chapada, Brazil, September (no year), C. F. Baker collection.

Calliscarta tinga, new species
(Figs. 14-17)

Length: Male 10 mm.

Coloration: Venter and legs pale brown to yellow, thorax touched with black ventrally. Genae, lora, and clypellus yellow, suture between clypeus and lower face black, clypeus and crown with ground color pale purplish-gray, combined clypeal-



Calliscarta tinga n. sp. Fig. 14, lateral view of pygofer and anal tube; fig. 15, stylar apex ventrally; fig. 16, ventral view of style; fig. 17, lateral view of aedeagus. **Psibala empusa** n. sp. Fig. 18, ventral view of aedeagus; fig. 19, lateral view of aedeagus; fig. 20, lateral view of genital capsule (setae of plate omitted); fig. 21, stylar apex ventrally. **Neobala metapanella** n. sp. Fig. 22, lateral view of style; fig. 23, stylar apex laterally; fig. 24, lateral view of genital capsule (setae of plate omitted); fig. 25, lateral view of aedeagus Note: Drawings made at various magnifications.

coronal area with four broad transverse red-orange bands, the lowermost band broken at middle and only the uppermost band visible dorsally as a marking between the eyes. Pronotum grayish-orange with three pale longitudinal stripes none of which touch anterior or posterior margins, scutellum grayish-orange with a pair of poorly defined purplish longitudinal stripes. Forewings tan suffused with orange, two or three transverse brown bands at apex.

Male Genitalia: Lateral view of pygofer with dorsal margin strongly indented and with two sharp upright projections, one apical and one preapical (Fig. 14). Valve, plates, and connective typical of genus. Aedeagus in lateral view narrowly U-shaped with irregular projections in area of gonopore (Fig. 17). Style in ventral view nearly uniformly slender and curved outward distally, and with apex twice-pronged (Figs. 15 and 16).

Female Genitalia: Female unknown.

Type: Holotype male (USNM Type No. 34870) Tingo Maria, Peru, October 10, 1944, E. J. Hambleton.

Discussion: The color pattern and male genitalia are distinctive.

Psibala, new genus

Type of genus: *Psibala empusa,* new species.

Characters as in *Neobala* (Linnavuori 1959: 23) with modifications as indicated in key to genera. Differs from *Neobala* in having the crown bluntly angular in dorsal view and with length at middle distinctly longer than next to eye. Male genitalia differ in having a single asymmetrical appendage at apex.

Psibala empusa, new species
(Figs. 18-21)

Length: Male 5.25 mm.

Coloration: Ground color of venter including legs and face stramineous to yellow, touched with brown on legs and thoracic venter, face unmarked except for transverse wavy red-orange band between eyes above antennal bases. Ground color of crown, pronotum, and scutellum gray, crown with transverse, red-orange band at extreme apex between eyes and a pair of highly irregular angular red-orange discal markings, pronotum with four irregular longitudinal, red-orange stripes the outer pair doubled with all more or less fusing at anterior and posterior margins, scutellum red-orange mesally. Forewings gray hyaline, clavus marked near base irregularly with red-orange, and distally with brown, corium with a subrectangular brown marking extending from middle of claval suture to costal margin, a second similarly shaped but much smaller marking anterior to first, costal margin with two small brown spots near base, distal portion with a large H-shaped marking, sides of "H" parallel to the two anterior markings.

Male Genitalia: Genital capsule in lateral view with posterior margin of pygofer deeply excavated forming a small ventral portion and a large dorsal portion, both portions setose (Fig. 20). Macrosetae of plates in disorder on venter. Connective approximately Y-shaped. Aedeagus in lateral view subrectangular, not stout, apex projecting ventrally with a single long basally directed appendage (Fig. 19). Aedeagus in ventral view enlarged basally and apically with apical process distinctly curved (Fig. 18) Style slender with apex slightly hooked in ventral view (Fig. 21).

Female Genitalia: Female unknown.

Type: Holotype male (USNM Type No. 34875) Huachi Beni, Bolivia, September, 1921, Mulford Biol. Expedition, Wm. M. Mann.

Neobala metapanella, new species
(Figs. 22-25)

Length: Male 7.00-7.50 mm.

Coloration: Ground color of venter including legs and face stramineous to yellow, abdomen heavily marked with black, thoracic sclerites with irregular black patches, legs variably touched with dark areas, central area of clypellus black, a V-shaped black marking with apex at center of clypellus and arms extending to base of eye on either side, a large black pi-shaped marking on clypeus, and a black slightly curved band at top of face below ocelli. Ground color of crown, pronotum, and scutellum yellow to yellowish-green, crown with a transverse black band between eyes following curvature of head, pronotum with anterior margin narrowly black and four double longitudinal black stripes, each double stripe variably fused or touching especially at anterior and posterior margins, scutellum with basal angles black and a pair of irregular black longitudinal mesal stripes usually fusing distally. Ground color of forewing dark brown to black, clavus marked with a large slightly post-basal yellow-green patch and a smaller oval subapical yellow-green patch, one and sometimes a partial second oval yellow-green patch on corium slightly posterior to oval claval marking, and an irregular oval hyaline spot flanking extreme apex of clavus.

Male Genitalia: Genital capsule in lateral view with ventral portion of pygofer extended and terminating in a lightly setose lobe, tenth segment large with a pair of sharp extensions (Fig. 24). Macrosetae of plates in disorder. Connective approximately Y-shaped. Aedeagus in lateral view simple, but stout, and gradually narrowing in distal portion to sharp apex (Fig. 25). Style in lateral view uniformly slender with apex upturned and tapered to a sharp point (Figs. 22 and 23).

Female Genitalia: Female unknown.

Types: Holotype male (USNM Type No. 34872) Metapan, El Salvador, July 5, 1954, collector "M.S.V." Four paratype males with the same data.

Discussion: This species represents the first record for the subfamily in Central America. Its large size and yellow-green and black coloration are distinctive. It is not a typical *Neobala*, but it is placed here on the basis of the redefined generic definition noted in the key to genera.

Neobala huachia, new species
(Figs. 26-29)

Length: Male 6.00 mm.

Coloration: Ground color of venter including legs and face yellow, abdomen and venter of thorax heavily touched with black, face with an irregular Y-shaped black area, stalk covering clypellus and most of lora, arms covering lower portion of clypeus extending laterally to eye on either side, extreme uppermost portion of clypeus with an irregular transverse wavy red-orange band between eyes. Ground color of crown, pronotum, and scutellum pale sordid gray, crown with a red-orange irregular band between eyes, pronotum with anterior margin orange and discal area heavily suffused with brownish-orange but leaving lateral and posterior margins plus two anterior discal spots gray, scutellum heavily suffused with orange. Forewing brown hyaline touched with gray hyaline at base and apex of clavus, centrally near costal margin, and in area of outer apical cell.

Male Genitalia: Genital capsule in lateral view moderately elaborated, pygofer terminating in a lightly setose lobe, dorsal margin of pygofer with a large somewhat avicephaliform projection (Fig. 28). Macrosetae of plates in disorder, seemingly restricted to dorsal half. Connective approximately rectangular (Fig. 26). Aedeagus in both lateral and ventral views slender with a pair of moderately long basal processes (Figs. 27 and 29). Style in ventral view heaviest at middle with long straight undistinguished mesal lobe (Fig. 26).

Female Genitalia: Female unknown.

Type: Holotype male (USNM Type No. 34873) Huachi Beni, Bolivia, September, 1921-1922, Mulford Biol. Expedition, W. M. Mann.

Discssion: The color pattern and the male genitalia of this species are distinctive.

Perubala furvata, new species
(Figs. 30-31)

Length: Male 6.00 mm.

Coloration: Venter including face black. Pro- and mesothoracic legs stramineous, metathoracic legs black with apex of each femur stramineous. Crown stramineous with a broad A-shaped red-orange marking, apex of "A" at apex of crown, sides extending to eyes with crossbar broken mesally. Pronotum black with a pair of discal spots and lateral and posterior margins yellowish. Scutellum black. Forewings black with color less intense apically, claval suture with a mesal yellowish stripe widened distally, and claval base irregularly pale.

Male Genitalia: Aedeagus broadly U-shaped, quite slender, paired apical processes with slight mesal curvature (Fig. 30). Style in ventral view fairly stout with almost a 90° bend in apical portion (Fig. 31). Rest of genital structures as in *apicimacula* Linnavuori.

Female Genitalia: Female unknown.

Type: Holotype male (USNM Type No. 34871) Tingo Maria, Peru, September 10, 1944, E. J. Hambleton.

Discussion: This species most closely resembles *apicimacula* Linnavuori, but the markings of the pronotum and forewings are different. The aedeagus is shorter and the paired apical apendages are longer than in *apicimacula* (Linnavuori 1959: Fig. 8A).

Neobala permuta, new species
(Figs. 32-33)

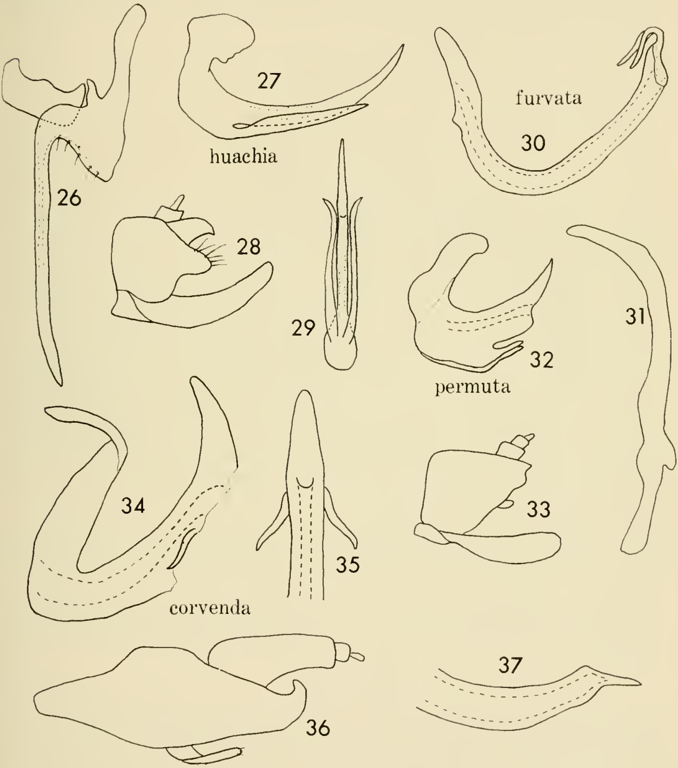
Length: Male 5.00-5.50 mm.

Coloration: Not distinguishable from that of *boliviensis* Metcalf (*pallidus* Osborn) except for the markings on the posterior margin of the crown. In *permuta* the markings consist of three black spots of more or less equal size. In *boliviensis* the central spot is greatly reduced, usually appearing as a line.

Male Genitalia: Genital capsule in lateral view simple, pygofer with a small lobe at middle of ventral margin and a slight expansion near apex (Fig. 33). Aedeagus in lateral view stout, sharply narrowed near apex to pointed tip, and with a pair of comparatively short basal appendages (Fig. 32). Rest of genitalia like *boliviensis.*

Female Genitalia: Female unknown.

Types: Holotype male (USNM Type No. 34874) Santa Elena de Uairen, Venezuela, November 20, 1940, Pablo Anduze. Two paratype



Neobala huachia n. sp. Fig. 26, ventral view of connective and style; fig. 27, lateral view of aedeagus; fig. 28, lateral view of genital capsule (setae of plate omitted); fig. 29, ventral view of aedeagus. **Perubala furvata** n. sp. Fig. 30, lateral view of aedeagus; fig. 31, ventral view of style. *Neobala permuta* n. sp. fig. 32, lateral view of aedeagus; fig. 33, lateral view of genital capsule (setae of plate omitted) **Calliscarta corvenda** n. sp. Fig. 34, lateral view of aedeagus; fig. 35, aedeagal apex ventrally; fig. 36, lateral view of pygofer and anal tube; fig. 37, stylar apex laterally. Note: Drawings made at various magnifications.

males, one same data as type, and the other Rio de Janeiro, Brazil, September 9, 1934, Souza and Lopes.

Discussion: This species is exceedingly close to *boliviensis* but differs in the shape of the pygofer and length of the aedeagal appendages. The color markings may or may not be reliable. Apparently *boliviensis* is a variable species because I have at hand one Brazilian male which agrees in every respect with the typical form, but the aedeagal processes are completely absent.

Calliscarta corvenda, new species
(Figs. 34-37)

Length: Male 9.75 mm.

Coloration: Ground color of venter including legs and face light brown heavily marked with dark brown to black, legs banded, venter of thorax with irregular markings, sutures of face variably darkened, area below antennal ledge dark, clypellus dark mesally, clypeus variably marked with short transverse vermiculate stripes or spots. Ground color of crown, pronotum, and scutellum brownish-gray, crown with a few ill-defined touches of orange, pronotum with vague touches of orange anteriorly and irregular dark brown areas discally, anterior angles of scutellum dark. Ground color of forewings gray hyaline heavily marked with dark brown vermiculate lines often appearing as extra cross veinlets between veins, distinct unpigmented areas at base of each clavus, subapically at each clavus, directly posterior to each claval apex, and at middle of each truncated extreme apex. *Male Genitalia:* Lateral view of pygofer with dorsal margin highest mesally and a fairly blunt recurved projection apically (Fig. 36). Valve, plates, and connective typical of genus. Aedeagus in lateral view narrowly U-shaped with a pair of short appendages at about middle of highly irregular ventral margin (Fig. 34). Appendages of aedeagus best seen in ventral view (Fig. 35). Style slender with apex rather abruptly narrowed producing a sharp terminus (Fig. 37).

Female Genitalia: Female unknown.

Types: Holotype male (USNM Type No. 34869) Covendo, Bolivia, August, 1921, Mulford Biol. Expedition, Wm. M. Mann. One paratype male with the same data.

Discussion: The color pattern of the forewings and male genitalia are distinctive. The specific name, *corvenda,* is an arbitrary combination of letters.

REFERENCE

Linnavuori, R., 1959. Revision of the Neotropical Deltocephalinae and some related subfamilies (Homoptera). Ann. Zool. Soc. 'Vanamo' 20(1): 1-370.

THE SPECIES OF LIMNEPHILUS FROM CENTRAL AMERICA AND HAITI

(Trichoptera: Limnephilidae)

Oliver S. Flint, Jr., *Smithsonian Institution, Washington, D. C.*

Five relic species of the large Holarctic genus *Limnephilus* are found in the mountains of Central America and Haiti. One of these is well known, but two others are based on unique types never adequately figured, one on a type now possibly lost, and one is here described as new. The other species from South America originally placed in this genus by early workers have now been transferred to another subfamily, the Dicosmoecinae. I should like to express my appreciation to Drs. P. J. Darlington, Jr., and H. E. Evans, who made it possible for me to study the types of Banks at Harvard.

Limnephilus toussainti Banks
(Figure 1)

Limnephilus toussainti Banks, 1924, Bull. Mus. Comp. Zool. 45: 439.

The presence of a limnephilid in the Antilles is most unexpected, as no other species of the family is known from the islands. The type may represent a mislabelled specimen; however, it may well be another of the Nearctic isolates known to occur on this island.

I recently studied this unique type so that I am able to present the following description and figures.

Male.—Fore tarsal segments subequal in length. Fore femur inflated basally and with many short dark setae on ventral surface and 1 short dark spur apically from inner angle. Fore tibia slightly bowed and with 2 very short dark spurs on outer surface apically. Forewings brownish with pale spots, especially abundant along posterior margin. No scabrous patch from posterior margin of eighth tergum. Ninth segment slightly inflated laterally. Clasper projecting from ninth segment as a finger-like process. Cercus long, with a somewhat sinuate tip curving dorsomesally; with a dark internal tooth near midlength. Tenth tergum elongate with tip black and upturned, basally widened and well developed internally. Aedeagus with lateral arms as long as central tube and capped by a sparse cluster of setae; tip of central tube unmodified.

Type.—Male, Port au Prince, Haiti (Mann.). MCZ type 14868.

Limnephilus discolor (Banks), new combination
(Figure 2)

Platyphylax discolor Banks, 1901, Trans. Amer. Ent. Soc. 27: 367; Ulmer, 1913, Deutsch. Ent. Zeitschr. 1913: 410.

Since its original description the species has been generally overlooked. Recently I was able to study the type and make notes and drawings of its genitalia which are presented here. The species is still known only from this unique type.

Male.—Basal segment of the fore tarsus ⅓ length of second segment. Forewing membrane uniformly pale brown, veins with prominent setae especially basally and posteriorly. Eighth tergum without a scabrous patch posteromesally. Ninth segment very broad laterally. Clasper projecting distinctly from posterior margin of ninth segment, apex sinuately truncate. Cercus trianguloid, posterior margin nearly vertical and bearing a single strong tooth mesally. Tenth tergum low, extending no farther caudad than cerci, with a low, dark projection apicolaterally. Aedeagus with lateral arms half length of central tube, apex rounded and bearing a diffuse cluster of setae; central tube upturned distally, apex unmodified.

Type.—Male, Tacubaga, D. F., Mexico, September. MCZ type 11817.

Limnephilus hamifer Flint, new species
(Figure 3)

This species appears to be a close relative of *discolor*, but the male differs in numerous characters, especially those of the eighth tergum

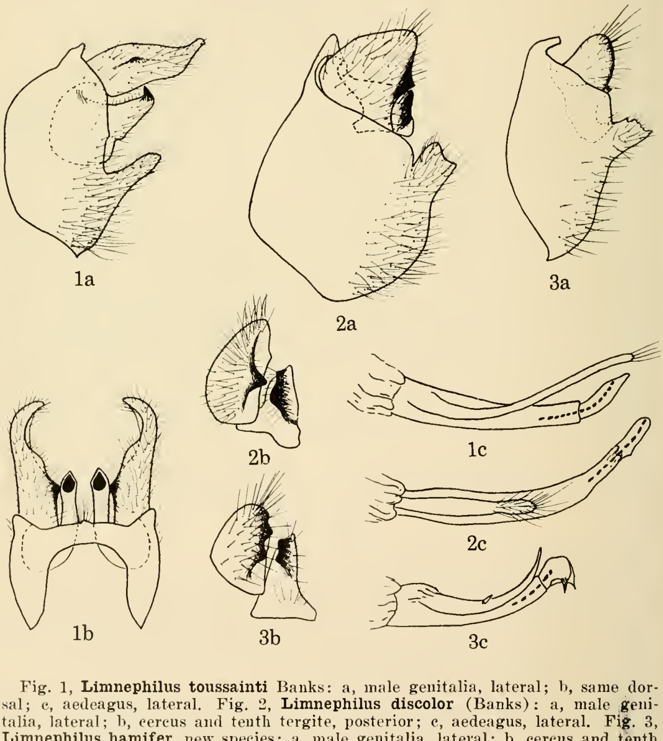


Fig. 1, **Limnephilus toussainti** Banks: a, male genitalia, lateral; b, same dorsal; c, aedeagus, lateral. Fig. 2, **Limnephilus discolor** (Banks): a, male genitalia, lateral; b, cercus and tenth tergite, posterior; c, aedeagus, lateral. Fig. 3, **Limnephilus hamifer**, new species: a, male genitalia, lateral; b, cercus and tenth tergite, posterior; c, aedeagus, lateral.

and aedeagus. The maculations of the forewings may resemble those of *L. solidus* (Hag.).

I have females of two species from Costa Rica and Guatemala, either of which may be the other sex of this species. But, because there is no way of definitely associating either with the type, I prefer to leave the designation of allotype until more material has accumulated.

Male.—Length of forewing 13 mm.; rather uniformly yellowish-brown. Forewings pale yellowish-brown with darker irrorations most noticeable along the veins, especially anally and at the anastomosis; membrane with many pale decumbent hairs, a few erect dark setae on veins basally and anally. Basal segment of fore tarsus about ⅓ length of second segment. Posterior margin of eighth tergum with a scabrous patch. Ninth segment slightly inflated laterally. Clasper projecting distinctly from posterior margin of ninth segment; apex slightly excised so as to form 4 points as seen from the posterior, one at each corner. Cercus trianguloid, posterior margin nearly vertical, black, and with several blunt teeth mesally. Tenth tergum low, extending no farther posteriad than cercus, with a low dark ridge apicodorsally. Aedeagus with lateral arms spine-like, upcurved, and with a short spine-like seta at midlength; central tube with apex produced into a pair of sharp decurved hooks laterally and a weaker hook mesally.

Type.—Holotype male, Mount Poas, C(osta) R(ica), March (Wm. Schaus). USNM type 64990.

Limnephilus frijole Ross

Limnephilus frijole Ross, 1944, Bull. Ill. Nat. Hist. Surv. 23(1): 282; Ross, 1949, Pan-Pacific Ent. 25: 122.

A male and female paratype of this well known species were recorded from Municipio de Galeana, Cerro Potosi, Mexico, by Ross (1944). It is also recorded from Texas, New Mexico, and California.

Limnephilus solidus (Hagen), new combination

Halesus solidus Hagen, 1861, Smiths. Misc. Coll. 4(1): 267; Ulmer, 1913, Deutsch. Ent. Zeitschr. 1913: 411.

This species remains known only from the original description of the female from Mexico. The type, if in existence, is not present in the Hagen material at the MCZ.

TREATMENT OF A RECREATION AREA LAKE FOR CONTROL OF BACKSWIMMERS

During the summer of 1962 a request was received for assistance on an insect problem in a small fresh-water lake at a day camp for girls located in a suburban area of Silver Spring, Maryland. The lake was being used for swimming instruction. The camp owner was concerned about severe biting attacks and wounds received by swimmers from a certain aquatic insect which often became trapped under their swimming suits.

Examination of the insect fauna in the lake by P. J. Spangler, Division of Insects, United States National Museum, disclosed the presence of various species of Hemiptera and Coleoptera as well as certain Megaloptera and Odonata. The lake was well populated with nymphs and adults of the backswimmer, *Notonecta undulata* Say (Notonectidae-Hemiptera), which turned out to be the insect that was biting the swimmers. This insect is a rather large backswimmer (7/16") and lives in all kinds of water from fresh to stagnant. It normally rests at the surface, floating head-down, with the tip of the abdomen piercing the surface film. This species is the most common species of backswimmer in the United States.

Since backswimmers repeatedly come to the water surface for air, it was decided to treat the surface of the lake with a kerosene-type spray. On the afternoon of July 20, the surface of the lake was treated with a spray containing pyrethrins 0.53% plus piperonyl butoxide 2.65%. The spray was applied at the rate of 1.9 gal./acre by means of a Hudson trombone-type hand-operated sprayer. Spraying was done from along the shore and piers which ran out into the water as well as from a canoe. The whole lake was covered with a coating of the oil spray. It appeared that thousands of backswimmers and water striders were killed very quickly by this treatment.

There was considerable concern that the spray might render the water unsuitable for swimming or that the insect or aquatic fauna killed by the treatment might cause an undesirable stench. There were no fish in the lake. The camp was not in general use on the weekend following the treatment. On the third day after treatment, the lake appeared to be nearly free of backswimmers. The oil by this time had disappeared from the water, which was now in splendid shape for swimming. On the day after treatment, the eyes of several swimmers were slightly irritated and light-colored swim suits were stained.

Although no quantitative results were determined, this first treatment gave a high degree of control of backswimmers without any apparent detrimental effect. Samples of the insect fauna taken with aquatic-type nets were made before and after treatment. There was no definite evidence that any species other than the backswimmers and water striders were affected appreciably by the treatment. The owners were greatly pleased with the results.

After 2 weeks, the backswimmers, mostly nymphs, were again present in the lake and the owner desired another treatment at a greater dosage. On August 3, the lake was treated with the same spray at the rate of 3.2 gallons per acre. Again a high degree of control was obtained. Before treatment, dippings with an insect net revealed an average of 4 backswimmers per dip. Three days following treatment the average was 1.5 per dip. The owners were highly satisfied with the control obtained, and the lake was suitable for swimming the rest of the summer.

From these two tests it was concluded that the backswimmer, *Notonecta undulata*, when in sufficient numbers to constitute a hazard to swimmers, could be controlled by a surface treatment of synergized pyrethrum spray. This treatment was made without upsetting the ecological balance of the lake. As far as could be determined this is probably the first time the backswimmers have been controlled by a specific treatment.—J. H. FALES, O. F. BODENSTEIN, *and* G. D. MILLS, JR., *Entomology Research Division, A.R.S., U. S. Department of Agriculture, Beltsville, Md.*

NOTES ON AMERICAN PHYMATIDAE III

(Hemiptera-Heteroptera)

Nicholas A. Kormilev, *365 Lincoln Place, Apt. 2C, Brooklyn 38, N. Y.*

I wish to express my sincere thanks to Drs. J. F. Gates Clarke and Carl J. Drake, of the United States National Museum, Washington, D. C., Dr. Thomas H. Farr, of the Institute of Jamaica, Kingston, Jamaica, and Dr. A. Soos, of the Hungarian National Museum, Budapest, for the privilege of studying unidentified Phymatidae from the collections of their respective Institutions.

Among them the most striking were, a new species of the genus *Phymata* Latreille, 1802, from Jamaica, with fore femora covered with long, erect bristles, a unique case among Phymatinae, and a new genus and species, also from Jamaica, both collected by Dr. T. H. Farr. The new genus, the fifth in the subfamily, I propose to name *Kelainocoris* n.g. (*Kelaino* = one of Pleiades, and also = dark, *coris* = a bug).

The five genera of the Phymatinae may be separated by the following key:

1. Middle and hind tibiae with the upper side carinate laterally and sulcate medially 2
   Middle and hind tibiae convex on the upper side, neither carinate, nor sulcate 3
2. Fore femora subtriangular, more or less swollen .... **Phymata** Latreille, 1802
   Fore femora elongately ovate, constricted in the middle, and with a ring-shaped carina on the exterior side of the fore lobe .... **Paraphymata** Kormilev, 1962
3. First rostral segment (visible) twice as long as the second; sutures between sterna II to V indistinct .... **Kelainocoris** n.g.
   First rostral segment at most as long as the second; suture between sterna II and III at most indistinct 4
4. Fore femora subtriangular, swollen and scabrous; suture between sterna II and III clearly visible .... **Anthylla** Stål, 1876
   Fore femora elongately ovate, completely flat and glossy exteriorly, as if polished; suture between sterna II and III indistinct .... **Neoanthylla** Kormilev, 1951

1. Subfamily Phymatinae A.S., 1943
Genus **Phymata** Latreille, 1802

1. **Phymata interjecta** Dudich, 1922

Phymata marginata var. *interjecta* Dudich, 1922, Ann. Mus. Nat. Hungarici; *19:* 164.

5 ♂ & 2 ♀, Hispañola, Haiti, Furcy—M. W. Sanderson & T. H. Farr coll., May 16, 1959.

2. **Phymata jamaicensis** n.sp.
(Fig. 1-2)

Male. Moderately elongate, with reflexed lateral angles of the pronotum and abdomen.

Head as long as wide through the eyes (♂-17:17, ♀-18:17.5); (20 units = 1 mm.); frontal processes short and blunt, slightly incised in front; preocellar processes placed at the same level as the frontal portion of the head; ocellar processes dentiform. Proportions of the antennal segments, I to IV, are: ♂-5:6.5:8:12.5, ♀-5:7.5:10:12.

Pronotum shorter than wide across lateral angles (♂—27:45, ♀—36:55), sloping anteriorly. Anterior angles short, form a right (♂), or obtuse (♀) angles. Antero-lateral-anterior borders (from anterior angles to lateral notch) more (♂), or less (♀) strongly curved. Lateral notch deep, angular (♂), or less deep and rounded (♀). Antero-lateral-posterior borders (from lateral notch to lateral angles) strongly curved. Lateral angles produced obliquely upward as small, triangular, almost dentiform, lobes, more acute in the male, but the tips themselves are blunt. Postero-lateral-anterior borders (between lateral and postero-lateral angles) short and more (♂), or less (♀) sinuate. Postero-lateral angles acute; posterior processes minute. Fore disc with a smooth, inverted triangle in the middle anteriorly; rugose and finely granulate at the bases of the pronotal carinae. Hind dics more or less roughly punctured. Carinae parallel between themselves, densely granulate anteriorly; provided with a small tubercle, or knob on the highest point; slightly divergent posteriorly.

Scutellum shorter than wide at the base (♂-9.5:14, ♀-21:18); median carina high, cruciform, granulate; lateral borders granulate near the tip.

Hemelytra. Corium very finely punctured, and with a few fine granules; membrane yellowish, with an elongate, brown spot at the base; venation simple.

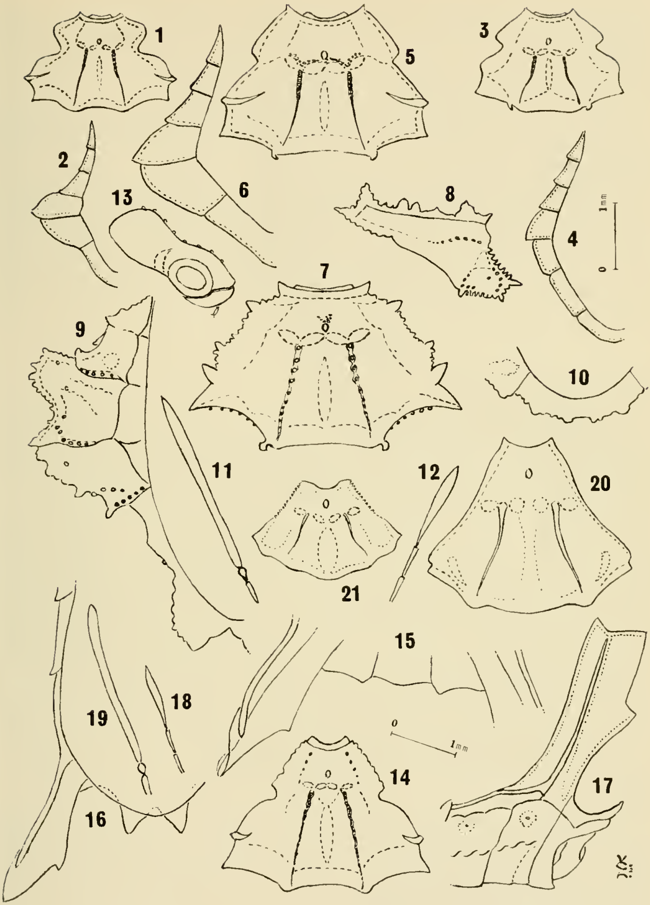
Abdomen shorter than wide (♂-50:54, actual width 60; ♀-70:80, actual width 87; as lateral angles of the abdomen are raised it is given "width" as taken perpendicularly to the disc of the abdomen, and "actual width" as if abdomen was unrolled). Antero-lateral borders firstly sinuate (segments II to IV), then convex (V). Lateral angles form a right (♂), or slightly obtuse (♀) angle. Postero-lateral borders angularly sinuate (♂), or straight (♀); hind border rounded. PE-angles (postero-exterior of connexiva II to IV) not produced.

Propleura: fore border finely denticulate; disc finely granulate; antennal groove reaches to the lateral notch of the pronotum.

Fore femora subtriangular, swollen, longer than wide (♂-18:11, ♀-23:13), with a row of fine teeth on the upper border, sparsely and finely granulate on the disc.

Color. Male, pale testaceous; transversal band of the pronotum light brown; basal portion of the corium, transversal band of the abdomen, and lateral angles of the venter, brown to chestnut brown; middle of the corium pink with whitish veins; venter yellow. Female ivory with pale brown to brown bands and spots; middle of the corium pinkish; pleurae and venter yellow. Some females have color of males.

Total length: ♂-5.1, ♀-6.25 mm.; width of the pronotum: ♂-2.25, ♀-2.75 mm.; width of the abdomen: ♂-2.7, ♀-4.0 mm.



Phymata jamaicensis n.sp. Fig. 1. ♂, pronotum; fig. 2. **Phymata jamaicensis** n.sp. ♂ connexivum. **Phymata elongata** n.sp. Fig. 3. ♀, pronotum; fig. 4. connexivum. **Phymata variegata** n.sp. Fig. 5. ♂, pronotum; fig. 6. connexivum. **Phymata pilifera** n.sp. Fig. 7. ♂, pronotum; fig. 8. propleuron; fig. 9. connexivum; fig. 10. ♀, tip of the abdomen; fig. 11. ♂, antenna; fig. 12. ♀, antenna. **Paraphymata saileri** Kormilev. Fig. 13. ♂, fore femur and fore tibia. **Kelainocoris farri** n.g. Fig. 14. n.sp., ♂, pronotum; fig. 15. ♀, lobe and the tip of abdomen; fig. 16. ♂, lobe and the tip of abdomen; fig. 17. ♂, lobe and the tip of abdomen; side view; fig. 18. ♀, antenna; fig. 19. ♂, antenna. **Macrocephalus testaceus** n.sp. Fig. 20. ♀, pronotum. **Macrocephalus dominicanus** n.sp. Fig. 21. ♂, pronotum.

Holotype: ♂, Jamaica, W. I., St. Andrew, Ferry—T. H. Farr coll. July 26, 1955; deposited in the Institute of Jamaica, Kingston, Jamaica.

Allotype: ♀, Jamaica, W. I., St. Thomas, Holland Bay—T. H. Farr coll. Nov. 28, 1954; deposited in the same collection.

Paratypes: 1 ♂ and 3 ♀, Jamaica, W. I., St. Mary, Aleppo; Manchester, and St. Andrew; in the same collection, and in the collection of the author.

Phymata jamaicensis n.sp. is allied to *Ph. minuta* Kormilev, 1962, from Honduras. It is of the same size and general appearance, but differs from the latter by: antero-lateral-anterior borders of the pronotum curved posteriorly; the lateral notch is deeper, and antero-lateral-posterior borders much more convex; lateral angles of the pronotum produced into blunt teeth; antero-lateral borders of the abdomen more sinuate, and postero-lateral angularly sinuate (♂).

3. **Phymata elongata** n.sp.
(Fig. 3-4)

Female, elongate, twice as long as wide across abdomen.

Head slightly longer than wide through the eyes (17.5:16.5). Frontal processes short, blunt, slightly incised in front; preocellar processes tiny, do not rise above the frontal portion of the head. Granulation fine, dense, semispiculoid, or spiculoid (at occiput). Antennae slender; proportions of the antennal segments, I to IV, are: 5:7.5:10:13.

Pronotum shorter than wide across postero-lateral angles (the maximal width) (30:42). Disc strongly sloping anteriorly. Anterior angles form an obtuse angle; antero-lateral-anterior borders barely curved, almost straight, and finely granulate; lateral notch deep and narrow; antero-lateral-posterior borders slightly curved; lateral angles subangular, not produced, form an obtuse angle; postero-lateral-anterior borders shallowly sinuate; postero-lateral angles obtuse, horizontal; posterior processes minute. Fore disc finely and densely granulate; hind disc strongly convex, finely punctured; carinae slender, parallel between themselves, and finely granulate, anteriorly, then divergent and without granulation.

Scutellum shorter than wide at the base (10:14); median carina cross-shaped, granulate; disc and lateral borders with a few granules.

Hemelytra. Corium with a few, semiobliterated granules; membrane with veins simple.

Abdomen longer than wide (60:53, actual width 55). Antero-lateral borders slightly sinuate at the base, then a little curved; lateral angles form an obtuse angle, but the tips of segment V are acute; PE-angles angularly produced; postero-lateral borders straight, posterior rounded. Connexivum rather narrow; venter smooth, without granulation.

Propleura with anterior border sinuate and granulate, but not denticulate; disc granulate; antennal groove deep, reaches to the lateral notch of the pronotum. Meso and metapleura densely granulate.

Fore femora relatively small, longer than wide (20:12), swollen; upper border with a row of inclined, setigerous granules; disc finely and sparsely granulate.

Color: yellow to orange; hind disc of the pronotum, and scutellum, yellow brown; transversal bands of the pronotum and abdomen, hind half of the propleura, entire meso and metapleura, and lateral angles of the venter, reddish brown, veins along membrane carmine-red.

Total length 5.5 mm.; width of the pronotum 2.1 mm.; width of the abdomen 2.75 mm.

Holotype: ♀, Perú, Marcapata; deposited in the Hungarian National Museum, Budapest.

Phymata elongata n.sp. is allied to *Ph. atra* Melin, 1930, from Bolivia, but is smaller, lateral notch of the pronotum rounded, not angular; lateral angles of the pronotum lower and subangular, almost rounded; PE-angles of the connexiva acute, and slightly produced. Color also may be distinctive, but as the female of *Ph. atra* is not known yet, it is impossible to say.

4. **Phymata variegata** n. sp.
(Fig. 5-6)

Male. *Head* slightly longer than wide through the eyes (22:21), covered with subspiculoid, or spiculoid (occiput) granulation. Frontal processes moderately long, blunt, directed forward, deeply incised in front; preocellar processes slightly raised over frontal portion of the head. Antennae moderately long; proportions of the antennal segments, I to IV, are: 6:10:10:20.

Pronotum rather long and sloping forward, but shorter than wide across the postero-lateral angles (maximal width) (42:60). Anterior angles small, dentiform, divergent; antero-lateral-anterior borders slightly curved, finely denticulate; lateral notch deep, angular, form a slightly obtuse angle; antero-lateral-posterior borders curved and raising; lateral angles form a right, or slightly acute angle; postero-lateral-anterior borders short and sinuate; postero-lateral angles subacute, divergent. Fore disc scabrose and granulate along posterior border; hind disc transversely rugose, but without granulation. Pronotal carinae high, parallel between themselves, and granulate, anteriorly; lower, divergent, and without granulation posteriorly.

Scutellum shorter than wide at the base (16:24); median carina cross-shaped, with longitudinal branch transversely rugose, and lateral branches granulate. Lateral borders with scarce granulation, placed mostly near the tip of the scutellum.

Hemelytra. Corium without granulation; membrane with veins simple.

Abdomen shorter than wide (65:88, actually 94); antero-lateral borders slightly sinuate, then curved; PE-angles slightly produced; lateral angles form a slightly acute angle, the tips of segment V are pointed. Postero-lateral borders slightly sinuate; posterior border widely rounded. Venter very finely granulate.

Propleura with fore border sinuate and finely denticulate, teeth are progressively longer toward the antero-inferior angle. Disc granulate along anterior, inferior and superior (antennal groove) borders; antennal groove reaches to the lateral notch.

Legs. Fore coxae armed with a strong tooth anteriorly, near the base. Fore femora subtriangular, swollen, longer than wide (28:16); disc finely granulate; upper border with a row of setigerous granules.

Color: head and pronotum dark testaceous to chestnut brown; anterior border and the lateral notch of the pronotum dark yellow; small spot on segment IV, and transverse band of the abdomen are chestnut brown to black; ventral side dark yellow; transverse band across antennal groove, lateral angles of the pronotum and abdomen, fore coxae and fore femora, dark brown to black. The paratype is slightly lighter, and larger.

Total length 6.85 mm. (paratype 7.4); width of the pronotum 3.0 mm. (paratype 3.35); width of the abdomen 4.4 mm. (paratype 4.6).

Holotype: ♂, Brazil, Chapada; deposited in the Drake collection, U. S. National Museum, Washington, D. C.

Paratype: ♂, collected with the holotype; in the collection of the author.

Phymata variegata n.sp. is allied to *Ph. communis* Handlirsch, 1897, but differs from it by: head relatively shorter; lateral angles of the pronotum more directed up and backward; antero-lateral-posterior borders longer and more convex; color is more reddish-brown, with very few black.

5. **Phymata (Euryphymata) pilifera** n. sp.
(Fig. 7-12)

Male. *Head* longer than wide through the eyes (♂-25:22, ♀-25:22). Frontal processes strong, finely denticulate, deeply incised in front, directed up and forward; preocellar processes dentiform, raised over the level of the frontal portion of the head; ocellar processes dentiform and slightly divergent. Proportions of the rostral segments, I to III (visible), are: 3:5:2.5. Proportions of the antennal segments, I to IV, are: ♂-5:10:5:56, ♀-5:10:11:28.

Pronotum shorter than wide across postero-lateral angles (the maximal width) (♂-45:80, ♀-45:78). Anterior angles acute, divergent; antero-lateral-anterior borders deeply and roundly incised anteriorly, then raised as acute angle; lateral notch shallowly sinuate (♂), or absent (♀); antero-lateral-posterior borders angularly raised and denticulate (♂), or slightly curved and finely denticulate (♀). Lateral angles dentiform, directed upward; postero-lateral-anterior borders short, sinuate, and finely denticulate; postero-lateral angles long, acute, directed sideways; postero-lateral-posterior borders widely sinuate and granulate (♂), or almost straight (♀). Fore disc swollen, scabrous, with a cluster of ivory granules in front of a pit. Hind disc finely and sparsely punctured; carinae slightly divergent, granulate anteriorly, with a small knob on the highest point, almost evanescent in the third quarter of their length, then reappearing again in the last quarter, and granulate.

Scutellum shorter than wide at the base (♂-12:20, ♀-12:22). Median carina linear, convex, with a cluster of ivory granulation.

Hemelytra. Corium smooth, with a few granules apically (♂), or without granulation (♀). Membrane with only one closed cell clearly visible, the second cell is obliterated (♂), or subobliterated (♀).

Abdomen is cross-shaped (♂), or rounded posteriorly (♀); much shorter than wide (♂-116:125, actually 133, ♀-116:140, actually 148). Antero-lateral borders straight; PE-angles long, dentiform, almost vertical; connexivum V with a wide, twisted, and denticulate ultra-connexivum, seen from above looks S-shaped (♂), in the female connexivum V is lower; connexivum VI also with ultraconnexivum, firstly convex, then sinuate, provided with a few smaller and two larger teeth (♂); the female has smaller teeth. The tip of the abdomen is different in both sexes: in the male, segment VII is produced backward as a long lobe, deeply incised in the middle posteriorly, what gives to the abdomen a shape of a cross. In the female, connexivum VII has one tooth in the middle of the border; connexivum VIII is widely rounded, and rectangularly, shallowly incised in the middle posteriorly. The discs of connexiva II to IV each with a large, round, mother of pearl spot; similar but elongate spot is along posterior margin of connexivum VI, and one larger at the base of connexivum VII.

Sterna II to V with sparse granulation along the sutures and laterally; connexiva VI to VII densely granulate on the ventral side.

Propleura densely denticulate at the fore border; densely crenelate at the inferior border; finely punctured on the posterior half of the disc. Antennal groove wide and shallow, reaches to the postero-lateral angles of the pronotum.

Mesosternal cross with the anterior branch long, thin, densely granulate, reaching to the fore border of the mesosternum; hind and lateral branches also granulate.

Legs. Fore coxae with an oblique row of granules, and a single tooth, anteriorly. Fore femora large, longer than wide (♂-38:18, ♀-37:21), strongly swollen, smooth on the disc, and with a row of small, remote granules on the upper side. The whole disc of the fore femora is covered with long, erect bristles, half as long as the femor wide. Fore tibiae are covered with dense, short, inclined hairs. Fore tarsi present.

Color: brown to sepia, variegated with light brown, and ochraceous; membrane dark brown. The female is lighter: pronotum, with exception of fore disc, is ochre-brown; tergum with orange and reddish tinge in the middle.

Total length: ♂-10 mm., ♀-10.15 mm.; width of the pronotum: ♂-4.0 mm., ♀-3.9 mm.; width of the abdomen: ♂-6.25 mm., ♀-7.0 mm.

Holotype: ♂, Jamaica, W. I., St. Thomas, Whitefield Hall—T. H. Farr coll., June 11, 1954; deposited in the Institute of Jamaica, Kingston, Jamaica.

Allotype: ♀, Jamaica, W. I., St. Ann, Mt. Diablo, Forest Reserve —T. H. Farr coll., June 18, 1960; deposited in the collection of the author.

Phymata pilifera n.sp. is allied to *Ph. superba* Kormilev, 1962, from Haiti. It is of the same aspect and color, only the male of *Ph. pilifera* (the female of *Ph. superba* is yet unknown) has relatively narrower and longer body, particularly segment VII is more produced backward, and postero-lateral angles of the pronotum are more salient. The main difference between these two species is in long, erect bristles on the discs of the fore femora, which are completely absent in *Ph. superba*.

Kelainocoris n.g.

Body very long and narrow; abdomen is narrow at the base and widening backward; connexiva V posteriorly, and the entire VI, together form long, flaring, divergent lobes, directed obliquely back and upward.

Head small, slightly longer than wide through the eyes; frontal processes small, directed forward; preocellar and ocellar processes also small. Head on the upper and lateral surfaces without granulation, with exception of occiput and borders of the antennal groove. Genae small, curved, barely produced. Rostrum with segment I (visible) twice as long as II, II much longer than III. Antennae three times (♂), or only twice (♀) as long as the head; segment IV very long and cylindrical in the male, shorter and elongately fusiform in the female. Eyes moderately large, exserted; ocelly dorso-lateral, placed equidistant from each other and the hind border of the head.

Pronotum trapezoidal, shorter than wide across postero-lateral angles (the maximal width). Anterior border deeply sinuate; anterior angles short and blunt; antero-lateral-anterior borders finely granulate, almost straight (♂), or firstly sinuate, then curved (♀). Lateral notch short and rather deep; antero-lateral-posterior borders curved; lateral angles small, low, blunt, directed upward, form a slightly acute (♂), or right (♀) angle; postero-lateral-anterior borders short, sinuate (♂), or almost straight (♀); postero-lateral angles larger than lateral, produced sideways, and a little backward, form acute (♂), or almost right (♀) angle; postero-lateral-posterior borders long, sinuate; posterior processes absent; posterior border sinuate. Fore disc small, slightly seabrous, and finely granulate laterally; hind disc sloping forward and backward, unevenly punctured along carinae, velvet-smooth on the median line, transversely rugose along posterior border. Carinae slightly divergent backward, well developed on the whole length, very fine, and densely granulate anteriorly.

Scutellum triangular, small, much shorter than wide at the base; median carina linear, granulate; borders carinate, but without granulation.

Hemelytra reach almost to the tip of the abdomen; corium leathery, very long, without granulation; membrane large; veins of membrane form two large, and a few smaller, closed cells, then simple.

Abdomen very long, narrow at the base, and widening backward, more so in the female. Connexivum narrow on segments II to IV; connexivum V posteriorly, and the entire connexivum VI, together form long, flaring lobes, directed obliquely up and backward, and divergent, more so in the female. The tip of the abdomen is produced backward, and deeply, angularly incised in the male; widely rounded in the female. PE-angles produced as blunt tubercles, somewhat inclined backward. Venter longitudinally rugose laterally. Sterna II to IV almost fused together, sutures between them barely discernible. Spiracles very small.

Prosternum short, stridulatory groove moderately deep. Mesosternum twice as long as prosternum, flat; mesosternal cross with fore branch straight, low, thin, and remotely granulate. Propleura long and narrow, sparsely granulate anteriorly, and finely punctured posteriorly; fore border crenelate; antero-inferior angles acute, directed fore and downward; antennal groove reaches to the lateral notch of the pronotum.

Legs: fore coxae shorter than fore femora, unarmed. Fore femora subtriangular, long and flat, slightly seabrous; upper border with a row of small, remote granules. Fore tibiae and fore tarsi as in *Phymata*. Middle and hind legs as in *Neoanthylla;* femora finely denticulate on the lower side; tibiae convex, rounded on the upper surface, neither carinate laterally, nor sulcate medially. Tarsi as in *Neoanthylla*.

Type species: *Kelainocoris farri* n.sp.

Kelainocoris n.g. is allied to *Neoanthylla* Kormilev, 1951, but differs from it mainly by: the first rostral segment (visible) is twice as long as the second, and by fore femur being subtriangular, moderately swollen, and seabrous.

1. **Kelainocoris farri** n.sp.
(Fig. 14-19)

Female. *Head* slightly longer than wide through the eyes (♀-21:17.5, ♂-21:17.5); frontal processes small, directed forward, compressed laterally, and contiguous at their tips. Proportions of the rostral segments, I to III (visible), are: ♀-16:9:6, ♂-15:8:5. Proportions of the antennal segments, I to IV, are: ♀-5.5:7.5:8:20, ♂-5.5:6:2.5:50.

Pronotum much shorter than wide across postero-lateral angles (♀-44:64, ♂-42:63); fore lobe much narrower than the hind lobe (♀-33:64, ♂-36:63). *Scutellum* shorter than wide at the base (♀-11:19, ♂-11:19).

Abdomen much longer than wide across segment VI: ♀-121:61 (length to the tip of the abdomen), or 125:61 (length to the tip of the lobes); ♂-127.5:51 (length to the tip of abdomen), or 145:51 (length to the tip of the lobes). Actual width across the lobes is: ♀-130, ♂-86. Hypopygium of the male small, rugose, longer than wide (19:15).

Legs: fore coxae 3/5 as long as fore femora; fore femora longer than wide (♀-40:16, ♂-38:15). Middle and hind legs as in the female.

Color: female dark brown, venter reddish brown, connexiva II to V, and VII, pale ochraceous in the middle; middle and hind femora, tibiae, and tarsi, pale ochraceous. Male dark brown to black; venter reddish brown, partially dark brown, with hypopygium ochraceous.

Total length: ♀-9.65 mm. (to the tip of abdomen), or 10.1 mm. to the tip of lobes; ♂-10.15 mm. (to the tip of abdomen), or 11.0 mm. (to the tip of lobes). Width of the pronotum: ♀-3.20, ♂-3.15 mm. Width of the abdomen: ♀-3.05 mm. (abdomen proper, without lobes), or 6.5 mm. (across the lobes); ♂-2.55 mm. (abdomen proper), or 4.3 mm. (across the lobes).

Holotype: ♀, Jamaica, W. I., Portland, Hardwar Gap—T. H. Farr coll. Aug. 6, 1961; deposited in the Institute of Jamaica, Kingston, Jamaica.

Allotype: ♂, Jamaica, W. I., St. Andrew, Hardwar Gap—T. H. Farr coll.; deposited in the collection of the author.

It is a pleasure to dedicate this striking species to Dr. Thomas H. Farr, who collected it, and by whose kind office I have had a privilege to study this interesting lot from the West Indies.

II. Subfamily Macrocephalinae A. S., 1843
Genus **Macrocephalus Swederus, 1787**

1. **Macrocephalus testaceus** n.sp.
(Fig. 20)

Female. Ovate; granulation rounded and spare; punctures very fine, with exception of the base of the scutellum.

Head cylindrical, longer than wide through the eyes (27:19); anteocular portion of the head slightly narrower, and distinctly shorter than postocular. Granulation of the head is rather flat and subobliterated on the upper surface, slightly more prominent on the sides. Antennae short and slender, only segment IV is larger and wider; proportions of the antennal segments, I to IV, are: 7.5(4):6(3.5):7(3):12(7), figures in brackets represent the maximal width of the segment.

Pronotum subtrapezoidal, flattened, much narrower anteriorly, and abbreviated behind the lateral angles; shorter than wide across the lateral angles (50:62); fore lobe almost half as wide at the base as the hind lobe across lateral angles (33:62). Anterior border sinuate; anterior angles form a slightly acute angle; antero-lateral borders long and slightly sinuate; lateral angles rounded, slightly incised behind the tip, and a little raised; postero-lateral borders about one third as long as the antero-lateral, firstly convex, then sinuate; posterior border slightly convex in the middle. Fore disc slightly swollen, with subobliterated, concolor granulation, and with a deep pit in the middle. Hind disc slightly depressed medially, moderately swollen laterad of it, depressed again mesad of humeri; finely punctured, and with dispersed, subobliterate, concolor granulation between the punctures. Antero-lateral borders with a triple or double row of fine, whitish granulation, very conspicuous by its color.

Scutellum long, tongue-shaped, almost reaching to the tip of abdomen, covering the whole membrane, but leaving the corium exposed (102:48). The base is triangularly raised; median ridge tapering backward, clearly visible on the whole length from the base to the tip of the scutellum. Disc roughly punctured on triangular elevation, and laterad of it, very finely punctured on the rest of the scutellum.

Hemelytra reach to the tip of the abdomen; corium very finely punctured; membrane large, with reduced venation forming two large, closed cells (M and Cu, and Cu and PCu).

Abdomen cordate, longer than wide (95:90). Almost entire connexivum, and a narrow strip of tergum, are exposed. Lateral borders strongly curved anteriorly, less so posteriorly; the tip of the abdomen evenly rounded. Discs of connexiva rugose, and with spare, subobliterate granulation. PE-angles not protruding. Venter very convex, with flattened, rough, whitish granulation. The cross of mesosternum high and narrow, without granulation.

Legs: fore femora very long (45:17), swollen, with a row of small, setigerous granules on the upper border, and with a few, flattened, subobliterate granules on the exterior surface. Fore tibiae without tarsi.

Color: uniformly testaceous; head paler; granulation of the antero-lateral borders of the pronotum, venter, and fore femora, whitish.

Holotype: ♀, Hispañola, Dominican Republic, Puerto Plata—M. W. Sanderson & T. H. Farr coll., May 10, 1959; deposited in the collection of the author.

Macrocephalus testaceus n.sp. should belong to the subgenus *Lophoscutus* Kormilev, 1951 (parameres?). It is allied to *Macrocephalus drakei* Kormilev, 1962, from Cuba, but differs from it by: lateral angles of the pronotum slightly incised behind the tip, pronotum relatively longer, and abdomen relatively narrower.

2. **Macrocephalus dominicanus** n.sp.

(Fig. 21)

Female. Elongately ovate; head, fore disc of the pronotum, scutellum, and fore femora, roughly granulate.

Head longer than wide through the eyes (♀-22:17.5, ♂-20:16.5); deeply, angularly incised in front; anteocular portion of the head slightly narrower, and shorter, than postocular. Eyes large, excerted. Head roughly granulate laterally.

Antennae short, and slender, only segment IV is large and thick; proportions of the antenal segments, I to IV, are: ♀-6(3):3(3):5(2.5):10:5.5, ♂-7(3):3(3):-6(3):12(5).

Pronotum subhexagonal, rather flat, half as long as wide across lateral angles (♀-30:50, ♂-22:44). Anterior angles small, acute, granulate, and slightly divergent; antero-lateral borders sinuate, and granulate along the fore lobe; lateral angles form a right angle with acute tip; neither raised, nor incised; postero-lateral borders slightly convex in the middle, and slightly sinuate laterally; posterior border convex. Fore disc moderately swollen, covered with dispersed, spare, rough, rounded granulation; hind disc punctured, and with a few scattered, round granules; carinae thin, divergent, and evanescent at ¾ of the length of the hind disc, with a few granules at the base.

Scutellum long, tongue-shaped, covers the entire membrane, but leaves corium exposed, reaches to the tip of the abdomen, longer than wide (♀-73:35, ♂-63:30). The base is swollen in the shape of a halfmoon; median carina enlarged at the base, then thin, slightly tapering toward the tip. Disc finely punctured, more roughly laterad of basal elevation, and with dispersed, whitish granulation.

Hemelytra reach to the tip of the abdomen; corium with spare granulation, similar to that of the scutellum.

Abdomen longer than wide (♀70:63, ♂60:48); the maximal width across segment III. Connexivum narrow, with spare, subobliterate granulation; at junctions of connexiva slightly incised, so that entire connexivum looks slightly festooned. Venter and pleura without granulation.

Legs: fore femora subtriangular, swollen at the basal half, and with spare, subobliterate granulation. Fore tibiae without tarsi.

Color: Female is pale testaceous to orange-yellow, with greenish tinge (immature); male ochraceous with greenish tinge (also immature); posterior half of the scutellum laterad of the median carina, apical ⅔ of the corium, and transversal band of the abdomen, all brown to reddish brown; granulation mostly whitish.

Total length: ♀-6.05, ♂-5.65 mm.; width of the pronotum: ♀-2.5, ♀-2.2 mm.; width of the abdomen: ♀-3.15, ♂-2.4 mm.

Holotype: ♀, Hispañola, Dominican Republic, Valle Nuevo—M. W. Sanderson & T. H. Farr coll., May 6, 1959; deposited in the Institute of Jamaica, Kingston, Jamaica, W. I.

Allotype, ♂, and *Paratype*, ♀, collected with the holotype; in the collection of the author.

Macrocephalus dominicanus n.sp. belongs to the subgenus *Lophoscutus* Kormilev, 1951. It is allied to *Macrocephalus* (*Lophoscutus*) *lepidus* Stål, 1862, from Central America, but differs from it by: longer body, particularly abdomen; larger eyes; head much deeper incised in front; scutellum very finely punctured, and with dispersed, fine, whitish granulation between the punctures; color is also slightly different.

3. **Macrocephalus pulchellus** Westwood, 1843

Macrocephalus pulchellus Westwood, 1843, Trans. Ent. Soc.; *3:* 25.

1 ♀ Jamaica, W. I., St. Andrew, Hermitage Road—T. H. Farr coll., July 15, 1959; deposited in the Institute of Jamaica, Kingston, Jamaica.

4. **Macrocephalus leucographus** Westwood, 1843

Macrocephalus leucographus Westwood, 1843, Trans. Ent. Soc.; *3:* 25.

1 ♂, Hispañola, Dominican Republic, Constanza—M. W. Sanderson & T. H. Farr coll., May 6, 1959; deposited in the collection of the author.

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TWO RARE ANOPLURA FROM KENYA

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Through the kindness of Dr. Theresa Clay of British Museum (Natural History) I had the privilege of examining the specimens of Anoplura collected in Kenya by Dr. G. B. Corbet during 1960-62. Among other interesting finds were the hitherto unknown male of *Hoplopleura rukenyae* Ferris and a good series of *Polyplax praecisa* (Neumann), a species known previously only from the poorly preserved type material which left its status in some doubt. Both are described and figured below.

Hoplopleura rukenyae Ferris
(Figs. 1-5)

Hoplopleura sukenyae Ferris, 1921, Contributions toward a monograph of the sucking lice, v. 2, pt. 2, p. 86, fig. 51 (misspelling).

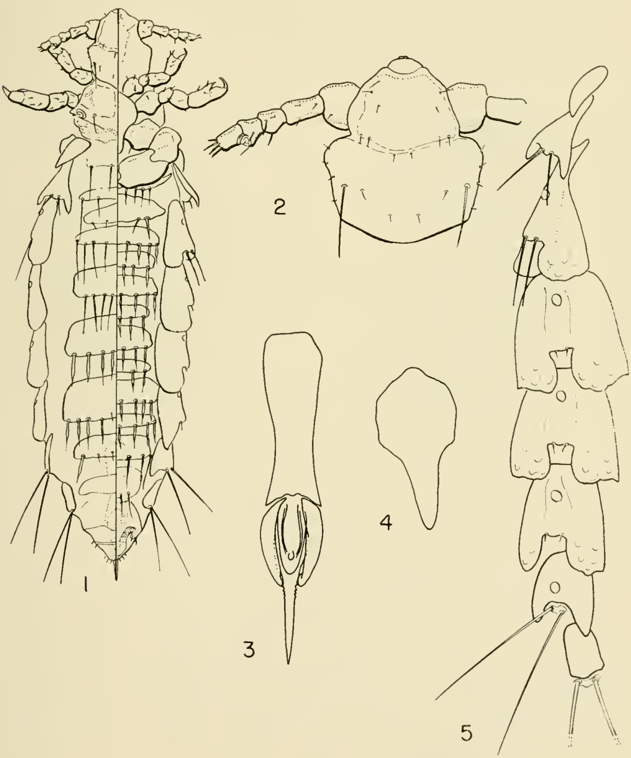
Hoplopleura rukenyae, Ferris, 1951, The sucking lice, p. 143 (emendation). Johnson, 1960, U. S. D. A. Tech. Bul. no. 1211:17.

The holotype female was taken from *Mus triton,* Mt. Rukenya, British East Africa. There are no other records of its occurrence.

New record.—One male from *Mus triton*, Kerugoya, Kenya, 22 Sept. 1960, G. B. Corbet no. 236.

Diagnosis.—Except for sexually-determined differences, the male *rukenyae* recorded above agrees closely in morphology with the original description of the female. It may be immediately separated from other described African *Hoplopleura* species by having the pseudopenis extended into a long, acute point (fig. 3). As in the female, there are medium-sized setae on the thoracic dorsum (fig. 1); the apical lobes of the paratergal plates are scaly, plate III has both apical lobes rounded, and plate VII has two apical lobes, although these are not as long as in the female (fig. 5).

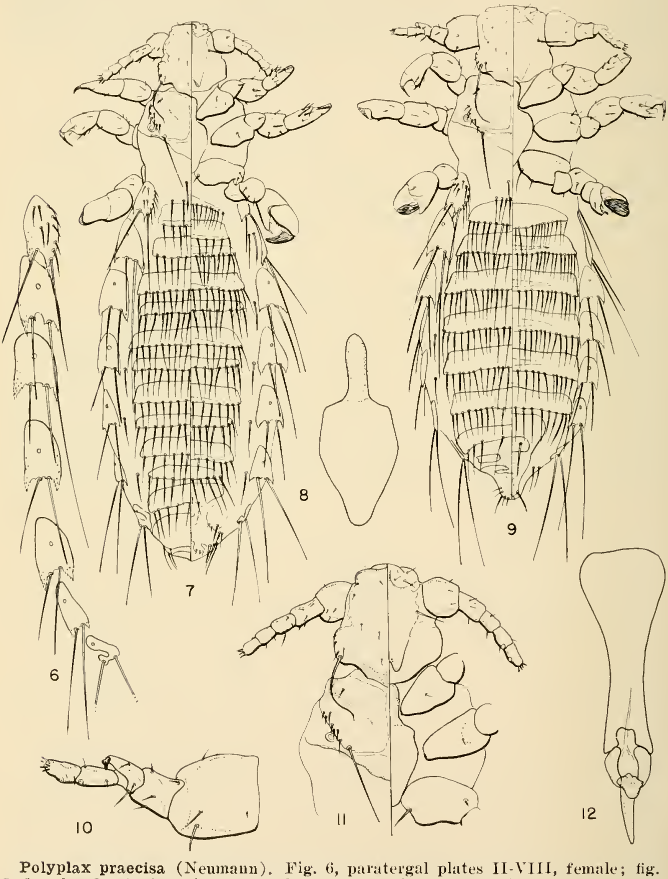
Description.—Head (fig. 2). One very slightly enlarged dorsal seta on each of antennal segments 3 and 4. Postantennal angles rounded, postantennal margins slightly convergent posteriorly, head not rugose dorsally. *Thorax* (fig. 1). Sternal plate with long, sharply rounded, posterior extension. Medium-sized setae on dorsum. Dorsum not especially rugose. *Abdomen* (fig. 1). Some of apical setae on tergal and sternal plates are sword-shaped. With usual one dorsal plate and two ventral plates per segment. Apical setae of paratergal plate III (fig. 5) extending well beyond rounded apical lobes; apical setae on plates IV-VI short



Hoplopleura rukenyae Ferris. Fig. 1, Male; fig. 2, Dorsal view of head, male; fig. 3, Aedeagus; fig. 4, Thoracic sternal plate, male. Fig. 5, Paratergal plates II-VIII, male.

but not minute; plates IV-V with apical lobes truncate; plate VI with ventral lobe rounded and dorsal lobe truncate; plate VII with two rounded apical lobes, the dorsal one being the larger. *Aedeagus* (fig. 3). Basal plate not especially broad anteriorly, about as long as aedeagus proper. Parameres evenly convex laterally. Pseudopenis with very long narrow posterior extension which is as long as the parameres.

Length.—1.2 mm.



Polyplax praecisa (Neumann). Fig. 6, paratergal plates II-VIII, female; fig. 7, female; fig. 8, thoracic sternal plate, female; fig. 9, male; fig. 10, dorsal view of antenna, male; fig. 11, head and thorax, female; fig. 12, Aedeagus.

Polyplax praecisa (Neumann)
(Figs. 6-12)

Haematopinus praecitus Neumann, 1902, Arch. Parasitol. (Paris) 5:600 (*partim*, typographical error for *praecisus*).
Haematopinus praecisus, Neumann, 1903, loc. cit., 6: 144, fig. 1 (emend.).
Polyplax praecisa, Enderlein, 1904, Zool. Anz. (Leipzig) 28: 143 (*partim*). Fahrenholz, 1919, Niedersächs Zool. Ver. Hannover Jahresb. (1913-18) 5-10:25 (restricts name *praecisa*). Ferris, 1923, Contributions toward a monograph of the sucking lice, v. 2, pt. 4, p. 196, fig. 123. Hopkins, 1949, (London) Zool. Soc. Proc. 119:477. Ferris, 1951, The sucking lice, p. 209. Paterson and Thompson, 1953, Parasitology 43:199. Werneck, 1953, Rev. Bras. Biol. 13:59. Johnson, 1960, U. S. D. A. Tech. Bul. no. 1211:61.

The type series of *praecisa* was taken from "gros rats" in Abyssinia (Ethiopia). Hopkins (1949) thought the host might be *Tatera nigricauda* since *Hoplopeura neumanni* Fahrenholz (included in the type collection of *praecisa*) is regularly taken from *T. nigricauda.* The long series taken by Dr. Corbet from this animal strengthens Hopkins' theory. Johnson (1960) reported one small collection of *P. taterae* Ferris from *Tatera nigricauda* from Kenya, although not from the same locality as the Corbet material. Certainly it is not impossible that both *taterae* and *praecisa* occur on the same host species but it is also not impossible that human error is involved in the record of *taterae* from *nigricauda.*

New record.—Numerous males and females from *Tatera nigricauda*, South Rift Wall, Kenya, 31 October 1960, G. B. Corbet no. 374.

Diagnosis.—*P. praecisa* differs from closely related African species in having the apical setae of paratergal plates III-VI all longer than the respective plates (fig. 6). It is apparently most closely related to *taterae* Ferris. As well as having longer apical setae on the paratergal plates, *praecisa* differs from *taterae* in that both apical angles of plates III-VI are acute, not with the dorsal lobe of each of these plates larger and subrounded.

Description.—*Male* (fig. 9): *Head* (fig. 11, ♀). Basal antennal segment much enlarged, about as broad as long, third segment with dorsal prolongation bearing short spine (fig. 10). Occipital angles marked. *Thorax.* Dorsally with seven to ten small setae above spiracle on each side. Sternal plate (fig. 8, ♀) with anterior prolongation about one-third total length of the plate. *Abdomen.* Each segment with one dorsal and one ventral plate. These plates broad and well-sclerotized, with a darker area medially along posterior margin. Apical rows of setae very numerous, averaging between 24-30 setae on each plate. Paratergal plates III-VI (fig. 6, ♀) scaly, apical lobes short and acute, dorsal and ventral lobes not differing in size; all plates with apical setae longer than plate bearing them and with dorsal seta of plate III very long. *Aedeagus* (fig. 12). Basal plate expanded anteriorly. Pseudopenis as long as parameres, narrowing to pointed apex. *Female* (fig. 7). *Head* as in male except antennae not modified. *Thorax* as in male. *Abdomen.* Two well-marked plates per segment dorsally and ventrally. Apical setae on these plates numerous as in male. Paratergal plates as in male. *Genitalia* not distinctive.

Lengths.—Male: 1.4 mm. Female: 1.6-1.8 mm.

A NOTE ON UNITED STATES MICROBEMBEX (HYMENOPTERA: SPHECIDAE: BEMBICINI)

In the First Supplement to the Synoptic Catalog of Hymenoptera of America North of Mexico, K. V. Krombein (1958, p. 196) pointed out that *Microbembex nigrifrons* (Provancher) is a species distinct from *M. monodonta* (Say), and assigned *M. aurata* Parker to the synonymy of the former. Recently I examined the type of *nigrifrons* at Laval University, Ste. Foy, Quebec, where the Provancher collections are now located, and find I am in agreement as to the distinctness of *nigrifrons* and *monodonta*, but that aurata is also distinct. I have seen the type of *aurata* and have specimens of it from a number of localities, including at least two sympatric occurrences with *nigrifrons* and one with *mondonta*. It is the purpose of this note to make the distinctiveness of *aurata* of record in order that this information may be available for the forthcoming Second Supplement to the Catalog.

Aurata is separable from both *nigrifrons* and *monodonta* by a convenient color character, the failure of black to completely encircle the trochanters. It also averages larger in size, has the scutellar punctation coarser and more sparse, the process of the second sternite of the male more slenderly elongate and erect and usually larger, and the parameres of the male genitalia distinctly broader. Unfortunately I am unable at this time to provide key characters for the separation of *nigrifrons* and *monodonta*, although they are distinguishable by direct comparison, the scutellar punctation of *monodonta* being finer and more dense, average size smaller, and process of metasomal sternite two of the male low and differently formed from either of the other species. I have seen *aurata* from Riverside, Riverside County, Jacumba, Scissors Crossing and Warner Springs, San Diego County, California, eastward to a locality 13 miles WNW of Sierra Blanca, Hudspeth County, Texas. *Nigrifrons* will probably prove to be considerably more extensive in range than *aurata*, but variability encountered in studies made to the present time causes hesitancy in extending conclusions to populations beyond those at Jacumba, Scissors Crossing and Warner Springs, fairly near the type locality (Los Angeles), specimens of which were compared with the type. The third species, *monodonta*, is relatively uncommon in collections from California, but apparently at least fairly widespread there. I have seen specimens from San Diego and Jacumba, San Diego County and from San Francisco that I consider assignable to this species. These resemble the eastern form more in color than do populations from mid-Continent areas, where a striking, broadly maculated infraspecific form occurs which first came to my attention from specimens collected by E. R. Tinkham at Sandhills State Park, Monahans, Ward County, Texas, in 1959. I have since seen specimens of this form from Eureka, Juab County, Utah, Riley and Pottawotamie Counties in Kansas, and a few other more or less intermediate localities.

Microbembex is in great need of revisionary study but this cannot be carried to conclusion at the present time.—JAMES E. GILLASPY, *Museum of Comparative Zoology, Cambridge, Massachusetts*

MITES FROM POCKET MICE AT THE NEVADA TEST SITE[1] (ACARINA)

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This reports mites of pocket mice, *Perognathus formosus mohavensis* Huey, *P. longimembris* ssp., and *P. parvus olivaceus* Merriam, taken at the nuclear test site near Mercury, Nevada. It is part of a faunal study described by Allred, Beck, and Jorgensen (1963). Appreciation is given James M. Brennan, Rocky Mountain Laboratory, and Russell W. Strandtmann, Texas Technological College, for identification and verification of some of the mites.

Totals of 156 *Perognathus formosus*, 473 *P. longimembris*, and 23 *P. parvus* were examined during the three-year period of 1959-1962. These were collected from most of the major plant communities defined by Allred, Beck, and Jorgensen (1963). Percentages of mice infested with representatives of 14 species of mites were 30% of the *P. formosus*, 16% of *P. longimembris*, and 43% of *P. parvus*. Males and females of each host were about equally infested. Mice of *P. formosus* were more heavily infested than the other two hosts. Although fewest species of mites were found on *P. parvus*, additional species may be found when more hosts are examined.

Species and numbers of mites found, their seasonal occurrence and host relationships are summarized in Table 1.

Records of mites from pocket mice have been listed by Eads (1951), Keegan (1953), Brennan and Jones (1954), Brennan and Beck (1955), Gould (1956), Loomis (1956), and Strandtmann and Wharton (1958). For the most part, these resulted from incidental collections which did not involve systematic, seasonal collections of the hosts.

In this study *P. formosus* was collected in six plant communities, but most infested animals were found in the *Coleogyne ramosissma* and *Larrea divaricata-Franseria dumosa* communities. Mice of *P. longimembris* were collected from all the plant communities except the *Pinus monophylla* (Pinyon)—*Juniperus osteosperma* (Juniper). There were no significant differences between numbers of individuals infested in one community when compared with those in another. *Perognathus parvus* was taken in four plant communities, but more mice in the *Coleogyne* and Pinyon-Juniper areas were infested than in the other communities.

The predominant trombidiform mite on *P. formosus* and *P. longimembris* was the chigger *Trombicula arenicola* which was not found on *P. parvus*. *Euschongastia cricceticola* was most frequent in occurrence on *P. parvus*.

The mites found most commonly on pocket mice at the Nevada Test Site were mesostigmatids of the species *Haemolaelaps glasgowi* and

[1] This study was supported by contract AT(11-1)786 between the U. S. Atomic Energy Commission and Brigham Young University.

Hirstionyssus hilli, and the chiggers *Euschongastia criceticola* and *Trombicula arenicola.*

Seven females resembling *Haemolaelaps glasgowi* and one similar to *Ischyropoda armatus* are atypical morphologically and may represent undescribed species.

Table 1. Mite infestations of pocket mice (*Perognathus* spp.)

Mite	No. found	Season		% rats infested
Mesostigmata				
Haemolaelaps glasgowi	6	Jan-Mar	formosus	5%
	1	June	longimembris	[2]
	6	Apr-Sept	parvus	9%
Hirstionyssus hilli	2	June-Aug	formosus	1%
	5	Apr-June	parvus	10%
Hirstionyssus sp.	2	Apr	longimembris	[2]
Hypoaspis leviculus	7	June-July	formosus	4%
	4	Apr-June	longimembris	[2]
Ischyropoda armatus	7	Apr-June	formosus	3%
	5	June-July	longimembris	[2]
Kleemania sp.	48	Mar-June	formosus	6%
	7	May-Sept	longimembris	[2]
Trombidiformes				
Euschongastia criceticola	54	Mar-June	formosus	4%
	15	Mar-Apr	parvus	21%
Euschongastia decipiens	7	Mar	formosus	1%
	49	Feb-June	longimembris	3%
Euschongastia fassola	30	Sept	parvus	13%
Odontacarus linsdalei	89	Feb-Nov	formosus	5%
	98	Mar-Sept	longimembris	4%
	4	Apr	parvus	4%
Trombicula arenicola	272	June-Aug	formosus	9%
	374	Jan-Aug	longimembris	10%
Trombicula belkini	1	June	longimembris	[2]
Trombicula jessiemae	14	July	formosus	2%
Trombicula loomisi	9	Sept	parvus	8%
Chigger sp. B[3]	74	June-Sept	longimembris	3%

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[2] Less than 1%.

[3] Belonging to an undescribed genus of the subfamily Leeuwenhoekiinae.

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Loomis, R. B. 1956. The Chigger Mites of Kansas. Univ. Kansas Sci. Bull., 37: 1195-1443.

Strandtmann, R. W. and **G. W. Wharton.** 1958. Manual of Mesostigmatid Mites. Univ. Maryland, Inst. of Acarology, Contr. No. 4.

THE LOCATION OF SOME OBSCURE ENTOMOLOGICAL COLLECTING LOCALITIES IN THE UNITED STATES AND CANADA

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In the course of preparing distribution maps for revisionary studies of the Nearctic Ichneumonidae, we have searched for the locations of many places not indexed in readily available sources. Many localities are those frequently visited by entomological collectors whose specimens are incorporated in collections used for research in groups other than the Ichneumonidae, and it is hoped that by making the following information available others may be spared some of the tedious searching that was needed for finding the location of obscure place names.

We have included in the following list all names of places in the United States which we have used that are not indexed in three usually accessible sources: the 1961 Directory of Post Offices available from the U. S. Post Office Department; the Rand-McNally Commercial Atlas (1959), which is particularly useful because it lists geographic features as well as places; and the atlas of the Century Dictionary and Cyclopedia published in 1901, which is helpful in placing many older names which have since been abandoned or replaced. For Canadian localities we have listed those not indexed in the Gazetteer of Canada prepared by the Canadian Board of Geographical Names and issued by provinces beginning in 1952. Of Ontario, only the southwestern portion has so far been indexed, and there is yet no published Gazetteer for Quebec nor for the Maritime Provinces. Some of the place names included in the list below are locally or to the well-traveled quite obvious but are nevertheless included when we have not found them in the sources above.

Some additional useful sources are the following:
Annual Report of the New Jersey State Museum including a Report

[1] This paper is a by-product of research on Ichneumonidae supported by the National Science Foundation.

of the Insects of New Jersey, 1909, pp. 815-835. There is an alphabetical index to New Jersey localities with brief descriptions of ecological features.

Freeman, 1956 (1958). A Historical Account of Insect Collecting in Northern Canada. 10th International Congress of Entomology, 1: 613-617. This includes a map of localities visited by the Canadian Northern Insect Survey.

Leonard, 1926. A List of the Insects of New York. Cornell University Agricultural Experiment Station, Memoir 101, pp. 1085-1087. Includes a list of New York State collecting stations.

McAtee, 1918. Natural History of the District of Columbia. Biol. Soc. of Washington, Bull. No. 1. Includes an indexed edition of the U. S. Geological Survey map of Washington and vicinity, published in 1917.

In publications reporting on state faunas, as "Mammals of Nevada" by Hall, or "Birds of New Mexico" by Bailey, there are often gazetteers of localities which may be useful for entomological collections also. The U. S. Geological Survey maps and those of the National Forests put out by the Forest Service are, of course, very complete but lacking an index to the place names mapped, they are not easy to use and we have resorted to them only when other indexed sources were inadequate. Older editions of the Postal Guide include some place names no longer in use.

We have credited persons who have supplied information under the place names they have located for us. Included in the list are certain names which we have not been able to map because we thought it might be useful to indicate that these names have been searched for more or less thoroughly and not found. Some of these names are probably misspellings or were misread from the pin labels of specimens we have handled. We shall be grateful for information about those in this category.

Alphabetic List of Localities

Achray, Ont. 30± miles W of Pembroke on Canadian National Railroad.

Aden, Mich. Unknown. Possibly = Adrian.

Alcove, Que. 23± miles N of Hull on Canadian Route 11.

Aldershot, Nova Scotia. Suburb of Kentville.

Allegany State Park, N. Y. 25± miles E of Jamestown in Cattaraugus Co.

Alum Rock Park, Calif. 6± miles NE of San Jose in Santa Clara Co.

Amyot, Ont. 170± miles N of Sault Ste. Marie on Canadian Pacific Railroad.

Angora Peak, Calif. Between Fallen Leaf and Echo Lakes in Eldorado Co.

Antelope Mt., Harney Co., Oreg. Unknown.

Anthony Lakes, Oreg. 25± miles NW of Baker on border between Baker and Union Cos.

Aqua Viva, N. Mex. Unknown. Possibly = Agua Fria.

Archbold Biological Station, Fla. 8± miles S of Lake Placid in Highlands Co.

Atila, B. C. Unknown, unless = Atlin.

Avalanch Creek, Mont. 40± miles S of Cascade Glen, which is 26± miles SW of Great Falls.

Babler State Park, Mo. 35± miles W of St. Louis in St. Louis Co.
Balsam Gap, N. C. At Balsam in Jackson Co.
Barnum Point, N. Y. Unknown.
Barton Flat, Calif. 8± miles S of Big Bear Lake in San Bernardino Co.
Bass Ponds on Minnesota River, Minn. Unknown.
Baxter State Park, Maine. The Mt. Katahdin area in central Maine.
Bear Pass Creek, Butte Co., Idaho. Same locality as Pass Creek Gorge, 22± miles NW of Arco, *teste* R. M. Bohart.
Beaver Canyon, Utah. 10± miles E of Beaver in Beaver Co. at 9000′, *teste* G. E. Bohart.
Beaver Mts., Utah. 45± miles W of Fillmore in Millard Co.
Beech Grove, Que. 30± miles W of Hull on Ottawa River.
Benson State Park, Oreg. 30± miles E of Portland in Multnomah Co., apparently on the slopes of Larch Mt.
Berthier L(ake), Que. 15± miles N of Joliette, *teste* G. S. Walley.
Big Bend Mt., Butte Co., Calif. 15± miles NE of Oroville, between Brush Creek and Yankee Hill, *teste* J. A. Powell.
Big Island in Rhode River, Md. A little south of Annapolis in Anne Arundel Co., *teste* K. V. Krombein.
Big Stone Bay, Mich. 7± miles W of Mackinaw City in Wilderness State Park on Lake Michigan, in Emmet Co.
Blackburn, Ont. 5± miles E of Ottawa.
Blackjack Creek in Pottawatomie Co., Kans. A short, small stream 7± miles E of Manhattan, *teste* H. E. Evans.
Black Pond, Va. Along Potomac River south of Great Falls, *teste* W. S. Fisher.
Black Sturgeon Lake, Ont. Unknown. (There are two lakes of this name in Ont., one N of Lake of the Woods, the other S of Lake Nipigon.)
Blood Mt., Ga. In Lumpkin and Union Cos. on divide at the south headwaters of Nottely River.
Blue Mt. Reservation, N. Y. 3± miles S of Peekskill, in Westchester Co.
Bluff Lake, Calif. 2± miles S of Big Bear Lake in San Bernardino Co.
Boulder Cave, Wash. Unknown.
Brazeau Reserve, Alta. N of Mt. Lyall on Cardinal River.
Bridge Creek Camp, Lassen Co., Calif. Bridge Creek is 10± miles W of Susanville, flowing into Susan Creek which flows into Honey Lake.
Briggs Creek, Oreg. Unknown.
Britannia, Ont. = Britannia Bay on Ottawa River, at eastern outskirts of Ottawa.
Browns Flat, Los Angeles Co., Calif. 5± miles N of Claremont.
Brûle Lake, Ont. 30± NE of Huntsville in Algonquin Prov. Park.
Bumble Bee, Tuolumne Co., Calif. ½ mile W of Leland Meadows, N of Pinecrest Lake, on the Dardanelle Road (California Route 108).
Burbridge, Que. 60± miles N of Hull in valley of Gatineau River.
Cameron Bay, N. W. T. On east side of Great Bear Lake near Port Radium.
Cameron Pass, Colo. In Larimer Co., 2± miles NW of NW boundary of Rocky Mt. National Park.
Camp Creek at Krassel Ranger Station, Idaho. 45± miles E of McCall in Payette Co., a tributary of Salmon River.
Camp Holsum, Calif. Unknown.
Camp Howard, Idaho. = Mt. Idaho, 3± miles E of Grangerville, *teste* A. B. Gurney.

Camp Mead, Md. 25± miles NE of Washington, D. C., east of U. S. Route 1.
Camp Peary, Va. Seabee camp at Williamsburg, *teste* G. E. Bohart.
Camp Pickett, Va. E and SE of Blackstone.
Canard, Nova Scotia. 8± miles NE of Kentville.
Cantwell Cliffs, Ohio. 15± miles SE of Lancaster, in Hocking Co.
Canyon Creek, Yukon. 80± miles W of Whitehorse on Alaska Highway, *teste* W. R. M. Mason.
Carrs, Maine. "It is most likely in the vicinity of Bangor. Eddy had several other obscure personal labels of this sort, also referring to various spots in the environ of Bangor," *teste* W. J. Brown.
Carson Pass, Calif. 20± miles S of Lake Tahoe, in Alpine Co.
Cedar Swp., Ohio. = Cedar Swamp. 8± miles SW of Urbana, in Champaign Co.
Cedarwood, Mich. Unknown.
Chain Bridge, Va. Bridge crossing Potomac River on western edge of D. C.
Chalk Creek, Idaho. N of Richfield near Coalville.
Charter Oak, Pa. 15± miles S of State College, in northern Huntingdon Co.
Chasteen Creek, Great Smoky Mountains National Park, N. C. Unknown.
Chatterton, Ont. 15± miles N of Belleville, Ont.
Chenney Glch., Colo. Unknown. Possibly = Chimney Gulch.
Cherry River, Que. 8± miles SW of Sherbrooke.
Chesters Island, Ga. In Okefenokee Swamp.
Cheyenne Mt., Colo. 15± miles S of Colorado Springs, in El Paso Co.
Chile Bar, Eldorado Co., Calif. 3± miles N of Placerville on the American River, *teste* J. A. Powell.
Chimney Cp. Gr., Tenn. = Chimney Camp Ground in Great Smoky Mountains National Park, 6.5 miles from the Gatlinburg Entrance on the road to Newfound Gap, *teste* H. E. Evans.
Chimney Gulch, Colo. In Jefferson Co. on Colorado & Southern Railroad with mail service from Golden.
Clarke's Valley, Pa. 15± miles NW of Harrisburg, in Dauphin Co. near Dauphin.
Clear River, Minn. Township in Roseau Co.
Clement, Que. 60± miles N of Hull, in valley of Gatineau River.
Cloud Bay, Ont. 28± miles SW of Fort William, on Lake Superior.
Club Hill, Md. Unknown.
Clymont, Alta. 30± miles W of Edmonton, 53°26'N, 113°54'W.
Cody Ranch, Harney Co., Oreg. Unknown.
Colbert, Kans. Unknown.
Collins, Idaho. Near Moscow on Potlatch Creek in Latah Co. in northwest quarter of Section 6, Township 41N, Range 1E.
Cold Springs at 5915', Colo. Unknown.
Columbia Mt., Mont. Unknown.
Constance Bay, Ont. 30± miles W of Ottawa, on Ottawa River.
Cookshire, Pa. Unknown.
Coppei Creek, Wash. 15± miles E of Walla Walla, in Walla Walla Co.
Corlett, Mont. 35± miles NE of Missoula, near Seely Lake, in Missoula Co.
Corliss, Wis. 20± miles S of Milwaukee, between U. S. Route 41 and Sturtevant, in Racine Co.
Coyote Grade, Nez Perce Co., Idaho. 15± miles E of Lewiston, across Clearwater River N of Spalding.

Cramer, Minn. 10± miles N of Finland, in Lake Co.

Cranberry gls., W. Va. = Cranberry Glades. About 300 acres in 5 bogs along Cranberry River, in Monongahela National Forest, 9± miles W of Marlington, *teste* C. W. Sabrosky.

Cranberry Station, Wash. Unknown. Possibly = Cranberry in Pacific Co.

Crystal Lake, Los Angeles Co., Calif. 16± miles NW of Claremont, 5± miles N of San Gabriel River Reservoir.

Damariscove Island, Maine. 6± miles S of Boothbay Harbor, off coast in Atlantic.

Devil's Basin, 8000', Calif. 6± miles SW of Lake Tahoe, W of Angora Peak in Eldorado Co.

Devil's Court House on Blue Ridge Parkway, N. C. At mile 422.4 of the Parkway in Pisgah National Forest, near Beech Gap.

Devon, New Brunswick. Suburb of Fredericton.

Deward, Mich. In NW corner of Crawford Co., with mail service from Frederic.

Diamond O Mather, Calif. = Diamond O Camp near Mather in Tuolumne Co., *teste*, P. D. Hurd.

Difficult Run, Va. Stream flowing into Potomac River in Fairfax Co., 2± miles down river from Great Falls.

Dixie Landing, Va. Near mouth of Pimmit Run just down river from Chain Bridge over the Potomac River, *teste* A. B. Gurney.

Dolly Copp Forest Camp, N. H. 8± miles S of Gorham, east of Mt. Madison.

Doton, Nev. Unknown.

Double Meadow, Fresno Co., Calif. At 8000' E of Florence Lake and N of S. Fork of San Joaquin River, in Sierra National Forest.

Doughton Park, N. C. Probably = Doughton in Wilkes Co.

Duchesnay, Que. Just east of Quebec City.

Duttonville, N. J. Unknown.

East Harbor, Ohio. On north side of Sandusky Bay in Danbury Township, Ottawa Co.

Eels Lake, Ont. 45± miles N of Peterborough, W of highway Route 28.

Elizabeth, Maine. Unknown.

Elkhorn Ferry, Yolo Co., Calif. N of the town of Sacramento, on River Road at the bend of the Sacramento River.

Elk Lake, Ont. In the Timiskaming District at 47°7'N, 80°3'W.

Ellis Bay, Que. On Anticosti Island at the mouth of the St. Lawrence River.

Fairy Lake, Que. In Hull, Que., *teste* G. S. Walley.

Fieldrock, Calif. "Unknown without collector," *teste* P. D. Hurd.

Fish Canyon, Calif. Unknown.

Fish Creek Pond, N. Y. Possibly on Fish Creek in Lewis Co.

Fishtrap Lake, Wash. In SE corner of Lincoln Co.

Flint, Ont. 20± miles W of Fort William.

Fort Casey, Wash. On Whidbey Island.

Fort Tejon, Calif. At Lebec, in Kern Co.

Frater, Ont. 60± miles N of Sault Ste. Marie, on Central and Hudson Bay Railroad.

Fredericksburg, Md. Unknown.

Furnace, Penn. In either York or Cumberland Co., W of Susquehanna River, W of Harrisburg, *teste* W. S. Fisher. There are two places with this name, one in

Huntingdon Co. the other in Lebanon Co., *teste* Rand McNally Commercial Atlas.

Gale River, N. H. Unknown. The town of Gale is in Merrimack Co., with mail service from West Andover.

Gauvreau Lake, Que. 30± miles N of Hull, 2± miles W of Wakefield.

General Springs, Coconino Co., Ariz. 12± airline miles NE of Pine, on edge of Mogollon Ridge near southern boundary of Co., *teste* T. H. Hubbell.

Gillespie, Ohio. Unknown. Possibly Gillespieville.

G. Alpine Creek, Lake Tahoe, Calif. = Glen Alpine Creek.

Glenburnie, Ont. 2± miles N of Kingston.

Godman Spring, Wash. 25± miles E of Walla Walla, in Columbia Co.

Grail Hope, Ky. = Crailhope.

Grand Bend, Que. Unknown.

Granite, Utah. Unknown.

Gray Cloud Islands, Minn. Unknown.

Grays Siding, Ill. Old railroad stop, 6 miles west of Danville, *teste* H. H. Ross.

Greeley, Ont. 10± miles SE of Ottawa.

Green Falls, Colo. Unknown. Possibly = Green Mt. Falls 15± miles NW of Colorado Springs.

Green River Lakes, Wyo. 70± miles NW of Riverton, in northern part of Bridger National Forest.

Griffin Creek, Jackson Co., Oreg. 5± miles SE of Medford.

Gulf Road, Whatcom Co., Wash. Unknown.

Gunston Cove on the Potomac River, Va. Near Lorton in Fairfax Co.

Habitant, Nova Scotia. 12± miles NE of Kentville.

Haines, B. C. Possibly = Haines, Alaska.

Hallelujah Junction, Calif. The junction of California highway 24 with U. S. highway 395, in extreme southern Lassen Co., *teste* P. D. Hurd.

Harmon Field, Newfoundland. On west coast near St. Georges Bay.

Harold, Ont. 14± miles N of Frankford.

Hatchery Arm, B. C. Unknown.

Hatch Experiment Station, Mass. At Amherst (= Massachusetts Agricultural Experiment Station).

Havilah, Fresno Co., Calif. Unknown in Fresno Co.

Haywood, Ont. Unknown in Ontario.

Heart Lake, N. Y. 8± miles S of Lake Placid, at 2150′ in McIntyre Mts., Essex Co.

Heckton Mills, Pa. 10± miles N of Harrisburg on east side of Susquehanna River, in Dauphin Co.

Hedges, Ark. 10± miles NW of Mountain View in northern Stone Co.

Hells Canyon, N. Mex. A collecting locality of C. H. T. Townsend in Manzano Mts., *teste* C. W. Sabrosky.

Herkey Creek, San Jacinto Mts., Calif. Flows into the Hemet Reservoir near Keen Camp, in Riverside Co.

Hobon Lake, Oreg. Unknown.

Hope Summit, B. C. At summit of Hope Pass?

Hope Valley, Alpine Co., Calif. S of Lake Tahoe and Luther Pass, on W boundary of Alpine Co.

Hospital Canyon, San Joaquin Co., Calif. S of Tracy on boundary between San Joaquin and Stanislaus Cos.

Hot Creek, Mono Co., Calif. E of Sonora Pass, NW of Bridgeport.
Howland Flat, Calif. 15± miles N of Downieville, in Sierra Co.
Huckleberry Meadows, Calif. Unknown. (P. D. Hurd has records of 5 places with this name.)
Huntington, Pa. Unknown. Possibly = Huntingdon.
Hymers, Ont. 25± miles W of Fort William on Lake Superior.
Ice Mts., W. Va. 15± miles E of Romney, 5± miles NW of Capon Bridge in Hampshire Co.
Idaho Springs, Neb. Unknown.
Indian Ladder, N. Y. Unknown.
Inglewood, Pa. Unknown. Possibly Inglenook.
Inonoaklin Crossing near Edgewood, B. C. On west bank of Lower Arrow Lake.
Iris Town, Ont. Presumably = Iris Township, 75 miles N of Blind River in Sudbury District, *teste* G. S. Walley.
Ivy Lea, Ont. 8± miles E of Gananoque, on St. Lawrence River across from Alexandria Bay, N. Y.
Jacksons Island, Md. An island in Potomac River 3½ miles down river from Great Falls, now called Turkey Island, *teste* C. W. Sabrosky.
Jamet, Ont. 25± miles W of North Bay.
John A. Latsch State Park, Minn. 10± miles NW of Winona, on Mississippi River.
Jordan, Ont. 30± miles E of Hamilton, on Lake Ontario.
Jug Run, Ohio. Near Smithfield in Jefferson Co.
Katepwa Provincial Park, Sask. 22± miles N of Indian Head.
Kazabazua, Que. 55± miles N of Hull on Canadian Route 11. Also spelled Kazubazua.
Kelly, Calif. In Napa Co., with mail service from Vallejo.
Kelly's Camp on Gaspé, Que. Unknown.
Kent Lake, Beaver Creek Mts., Utah. Probably = Kent Lake in Beaver Canyon.
Kigalie Ranger Station, Utah. In Manti-LaSal National Forest at 8402′, San Juan Co., at 37°41′N, 109°49′W.
Kingsmere, Que. 8± miles W of Hull in Gatineau Park.
Kissena Park, Long Island, N. Y. In the borough of Queens and community of Flushing.
Krassel Ranger Station, Idaho. 45± miles E of McCall, in Payette Co. on South Fork of Salmon River.
Kyle Canyon, Charleston Mts., Nev. In Clarke Co. running from 36°16′N, 115° 40′W to 36°18′N, 115°27′W.
Lac Brûle, Que. 3± miles N of Ste.-Agathe-des-Monts.
Lac McGregor, Que. 20± miles N of Hull.
Lac Mercier, Que. 5± miles N of St. Jovite.
Lac Mondor at Sainte Flore, Que. Between Shawinigan Falls and Grand'Mere.
Lacoste, Que. 17± miles NW of Labelle on Canadian Route 11.
Lac Tremblant Nord, Que. Just S of SW corner of Mont Tremblant Park.
Lahaway, Ocean Co., N. J. In Delaware Valley. Island in pine barrens at head of Lahaway Creek.
Lake Curry, Calif. 6± miles W of Vacaville, in Napa Co.
Lake Drummond, Va. 20± miles S of Portsmouth, in Norfolk Co.
Lake Island, Que. Unknown.

Lake Montauk, Long Island, N. Y. At eastern tip of Long Island near Montauk Point.

Lake Tenaya, Calif. 25± miles W of Leevining, on Tioga Road in Yosemite National Park.

Lake Two Rivers, Ont. In Algonquin Provincial Park at 45°6′N, 78°5′W.

Lake Waha, Idaho. 20± miles S of Lewiston.

Lake Willoughby, Vt. 8± miles E of Barton, in Orleans Co.

Langford, B. C. An area in Victoria, *teste* G. S. Walley.

Laniel, Que. 25± miles N of Temiscaming, W of Kippewa Reserve.

Larkins, Que. Unknown in Quebec.

Larrimac, Que. Properly "Larrimac Links"—a flagstop on railway 18± miles NW of Hull, *teste* G. S. Walley.

Latsch State Park, Minn. See John A. Latsch State Park.

Leland Meadow, Tuolumne Co., Calif. About halfway between Strawberry and Dardanelles, a few miles south of California Route 108.

Leona Heights, Calif. A residential subdivision in the hills above metropolitan Oakland, in Alameda Co.

Letford, Ga. 30± miles W of Savannah on the Canoochee River, in Bryan Co.

Lewiston, Pa. Unknown. Possibly, Lewistown.

Lick Creek Ranger Station, Oreg. SE of Wallowa Lake, in Wallowa-Whitman National Forest.

Little Duck Island, Maine. 5± miles S of Mt. Desert Island, in Atlantic Ocean.

Little River-Codroy, Newfoundland. Little River flows from Bathurst Lake on south coast.

Livingston, Maine. Unknown.

Livingston, Wyo. Unknown.

Livingstown, Pa. Unknown.

Lonely Lane, Ont. Unknown.

Lorraine, Ont. Village near Niagara Falls, *teste* G. S. Walley.

Los Gatos Canyon divide to Diablo Range, Fresno, Co., Calif. Los Gatos River flows west of Oilfields and its valley goes into Diablo Range.

Los Piños, Calif. Possibly = Los Piños Peak in Orange Co.

Lost River State Park, W. Va. 15± miles SE of Moorefield in Hardy Co.

Lucia Falls, Wash. Unknown. Possibly near Lucia in Clarke Co.

Luskville, Que. 20± miles NW of Hull between Ottawa River and Gatineau Park.

Lyon, B. C. Probably Lyon Lake at 49°N, 123°W, *teste* G. S. Walley.

Macdiarmid, Ont. SE of Lake Nipigon, on Canadian National Railroad.

Magnesia (Springs) Cn., Calif. 20± miles S of Joshua Tree National Monument on California Route 111, in Riverside Co.

Manzano National Forest, N. Mex. Incorporated in Cibola National Forest? Not in 1959 list of National Forests.

Marie Lake, Fresno Co., Calif. NE of Florence Lake and N of Kings Canyon National Park, at 10,500′.

Marks, Que. 60± miles N of Hull, near Gracefield.

Matheson Hammock, Fla. Park on southern outskirts of Miami.

Meach Lake, Que. 12± miles NW of Hull, in Gatineau Park.

Mer Bleue, Ont. A peat bog 8± miles S of Ottawa.

Merivale, Ont. SW of Ottawa, near Bells Corners.

Miami Ranger Station, Mariposa Co., Calif. Field Station of Pacific-Southwest

Forest and Range Experiment Station, in Sequoia National Forest just south of Yosemite.

Middle Gallatin Canyon, Wash. Unknown. Possibly Montana, 35± miles S of Bozeman, *teste* R. H. Foote.

Middle Mt., Va. A former post office in Craig Co., 7± miles N of Newcastle.

Middlesex Fells Reservoir, Mass. 3± miles S of Wakefield, in Middlesex Co.

Mile 315 on Richardson Highway, Alaska. Between Big Delta (Mile 277) and Fairbanks (Mile 368).

Miller Lake, Ont. 45± miles NW of Owen Sound, near tip of Bruce Peninsula.

Mill Gulch, Colo. On South Platte River, 12± miles S of Fort Logan on Colorado and Southern Railroad, in Jefferson Co.

Millsville, Nova Scotia. SE of Pictou.

Milnet, Ont. NW of Lake Nipissing on Canadian National Railroad.

Miners Bay, Ont. 44± miles N of Lindsay, on Gullfoot Lake.

Mobert, Ont. 2 miles E of Regan, which is 21 miles W of White River on Canadian Pacific Railroad.

Mokel Hill, Calif. "Unfortunate abbreviation used by some collectors, especially F. E. Blaisdell, for Mokelumne Hill in Calaveras Co.," *teste* P. D. Hurd.

Mono National Forest, Calif. = Inyo-Mono National Forest or Toiyabe National Forest. Formerly in Mono and Alpine Cos., Calif., and western Nevada.

Moores Lake, Idaho. Unknown.

Mooresville, Pa. Probably the same as Mooreville = Neff's Mills, 15± miles N of Huntingdon, *teste* A. B. Gurney.

Moose River Crossing, Ont. Crossing of Ontario-Northland Railroad over Moose River, south of James Bay.

Mormon Gd., Blue Mts., Oreg. Probably = Mormon Guard Station at Mormon Flat, which is 35± miles NE of Enterprise in Wallowa Co.

Moss Pond, Essex Co., N. Y. Unknown.

Mountain Home, San Bernardino Co., Calif. Probably at Mountain Home Creek, 15± miles S of Big Bear Lake near town of Forest Home.

Mount Alto, Pa. 8± miles N of Waynesboro, *teste* A. B. Gurney.

Mt. Ascutney, Vt. 5± miles S of Windsor in Windsor Co.

Mt. Baker, Wash. 25± miles E of Bellingham in Whatcom Co.

Mt. Blue, N. Y. 25± miles NW of Glens Falls in Warren Co.

Mt. Cadillac, Maine. In Acadia National Park on Mt. Desert Island.

Mt. Constitution, Wash. SW of Bellingham on Orcas Island.

Mt. Graybeard, N. C. Unlocated but in Buncombe Co.

Mt. Haystack, Vt. Two mountains with this name, one in Windham Co., the other in Orleans Co.

Mt. Jefferson, Oreg. 35± miles E of Madras, in Jefferson Co.

Mt. Lyall, Que. On the Gaspé Peninsula near headwaters of Cascapedia River.

Mt. Manitou, Colo. Unknown.

Mt. St. Helena, Calif. 12± miles NE of Healdsburg, in Sonoma Co.

Mt. Tamalpais, Calif. 2± miles W of Mill Valley, in Marin Co.

Mt. Yamaska, Que. 8± miles NW of Granby.

Muscatine, Pa. Unknown.

Mystery Glacier, B. C. On Mt. Waddington.

Navajo Lake, Utah. 20± miles SE of Cedar City, in NW corner of Kane Co., at 9127′, *teste* A. T. McClay.

Neel Gap, Ga. In Rabun Co.

Neuecest, Tex. Unknown.

Niagara Glen, Ont. Well known locally as tourist attraction, between Niagara Falls and Queenston, Ont., *teste* G. S. Walley.

Nicholson, Ont. 85± miles N of Sault Ste. Marie on Canadian Pacific Railroad, at 49°9′N, 83°8′W.

North Beach, N. Y. At southern end of Flushing Bay in Queens Co.

North Boulder Creek, Boulder Co., Colo. Rises near Bald Mt. and flows into Middle Boulder Creek, 7± miles W of Boulder.

North Cheyenne Canyon, Colo. Unknown. Cheyenne Canyon is 4± miles W of Colorado Springs, in El Paso Co.

Northern Pine Camps, Minn. Unknown.

North Park, Allegheny Co., Pa. 7± miles N of Pittsburgh, 3 ± miles S of Pennsylvania Turnpike.

North Powder Lakes, Oreg. It appears that a stream at one time called North Fork of Powder River is now called Anthony Fork. The lake from which it arises is Anthony Lake (= North Powder Lakes?).

Northville, Nova Scotia. 7± N of Kentville.

Norway, Ohio. Unknown.

Norway Bay, Que. 35± miles W of Hull, on Ottawa River.

Oaks, Va. E of Hunting Creek on bay off Potomac River, on Washington-Virginia Branch Railroad in Fairfax Co. (a rooming house where H. L. Viereck once stayed, *teste* W. S. Fisher).

Ogoki, Ont. 30± miles W of James Bay, a trading post on Albany River.

Old Speckled Mountain, Maine. 21± miles W of Rumford, in Oxford Co.

Oliver Lake, Ind. 3± miles N of Wolcottville, in Lagrange Co.

Ombabika, Ont. 20± miles NE of Lake Nipigon.

Onion Valley, Calif. Probably the place of this name in Plumas County 10± miles S of Quincy.

Orestum, Ont. Unknown.

Otter Lake, Que. 8± miles E of Fort Coulonge, at junction of roads from Kazabazua and Ladysmith.

Pacheco Pass, Calif. SE corner of Santa Clara Co., on California Route 152.

Palmerlee, Ariz. = Miller Canyon in SW Cochise Co., in Huachuca Mts., *teste* J. N. Knull. An old mining camp SE of Huachuca Peak also called Reef and Garces. Collecting locality of C. R. Biederman and Charles Schaeffer. Apparently not exactly synonymous with Miller Canyon, *teste* A. B. Gurney.

Pamelia Lake, Oreg. 28± miles SE of Mill City in Linn Co.

Paradise Key, Fla. 10± miles SW of Homestead at Headquarters of Everglades National Park or Royal Palm Ranger Station.

Parke Reserve, Kamouraska Co., Que. On route 51, 10± miles SE of St. Alexandre de Kamouraska, extending upstream from Rivière du Loup, south of the river, *teste* W. R. M. Mason.

Parr Island in East Spence Lake, Ont. Comprising about 12 acres just south of Picton, Ont. (East Spence Lake is called East Lake on maps at hand.)

Passage Creek, Va. 5± miles N of New Market Gap in Massanutten Mts., *teste* R. L. Hoffman.

Patrick(s) Creek, Calif. 40± miles W of Crescent City in Del Norte Co.

Pelvis, Wash. Unknown.

Penn Mines, Cascade Mts., Wash. Unknown.

Perrytown, Ont. Unknown.

Petawawa Reservation, Ont. Probably = Petawawa Military Camp, 12± miles N of Pembroke.

Phantom Valley, Rocky Mt. National Park, Colo. Dude ranch on west edge of Rocky Mt. National Park, 6± miles N of Grand Lake.

Philadelphia Neck, Pa. Unknown.

Pimmit Run, Va. Flowing into Potomac River at Chain Bridge (*q.v.*), Fairfax Co.

Pine Spring, Minidoka National Forest, Oneida Co., Idaho. In NW corner of Oneida Co. Minidoka National Forest is now incorporated in Sawtooth National Forest.

Pingree Park, Larimer Co., Colo. = Colorado A & M Forestry Camp, 13± miles N of Estes Park on South Fork of Cache le Poudre River.

Pioneer Basin, Fresno Co., Calif. On boundary between Fresno and Mono Cos. just N of juncture with Inyo Co., at 10,000 to 11,000′.

Pioneer Camp, Idaho. 17± miles SE of Arco, in Butte Co. The camp was where the railroad crosses Big Lost River.

Plant City, Ill. Unknown.

Pleasant Point, Nova Scotia. 22± miles E of Halifax, on coast.

Pohono Trail at 7,000 to 7,750′, Calif. Unknown.

Porcupine Ranger Station, Alta. Located about midway between Coleman and Fort McCleod, *teste* G. S. Walley.

Poudre, Colo. 4± miles NE of Fort Collins on Colorado & Southern Railroad, in Larimer Co., with mail service from Fort Collins.

Princeton Summit, 6000′, B. C. SW of Princeton near U. S.-Canadian boundary, *teste* G. S. Walley.

Puritas Springs, Ohio. In Cuyahoga Co., with mail service from Cleveland. (Now incorporated in the city of Cleveland.)

Putah Canyon, Calif. On boundary of Yolo and Solano Cos.

Pyziton, Ala. A misprint for Pyriton on some pin labels.

Raccoon Key, Fla. 22± miles NE of Key West, 2± miles NW of Big Torch Key, in Great White Heron National Wildlife Refuge.

Rainbow Lodge, Utah. Rainbow is in Uintah Co. at 39°51′N, 109°12′W, with mail service from Watson.

Ramapo Mts., N. J. NW of Oakland, in Bergen Co.

Red Deer Reservation, Man. On Red Deer River?

Red House Ranch, Eureka Co., Nev. Unknown.

Red Rock, Siskiyou Co., Calif. Unknown in Siskiyou Co.

Redwood Meadow, Tulare Co., Calif. At junction of Cliff Creek and Kaweah River at 6000′, in Sequoia National Park.

Regan, Ont. 21± miles W of White River, on Canadian-Pacific Railroad.

Rib Mountain State Park, Wis. 3± miles SE of Wausau.

Rich Mountain Summit, Ark. The community of Rich Mountain is in NW Polk Co., with mail service from Eagleton.

Rock Creek Ranger Station, Idaho. = Rock Creek Guard Station on Goose Creek drainage, in Cassia Co., Sawtooth National Forest (= Minidoka National Forest).

Rockland, Nova Scotia. 15± miles W of Kentville.

Round Pond Mt., Maine. Unknown. Round Mountain Pond and Round Pond are indexed and on maps.

Rudds Mills, Mich. Rudds is in Oakland Co., with mail service from Orion.

Runda, N. Y. Unknown.

Sabino Canyon, Ariz. 10± miles NE of Tucson, in Pima Co.

St. Martins Falls, Ont. On Albany River a few miles upstream from junction with Ogoki River.

Salines, Ont. Unknown.

Samuel Spring, Napa Co., Calif. 6± miles E of Pope Valley or 10± miles E of Callistoga, *teste* A. T. McClay.

San Antonio Canyon, Calif. 6± miles N of Claremont, running N-S on boundary between Los Angeles and San Bernardino Cos.

San Antonio Valley, Santa Clara Co., Calif. Unknown. San Antonio Creek in Sonoma Co. and San Antonio River in Monterey Co. are indexed and on maps.

San Bernardino Ranch, Cochise Co., Ariz. 15± miles E of Douglas. The San Bernardino Grant is in the San Bernardino Valley, in the extreme SE of the county.

Sandia Mts., N. Mex. 10± miles NE of Albuquerque, in Bernalillo Co.

Sardine Creek, Mono Co., Calif. Just east of Sonora Pass at 8000 to 9000′, *teste* J. A. Powell.

Sawmill Bay, N. W. T. On SE shore of Great Bear Lake, at approximately 67°N, 119°W.

Sawmill Flat, Wash. Sawmill Flat Camp is at junction of Bumping and Naches Rivers, east of Mt. Rainier in Snoqualmie National Forest.

Schnialls Ranch at 9000′, Colo. Unknown.

Sentenac Canyon, San Diego Co., Calif. Between Banner and Barrego, just NW of (into) Anza Desert State Park boundary, *teste* J. A. Powell.

Silver (Creek) Falls (State Park), Oreg. 12± miles SE of Silverton, in Marion Co.

Smoky Falls, Ont. 45± miles NE of Kapuskasing, at the terminus of branch line railroad at Mattagami River.

Snake Hill, N. J. A hill rising abruptly in Hackensack meadows west of Hoboken, in Hudson Co.

Snake River at Divide Creek, Idaho. Unknown.

Snow Crest Camp, Calif. 12± miles NE of Claremont in San Bernardino Co., near Cucamonga Primitive Area.

Sondrestrom Air Base, Greenland. On west coast of Greenland at 67°N, 51°W.

South Gloucester, Ont. 5± miles S of Ottawa.

South March, Ont. 7± miles W of Ottawa.

Spider Bay, Georgian Bay, Ont. In Parry Sound District, at approximately 45° 13′N, 80°08′W.

Spruce Top, Caroline, N. Y. "Probably one of the numerous hills around the town of Caroline. Most of these hills have names and some of them end in "Top," *e.g.*, Round Top. I can't find anyone who has heard of Spruce Top specifically," *teste* H. E. Evans.

Starrs Point, Nova Scotia. 10± miles E of Kentville.

Strawberry Lake, Oreg. 15± miles SE of John Day, in Grant Co.

Strawberry Valley, Utah. In Wasatch and Duchesne Cos. at 7500 to 8000′.

Stubblefield Falls, Va. Falls in the Potomac River, between Great Falls and Plummers Island.

Sugar, B. C. Unknown. Possiby near Sugar Lake, 35± miles E of Vernon.

Sumas Prairie, B. C. 5± miles W of Chilliwack, really a drained marsh area, *teste* W. R. M. Mason.

Summerdale, Calif. In Mariposa Co., with mail service from Sugar Pine.

Summerlea, Que. Unknown.

Summerville, Calif. "Sometimes spelled Somersville—the most popular one of which I am aware is located in the hilly country several (10±) airline miles south and slightly east of Pittsburg, Contra Costa Co. It is a 'ghost town' that thrived on mining up until the influenza epidemic of World War I, as a nearby cemetery plainly attests," *teste* P. D. Hurd.

Summit Camp, Lassen Co., Calif. 18± miles NW of Susanville on NW slopes of Antelope Mt., W of Eagle Lake.

Sunnyside Canyon, Cochise Co., Ariz. S of community of Sunnyside in extreme SW corner of Co.

Sycamore Flat, Ariz. Unknown.

Sycamore Island, Md. In Potomac River, below Great Falls and 3± miles above Chain Bridge (*q.v.*).

Table Rock State Park, S. C. 15± miles NW of Easley, in Pickens Co.

Tahquitz Valley, Calif. "= Tahquitz Valley, Mt. San Jacinto, Riverside Co.—a small mountain valley (extremely interesting biologically) situated at about 7000′," *teste* P. D. Hurd.

Tamarack Lake, Calif. "= Tamarack Lake, Eldorado Co., a locality favored by Prof. Essig in earlier days," *teste* P. D. Hurd. ¾ mile W of Upper Echo Lake.

Tanbark Flat, Calif. 6½ miles NW of Claremont, E of San Gabriel Reservoir in Los Angeles Co.

Targhee Pass, Idaho. 45± miles N of Ashton, at Continental Divide in Fremont Co.

Tea Lake, Ont. Unknown.

Telford, Que. = Fulford, a hamlet 5± miles W of Knowlton.

Thunder (Bay) Beach, Ont. At Fort William.

Timagami (Provincial Forest), Ont. 40± miles N of Sudbury.

Tolay Creek, Solano Co., Calif. Unknown.

Townesendville, Tex. Unknown.

Triangle Lake, Oreg. Unknown.

Turkey Run, Va. Flows into Potomac River, about 3½ miles above Chain Bridge (*q.v.*), from a source near Langley in Fairfax Co.

Twin Sisters, 10,000′, Colo. 6± miles NE of Longs Peak.

Union Cy., Wash. = Union City = Union, 8± miles N of Shelton, *teste* A. B. Gurney.

Veitch, Va. 1± mile S of Ballston, between Ballston and E. Falls Church in Arlington Co.

Waldo Canyon, Colo. The community of Waldo is in Fremont Co., with mail service from Howard.

Wallapai Mts., Ariz. = Hualpai Mts., SE of Kingman.

Warren Woods, Mich. 20± miles W of Niles, in Berrien Co.

Wats. Crossing, Calif. Unknown.

Watson, Utah. In Uintah Co., at 5,346′, 45± miles SE of Vernal, at 39°53′N, 109° 10′W.

Webster Grvs., Mo. This appears to be a serial numbering system that originated at an experiment station at Webster Groves, Mo., and is found on many labels with specimens from other, quite different, localities.

Welsford, Nova Scotia. 20± miles W of Kentville.

Wensley, Ont. 50± miles S of Pembroke.

Westhome, Mass. Unknown.

Weston, Nova Scotia. 2± miles N of Berwick.

White Cup Ranch, Elko Co., Nev. Unknown. Possibly = Wine Cup Ranch, 25± miles NE of Wells.

White Mts., N. Mex. "= Sierra Blanca and the elevated country immediately adjoining, including localities recorded as Eagle Creek, Rio Ruidoso and Ruidoso" cf. Scudder and Cockerell, 1902, *teste* A. B. Gurney.

Whiteside Mt., N. C. 5± miles NE of Highlands, in Mason Co.

Widdefield, Ont. 5± miles E of North Bay.

Widewater, Md. Section of old Chesapeake & Ohio Canal, ¾ mile below Great Falls on Maryland side of Potomac River.

Wildwood Canyon, Calif. 10± miles W and slightly S of Redlands in San Bernardino Co.

Wildwood State Park, N. Y. 7± miles NW of Riverhead on Long Island Sound.

Williams Canyon, El Paso Co., Colo. Williams Creek flows near Gardner, 27± miles NW of Walsenburg, and along it is presumably Williams Canyon. Williams Creek is in Huerfano Co.

Willis Mt., Va. Possibly near Willis in Floyd Co. or according to A. B. Gurney, near Curdsville in Buckingham Co.

Wilton, Oreg. In Crook Co., with mail service from Prineville.

Winnemucca Lake, Alpine Co., Calif. Just S of Carson Pass.

Wittfeld, on Indian River, Fla. Unknown.

Woodkill, Del. Unknown.

Woodworth's Lake, Ont. Unknown.

W. Springs, Idaho. Probably Warm Springs, of which there are several.

Yankee Bend, Sask. A local name for a region W of North Battleford and about midway between that place and Lloydminster.

A HOMONYM IN TEMNOSTETHUS
(HEMIPTERA: ANTHOCORIDAE)

While compiling material for a catalog on Anthocoridae of the world, the following homonym was noted: *Temnostethus crassicornis* Reuter [1875, Genera Cimicidarum Europae. Bihang till Kongl. Svenska Vet.-Akad. Handl., vol. 3, p. 64] described from Algeria, and *Temnostethus crassicornis* Wagner [1949, *Temnostethus crassicornis*, n. sp. (Heteropt. Anthocoridae). Entomon, band 1, heft 8, p. 183] described from Hungary. Although Reuter's species was transferred to the genus *Elatophilus* by Reuter [1884, Monographia Anthocoridarum orbis terrestris. Acta Soc. Sci. Fennicae, vol. 14, p. 619] the original combination preoccupies the specific name and Wagner's species must be renamed. I hereby designate **T. wagneri (nom. nov.)** for **T. crassicornis** Wagner.—FLORENCE A. RUHOFF, *U. S. National Museum, Washington, D. C.*

HESPEROCIMEX COCHIMIENSIS NEW SPECIES, FROM BAJA CALIFORNIA, MEXICO

(HEMIPTERA: CIMICIDAE)[1]

RAYMOND E. RYCKMAN[2] and NORIHIRO UESHIMA[3]

The name *Hesperocimex cochimiensis* is being proposed for the population of cimicids found parasitizing Purple Martins in the Cardon cactus belt of Baja California, Mexico. The species name *cochimiensis* is proposed as a memorial to the Cochimi Indian Nation which occupied most of Baja California; these hardy people became extinct subsequent to the occupation of their lands by a culture foreign to them. A detailed report of the ecology, distribution, taxonomy and cytotaxonomy of the genus *Hesperocimex* is in manuscript form and is to appear in the "University of California Publications in Entomology" series, University of California, Berkeley.

Hesperocimex cochimiensis was collected 28 miles south of Punta Prieta, July 2, 1957; 30 miles south of El Arco, July 4, 1957; and 45 and 9 miles northwest of San Ignacio, July 5, 1957. The first collection was in Baja California Norte and the latter three were from Baja California T. S. Each of the above collections were made from woodpecker nest cavities in the Cardon cactus, *Pachycereus Pringlei;* the host was the Purple Martin, *Progne subis.* The collectors were Raymond E. Ryckman, Dean Spencer, Albert E. Ryckman and Joseph V. Ryckman.

Table 1 is presented as a diagnostic description indicating the morphological differences between *Hesperocimex cochimiensis* and the other species of the genus.

Hesperocimex cochimiensis, new species
(Figure 1)

Body color light brown, (intermediate between golden *H. coloradensis* and dark brown *H. sonorensis*). Head, sparsely clothed with setae, width including eyes 0.73 mm.; interocular 0.58 mm.; length 0.66 mm. Antennal segments, (proximal to distal) 10:19:20:16; sparsely clothed with bristles. Tip of rostrum reaching anterior margin of mesosternum; rostral segments (proximal to distal) 15:13:15. Pronotum, width 1.03 mm.; length 0.42 mm.; lateral margins fringed with long bristles. Wing pads dark on proximal and distal surfaces, central area relatively light. Keel of metasternum triangular, length 0.25 mm.; greatest width 0.3 mm. Coxae separated (fore to hind) 5:17:22. Length of first pair of legs, femur 37; tibia 35; tarsi and claws 18;—second pair of legs, femur 40; tibia 44; tarsi and claws 25;—third pair of legs, femur 50; tibia 64; claws and tarsi 26; legs

[1]Collection of the specimens was made possible by a grant from the Associates of Tropical Biogeography of the University of California.

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possess stout bristles. Ostiolar peritreme or scent gland present. Abdomen, sparsely clothed with setae; long bristles on margin of abdomen, (first apparent segment to last) bristle numbers 4-3-2-2-2-2-2-2; number of bristles variable on other specimens; a few short bristles on dorsal abdominal surface. Organ of Ribaga located on anterior, lateral, ventral surface of right sixth apparent abdominal segment.

Allotype male similar to holotype female with the exceptions that the long bristles on the margin of the abdomen are more numerous; i.e., 7-4-3-3-2-3-merging to a brush-like condition on posterior abdomen; well developed tibial brushes are present on the inner aspects of the first and second pairs of legs. Male aedeagus straight as shown in Figure 1.

Holotype female (USNM No. 65009) and *allotype* male, collected 28 miles south of Punta Prieta, Baja California Norte, Mexico; July 2, 1957, to be deposited with the U. S. National Museum, Washington, D. C. The host was the Purple Martin, *Progne subis*. Paratypes have been designated from the original collections and the type colony.

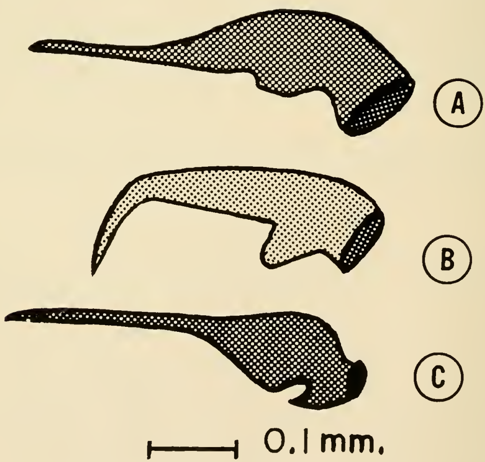

Figure 1. Aedeagi of Males of The Genus *Hesperocimex*. **(A)** Male aedeagus of *H. coloradensis* List, 1925. (Colorado); **(B)** Male aedeagus of *H. sonorensis* Ryckman, 1958. (Sonora, Mex.; type colony); **(C)** Male aedeagus of *H. cochimiensis* Ryckman & Ueshima, 1963, (Baja California, Mex.). The two sibling species, *H. sonorensis* and *H. cochimiensis* are readily separated by the curved aedeagi in males of *H. sonorensis*. Both of these species are readily separated from *H. coloradensis* because the latter is much larger and lighter in color. The illustrations in this figure are oriented as they would be seen in viewing the venter of males under a dissecting microscope. (The illustrations were made by Bioscope projection.)

Diagnostic Comparison of Hesperocimex Species

Species	Head Length ♀	Pronotum Width ♀	Body Color	Wing Pad	Male Genitalia	Hosts	Habitats	Chromosome Complement In The Male			
								2n	Autosome pairs	X Chromosome	Y Chromosome
H. coloradensis	0.74 mm.	1.60 mm.	light golden	pale	straight	Woodpeckers Purple Martins	Tree cavities	42	19	3 (small)	1
H. sonorensis	0.65 mm.	1.06 mm.	dark brown	dark	curved	Purple Martins	Saguaro cavities	42	20	1 (large)	1
H. cochimiensis	0.66 mm.	1.03 mm.	yellowish brown	proximal and distal portions dark	straight	Purple Martins	Cardon cavities	40	19	1 (large)	1

Paratypes are to be deposited with the California Insect Survey Collection of the University of California at Berkeley; the U. S. National Museum, Washington, D. C.; California Academy of Sciences, San Francisco, California; British Museum of Natural History, London, England and the Instituto de Salubridad y Enfermedades Tropicales, Mexico D. F., Mexico. Measurements were made with the aid of a dissecting microscope and an ocular micrometer; one ocular unit equals 0.0166 mm. Unless millimeters (mm.) are given, measurements are in ocular units.

BOOK REVIEW

Insect Pathology. Vol. I. Edited by Edward A. Steinhaus. Academic Press, New York and London, 1963. Pp. 661. Illustrated.

This book is the first of a two volume work that will be a comprehensive treatment of insect pathology. The first volume is composed of seventeen chapters, each by a different author. The entire volume was edited by Edward A. Steinhaus. The first chapter is an introduction by Steinhaus and sets the stage for the ensuing chapters. He defines in his first chapter the meaning of "insect pathology" as whatever "goes wrong" with an insect. This is the broadest interpretation of the word, for, as the next sixteen chapters indicate, this includes physical injuries, disorders brought about by chemicals, genetic diseases, and many other conditions that would cause abnormalities in insects. This first volume also includes discussions on viruses, rickettsiae, microorganisms in healthy insects and various inter-relations encountered in the study of insect pathology.

One helpful point in the format of the book is the outline that precedes each chapter. Each author has prepared a brief outline giving the subjects treated in his particular chapter. This helps the reader locate a particular point or subject and gives one a quick idea of the subject matter better than the table of contents. Each chapter is supported rather well with photographs and a list of references.

This book is indeed what it claims to be, an advanced treatise on insect pathology. It is not an elementary and basic text for beginning college courses. It will, however, be a valuable tool for the advanced student and researcher.—Floyd P. Harrison, *Department of Entomology, University of Maryland, College Park.*

THE ALTERNATE GENERATION OF HETEROECUS PACIFICUS (ASHMEAD)

(Hymenoptera, Cynipoidea)

Robert J. Lyon, *Los Angeles City College*[1]

Approximately 112 gall-making Cynipidae have been described from the Pacific Slope Region; however, there are still many undescribed species and the biology and life histories of the known species is largely incomplete. Cynipid life cycles are usually heterogonous, i.e. involve an alternation of generations. Such a cycle typically consists of a unisexual or agamic generation of females which develop in galls that often require many months to reach full maturity. The insects from these galls emerge in the early months of the year and parthenogenetically produce eggs which are oviposited into another part of the plant that is destined to develop rapidly in the spring. The spring gall, usually on the new leaves or staminate flowers, is generally quite different in appearance, matures in a period of a few weeks or months and produces a bisexual generation of males and females. These insects mate and the females in turn produce the galls characteristic of the agamic generation. Three of these alternating generations have been experimentally demonstrated in the past few years, Doutt (1959, 1960), Lyon (1959) and in addition, circumstantial evidence indicates the existence of alternating generations in the genera *Antron* and *Loxaulus*. Such genera as *Paracraspis, Trichoteras*, *Besbicus*, *Holocynips*, *Heteroecus* and *Disholcaspis* have been known from female insects only (Weld, 1957) and whether an alternate exists in these genera can only be determined by additional studies.

The genus *Heteroecus* was proposed by Kinsey in 1922 for eight cynipid species that formed galls on *Quercus chrysolepis* Liebm. in California (Weld: 1952). Kinsey stated at this time that field data would suggest that an alternate, bisexual generation did not exist in this genus; however, it can now be demonstrated that an alternate does exist in *Heteroecus pacificus* (Ashm.) and is probably present in other members of the genus as well. The galls produced by the members of the genus are among the most characteristic growths on *Quercus chrysolepis* and since the gall-makers are not difficult to rear, most of the larger entomological collections contain female *Heteroecus pacificus*, one of the most common species in the group. No males have previously been reared from any of the described species in the genus.

In 1958, the writer reared 246 cynipids, male and females, from a peculiar thorn-shaped gall growing on the leaves of *Quercus chrysolepis*. The gall itself had been collected before and was thought to have been produced by an undescribed species. Accordingly, a description was written and included with descriptions of several other

[1]The writer wishes to thank Lewis H. Weld of Arlington, Virginia for helpful suggestions concerning this paper. Thanks also to Gerhard Bakker, L.A.C.C. for the illustrations of the galls.

new species in a paper that was being prepared. Since the galls were growing in an easily accessible area and additional information on the biology of the insects was needed, publication of the paper was delayed. In the summer of 1961, these specimens were shown to Lewis Weld who pointed out that this was probably the alternating generation of a *Heteroecus* and suggested that the life cycle should be worked out. Since the only visible *Heteroecus* gall on these trees was *H. pacificus*, it was logical to attempt to link it with the new *Heteroecus*.

During the last two weeks of March and first three weeks of April 1962, large numbers of female *Heteroecus pacificus* were reared and released on young oaks growing in containers and also on the native trees from which the galls were obtained. The young oaks were seedlings grown from acorns and placed in individual, screened compartments. Cloth, mesh bags were used for the native trees and the wasps were placed singly in the bags. This was necessary in order to prevent the insects from killing the new growth through excessive egg deposition. The females were highly selective and carefully examined the various parts of the plant, invariably selecting new leaf buds that were almost ready to open. On native trees, the female wasps could be seen ovipositing in the leaf buds from April 1 until the middle of May. Galls began to appear on the leaves as early as April 15 and continued to appear throughout May. The new galls, as suspected, were the elongated, thorn-shaped growths that were previously thought to have been produced by a new species. This period of new gall growth on the native oaks was also a time of great activity for other insect types. Many of the galls were parasitized at this time and the inquilines or guests also entered the galls during the early stages of growth.

Description of Gall: (Fig. A) A conical, thorn-shaped, monothalamous or single chambered gall growing from the undersurfaces of the leaves. The leaf surface immediately above the gall is darkened and slightly depressed. Galls may occur singly or in groups or clusters that may be so numerous that the developing leaf is completely aborted with the resulting growths resembling twig galls. Often the new twigs are killed by heavy infestations. Development is quite rapid with the galls containing large larvae in late May and pupae in June. The young galls are pale red in color when they first appear but darken to deeper red or reddish-purple as they mature. Adults of both sexes begin to emerge the last few days of June and continue to appear until late July. Some of the gall clusters yield only males whereas others yield only females, indicating that certain gall clusters result from female wasps that lay eggs producing only the haploid males whereas others produce the eggs that develop into the diploid females. Male specimens outnumbered the females three to one. Preliminary evidence indicates that some female-producing gall clusters produce females with 13 antennal segments; others yield 14-segmented specimens. The genetic inheritance of this variation should be studied through experimental breeding.

The galls produced by the parthenogenetic or agamic generation show considerable morphological variation. Some are rather slender and elongated with a tapering point, whereas others are much more robust, with a shorter point. Using the shape of the gall as a primary distinguishing characteristic, Kinsey in 1922, described several varieties of *Heteroecus pacificus.* During the course of this study, females were obtained from galls that varied greatly in form (Figs. B, C, D). These galls were often on the same tree and sometimes on the same branch; however, in each instance the typical alternate generation was obtained. Some galls of *H. pacificus* are almost globular with little or no point whereas others are so slender that they resemble a thorn. These extreme variations were not numerous in the area that was used for this work, hence insects from these types were not used. It is significant to note that the extremely slender forms did not yield inquilines or guests whereas the more robust types housed *Synergus* which suggests that these inquilines influence the shape of the gall. It is hoped that future rearings and studies will help to clarify the taxonomy of this species.

Bisexual Generation

Females: Remarkably similar to the agamic females but smaller with the following differences: Color, rather uniform reddish brown, posterior margin of abdominal tergite II and other visible tergites dark brown like the ovipositor sheaths and the ventral spine. The agamic females are usually much darker and show great color variation ranging from light reddish brown to individuals that are almost chocolate brown. The antennae have 13 or 14 segments while the antennae of the agamic females possess 14 segments. Females which show only 13 segments invariably have a terminal segment that is twice as long as the preceding one, showing incomplete division of that segment. Sometimes the terminal segment will appear to be divided from the underside but undivided above. The wing veins of these females are light amber in color and the areolet is small whereas the agamic females have much darker wing veins and the areolet is larger and well-defined. The ventral spine is about one-half as long as the abdomen while in the agamic females it is not more than one-third the length of the abdomen. The range in length of 66 specimens was 2.2-2.8 mm. Average length 2.43 mm. Agamic females range from 2.8-3.7 mm. in length.

Males: Similar to females though smaller; head very dark, appearing almost black; parapsidal furrows more distinct in anterior part of the mesoscutum; antennae with 15 segments, terminal segments infuscated; wing distinctly ciliate with cilia on wing margin much

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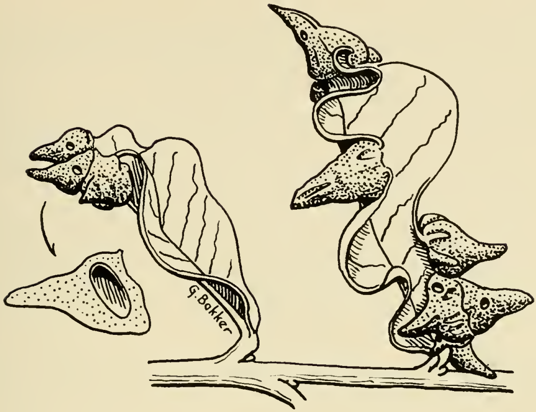
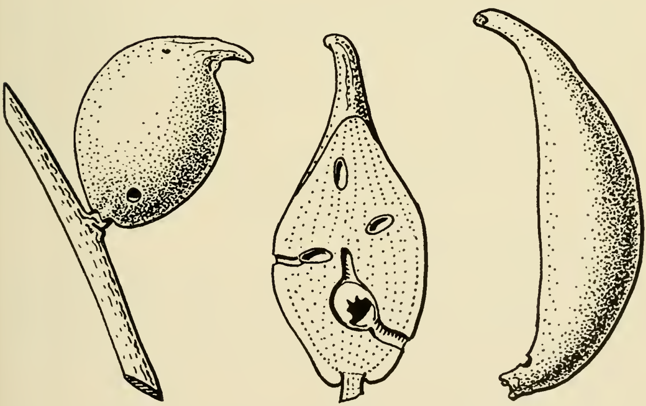
Fig. A. Leaf of *Quercus chrysolepis* Liebm. showing the thorn-shaped galls of the bisexual generation of **Heteroecus pacificus** (Ashm.) Gall measures 7 mm. in length; figs. B, C, D. Galls produced by the agamic or parthenogenetic generation of **H. pacificus** showing variation in form. Fig. C shows position of central cell occupied by the gall maker and also cortical cells occupied by *Synergus.* Range in length, 20-25 mm.



A



B C D

longer than in the female; tergites II and III are the only abdominal tergites visible in dorsal view, often tergite II is the only one visible. Range in length of 180 specimens 1.4-2.1 mm. Average length 1.8 mm.

Types: The types and ten paratypes are in the collection of the U. S. National Museum. Other paratypes are in the collections of the California Academy of Sciences, University of California at Los Angeles, and the Los Angeles County Museum.

Host: Quercus chrysolepis Liebm.

Habitat: The types were reared from galls grown on potted oaks in La Crescenta, Calif. Additional specimens have been reared from galls collected at Pasadena, Switzer's Camp, Mt. Wilson and Chilao in the San Gabriel Mountains of Southern California.

Summary: An alternate bisexual generation exists in the gall wasp *Heteroecus pacificus* (Ashm.) previously known from agamic females only. Heterogony has not previously been demonstrated in the genus *Heteroecus.* The gall produced by the alternating generation is a thorn-shaped, single-celled leaf gall that appears on the leaves of *Quercus crysolepis* Liebm. in late June and early July.

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SOCIETY MEETINGS

715th Regular Meeting, March 7, 1963

The 715th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on March 7, 1963 at 8 p.m. in the regular meeting room in the U. S. National Museum. Twenty-eight members and 8 guests were in attendance. Minutes of the previous meeting were accepted as read.

Three candidates were accepted to membership: *John M. Kingsolver, Frank R. Cole,* and *Jean R. Adams.*

F. L. Campbell reported that the Washington Academy of Sciences is initiating 2 membership categories. The fellows, which are equivalent to the old members, must show some attainment in science and will pay dues of $10 per year. The new category of member is open to anyone at the rate of $7.50 per year.

O. S. Flint reported the death of *Dr. Georg Ulmer* who died in his 86th year on January 15, 1963. He was a prolific worker on the Trichoptera, Ephemeroptera, and Plecoptera. His collection will go to the Hamburg Museum.

A B. Gurney noted the death of *Dr. Harry A. Allard* (Jan. 28, 1880-Feb. 25, 1963), of Arlington, Va., who retired in 1946 as a plant physiologist of the U. S. Dept. of Agriculture. He was distinguished as a co-discoverer of photoperiodism in plants, and known to entomologists for his collections of insects and studies of stridulation among Orthoptera and cicadas.

There ensued a considerable discussion of photoperiodism in insects and cicada songs by Wadley, Steyskal, and others.

George Steyskal mentioned that the famous dipterist *J. R. Malloch* died recently in Florida.

F. W. Poos circulated the recent book *Insects in relation to plant diseases* by Walter Carter, and mentioned that the March issue of American Home had an article by Cynthia Westcott in rebuttal to Rachel Carson.

Dr. Frances Ann McKittrick of Cornell University presented the evenings lecture on "The oviposition behavior of cockroaches: a comparative study." With the use of excellent slides she showed the primitive complex pattern of oviposition in certain roaches and the various modifications of this pattern in other roaches. She also discussed the pattern in relation to the structure of the oothecae, the water loss problem, and oviposition sites.

Visitors to the meeting who were introduced included Mr. Robinson and Mr. Moussa. The meeting was adjourned at 10 p.m.

OLIVER S. FLINT, JR., *Recording Secretary*

716th Regular Meeting, April 4, 1963

The 716th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on April 4, 1963, at 8 p.m. in the regular meeting room in the U. S. National Museum. Twenty-three members and thirteen guests were in attendance. Minutes of the previous meeting were accepted as read.

The composition of the picnic committee was announced: Ross Arnett, Mrs. Helen Sollers-Riedel, and Martin Jacobson.

Two candidates to membership were announced: *Harold Robinson*, and *John S. Buckett*.

Mrs. Snodgrass reported that the Snodgrass Memorial Fund now stands at $785.67, and that Dr. Snodgrass had donated his library and original drawings to the Smithsonian Institution where they are available for study by specialists. The publishers of Dr. Snodgrass' book *Principles of Insect Morphology* announced that a translation is being prepared for publication in Hindi.

Dr. Alexej B. Borkovec of the USDA Pesticide Chemicals Research Branch presented the evenings lecture on "Insect Chemosterilants." He discussed the various classes of chemosterilants in terms of their structure and relation to activity, the gross and molecular effects on the treated individuals, as well as the prospects and practical problems of this control method.

The meeting was adjourned at 10 p.m.

OLIVER S. FLINT, JR., *Recording Secretary*

PUBLICATION DATE

The date of publication of Vol. 65, No. 2 was July 22, 1963. The date of publication of Vol. 65, No. 3, will be found in Vol. 65, No. 4.

Vol. 65 DECEMBER 1963 No. 4

PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

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

PUBLISHED QUARTERLY

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

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PROCEEDINGS OF THE
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Vol. 65 DECEMBER 1963 No. 4

NEW SPECIES OF BANDAKIA FROM NORTH AMERICA
(ACARINA : MAMERSOPSINAE)[1]

DAVID R. COOK
Wayne State University, Detroit, Michigan

Cook (1961) described the first species of *Bandakia* from North America. The present study[2] treats three additional species, bringing the total known from the Nearctic Region to four species. One of the new species is phreaticolous, a member of the so-called "subterranean water" habitat. The remaining species were taken from surface water habitats.

The previously described members of the genus *Bandakia,* plus species of *Platymamersopsis* and *Mamersopsis,* possess a short, stocky palp, usually with well developed setal tubercles on the ventral side of P-IV. This palpal difference was the only character significant enough to justify separation of these genera from those of the family Anisitsiellidae. However, two of the North American species of *Bandakia* possess "anisitsiellid" type palps in which P-II and P-IV are relatively long and narrow, and in one species P-IV lacks setal tubercles. *Bandakia* differs from those genera now placed in the Anisitsiellidae in its possession of claws on the fourth legs, but both *Mamersopsis* and *Platymamersopsis* resemble members of the family Anisitsiellidae in lacking claws on the fourth leg. The nymph of *Bandakia* differs from the known nymps of the Anisitsiellidae in having two rather than three dorsal plates. However, nymphs of *Platymamersopsis* possess three dorsal plates (two anterior and one posterior) and resemble nymphs of the Anisitsiellidae in structure of the coxae and provisional genital field. Since there are no consistent differences which will separate the Mamersopsidae from the Anisitsiellidae, it is here proposed that Mamersopsidae be considered a synonym of Anisitsiellidae, but that the included genera be retained in the subfamily Mamersopsinae. In a study on African water mites now in press (but which may appear later than the present paper), the author suggested moving the systematic position of the Mamersopsidae next to the Anisitsiellidae. However, it now seems best to

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[1]Contribution no. 85 from the Department of Biology, Wayne State University.
[2]Supported by a grant (G-9042) from the National Science Foundation.

reduce the former to a subfamily under the latter. It is felt that the Psammotorrenticolinae, described by Angelier (1954) as a subfamily under the Mamersopsidae should remain as a distinct subfamily but shifted to the Anisitsiellidae. The family Anisitsiellidae would then contain four subfamilies, Anisitsiellinae Koenike 1910, Nilotoniinae Viets 1929, Mamersopsinae Viets 1914, and Psammotorrenticolinae Angelier 1954.

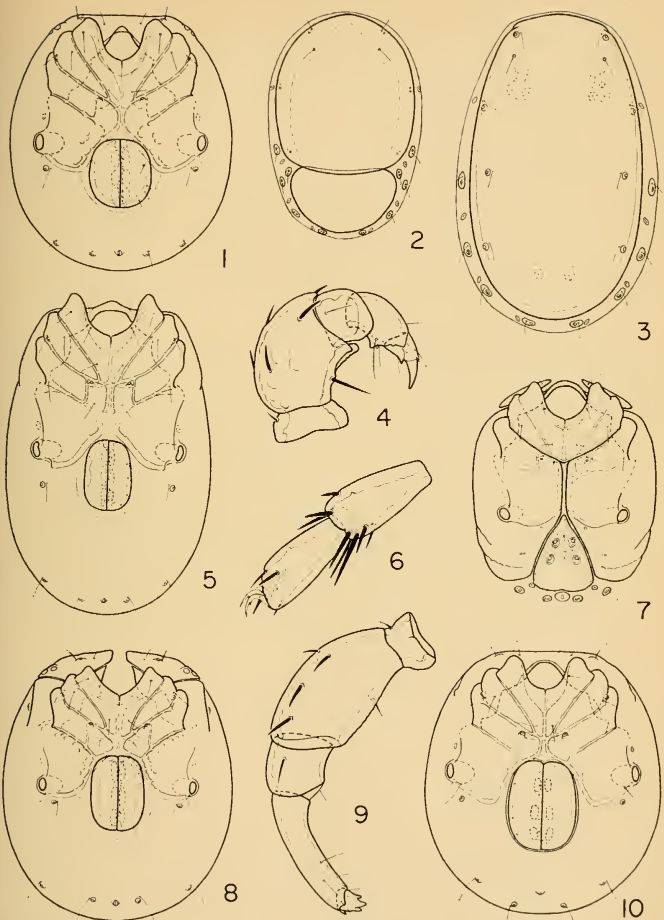
In presenting measurements in this paper, those of the holotype or allotype will be given first. Whenever a series of specimens are available, the range of size variation is given in parentheses following the measurements of the primary types. Holotypes and Allotypes will be placed in the Chicago Natural History Museum, Paratypes in the United States National Museum.

Bandakia similis new species
(Figs. 1, 4, 6, 12, 13, 15, 20)

Female.—Length of ventral shield 471μ (471μ-509μ), width 395μ (395μ-441μ); ventral shield oval, slightly concave at anterior end; numerous pores present; anterior portion of ventral shield not separated from remainder of ventral shield; first coxae fused medially, but with a well developed suture line between them; second coxae separated medially; capitular bay relatively wide and shallow; medial margins of third coxae rounded, and slightly separated; a suture line present on the third coxae slightly lateral to the gland opening; fourth coxae separated by the genital field; fourth coxae more or less rectangular (fig. 13); genital field 159μ (152μ-164μ) in length, 111μ (111μ-121μ) in width; three pairs of genital acetabula, these occupying most of the space along the medial margins of the genital flaps; anterior acetabula 33μ-38μ in length, middle acetabula 35μ-41μ in length, posterior acetabula 35μ-41μ in length; dorsal shield oval, slightly truncate at anterior end; dorsal shield 486μ (486μ-547μ) in length, 312μ (312μ-350μ) in width; dorsal shield bearing four pairs of glandularia and flanked by four pairs of glandularia platelets in the soft integument (fig. 20); color of dorsal and ventral shields a light purple.

Dorsal lengths of the palpal segments: P-I, 21μ (19μ-21μ); P-II, 83μ (80μ-83μ); P-III, 28μ (28μ-31μ); P-IV, 44μ (44μ-45μ); P-V, 35μ (33μ-36μ); greatest height of P-II, 55μ; ventral surface of P-II slightly concave, bearing a thickened seta 26μ (26μ-29μ) in length; anteroventral portion of P-II with a bluntly-pointed, distally-directed projection (fig. 4); P-IV with well developed setal tubercles on ventral side; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59μ (59μ-62μ); I-Leg-5, 66μ (66μ-69μ); I-Leg-6, 83μ (81μ-86μ); greatest height of I-Leg-6, 38μ (35μ-38μ); figure 15 illustrates the proportions and chaetotaxy of these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 76μ (76μ-80μ); IV-Leg-5, 83μ (83μ-90μ); IV-Leg-6, 83μ (83μ-90μ); IV-Leg-6, 83μ (83μ-96μ); figure 12 illustrates IV-Leg-5 and 6.

Male.—Length of ventral shield 395μ, width 350μ; ventral shield similar to female except that medial margins of third coxae are broader (compare figures 1 and 13) and the genital field is proportionally shorter; genital field 104μ in length, 93μ in width; dorsal shield 418μ in length, 266μ in width; dorsal shield similar to that of female.



Bandakia similis n. sp. Fig. 1, ventral view, male; Fig. 4, palp, female; Fig. 6, IV-Leg-5 and 6, male; *Bandakia anisitsipalpis* n. sp. Fig. 8, ventral view, female; *Bandakia elongata* n. sp. Fig. 2, dorsal shield, nymph; Fig. 3, dorsal shield; male; Fig. 5, ventral shield, male; Fig. 7, ventral view, nymph; Fig. 9, palp, female; *Bandakia vietsi* Cook. Fig. 10, ventral view, female.

Dorsal lengths of the papal segments: P-I, 19μ; P-II, 76μ; P-III, 28μ; P-IV, 43μ; P-V, 31μ; greatest height of P-II, 52μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 55μ; I-Leg-5, 59μ; I-Leg-6, 83μ; greatest height of I-Leg-6, 40μ; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 69μ; IV-Leg-5, 73μ; IV-Leg-6, 74μ; palp and first leg similar to female; fourth leg segments of male proportionally shorter and thicker than in female (compare figures 6 and 12).

Types.—Holotype, adult female, collected in seepage-wetted mosses on the sheer face of a cliff (on Highway 107 south east of Cashiers), Jackson Co., North Carolina, May 14, 1961. Water temperature 14°C.; Allotype, adult male, same data as holotype; Paratypes, one female, same data as holotype; one female, taken in a small reocrene spring near Peaks of Otter (at approximately Mile 85 on Skyline Drive), Bedford Co., Virginia, May 12, 1961. Water temperature 11°C., collection made in mosses on rocks.

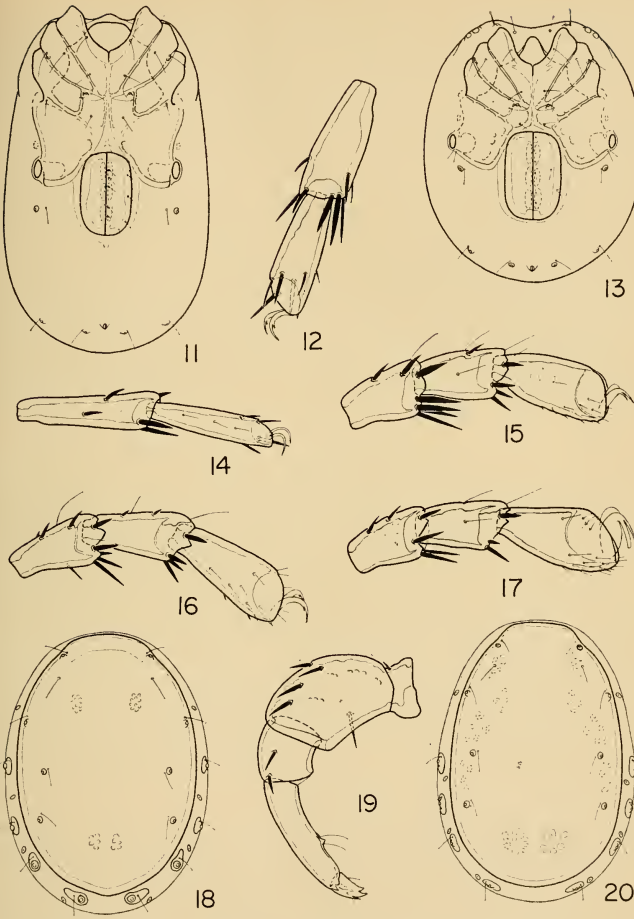
Discussion.—The present species possesses a "typical" mamersopsid palp (fig. 4) and therefore is most closely related to the European *Bandakia concreta* Thor and its subspecies, and to *B. vietsi* Cook, the latter known from Michigan. *Bandakia similis* differs from *concreta* in having a bluntly-pointed, distally-directed projection on the ventral side of P-II. The European species possesses a rounded hump on the ventral side of P-II distal to the insertion of the ventral seta. In the male of *similis*, the segments of the fourth leg are comparatively much shorter and thicker than in the male of *concreta*. The present species may be easily separated from *vietsi* by its comparatively long genital acetabula which occupy most of the medial margin of the genital flaps. In *B. vietsi* the acetabula occupy only a small portion of the medial margin of the genital flaps. Compare figures 10 and 13.

Bandakia anisitsipalpis new species

(Figs. 8, 17, 18, 19)

Female.—Length of ventral shield 525μ, width 449μ; ventral shield oval, with numerous, small pores; anterior portion of ventral shield separated into small right and left platelets bearing the lateral eyes and preocularia (fig. 8); a distinct ridge present on each side extending from the area of the lateral eyes postriorly to a line even with the anterior margin of the fourth coxae; first coxae touching medially, but with a distinct suture line between them; second coxae separated medially; capitular bay extremely shallow; medial margins of third coxae bluntly pointed and only slightly separated from each other; fourth coxae separated by the genital field; fourth coxae more or less triangular in shape; genital field 145μ in length, 104μ in width; three pairs of genital acetabula present, these occupying most of the space along the medial margins of the genital flaps; dorsal shield oval, slightly truncate at anterior end; dorsal shield bearing four pairs of glandularia; dorsal shield 516μ in length, 365μ in width; four pairs of glandularia platelets located in the soft integument near the periphery of the dorsal shield (fig. 18); dorsal and ventral shields purple.

Dorsal lengths of the palpal segments: P-I, 21μ; P-II, 91μ; P-III, 50μ; P-IV, 87μ; P-V, 24μ; greatest height of P-II, 57μ; ventral surface of P-II very slightly



Bandakia similis n. sp. Fig. 12, IV-Leg-5 and 6, female; Fig. 13, ventral view, female; Fig. 15, distal segments of first leg, female; Fig. 20, dorsal shield, female. *Bandakia anisitsipalpis* n. sp. Fig. 17, distal segments of first leg, female; Fig. 18, dorsal shield, female; Fig. 19, palp, female. *Bandakia elongata* n. sp. Fig. 11, ventral view, female; Fig. 14, IV-Leg-5 and 6, female; Fig. 16, distal segments of first leg, female.

concave, bearing a moderately developed seta; P-IV comparatively long and narrow, bearing small setal tubercles somewhat distal to middle of ventral side (fig. 19); dorsal lengths of the distal segments of the first leg: I-Leg-4, 57μ; I-Leg-5, 62μ; I-Leg-6, 83μ; figure 17 illustrates the chaetotaxy and proportions of I-Leg-4, 5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 86μ; IV-Leg-5, 97μ; IV-Leg-6, 95μ; well developed claws present at the tip of IV-Leg-6; swimming hairs absent.

Male.—Unknown.

Types.—Holotype, adult female, collected in a small stream near Bridal Veil Falls (on U. S. 64 northeast of Highlands), Macon Co., North Carolina, May 15, 1961. Water temperature 10°C., collection made in aquatic mosses covering the rocky bottom.

Discussion.—The presence of separate anterior platelets bearing the lateral eyes (fig. 8) will separate *anisitsipalpis* from all known species of *Bandakia*. The structure of the palp with its comparatively long and narrow P-IV is unique among the surface water inhabiting species of the genus. The phreaticolous species, *B. elongata* n. sp., possesses a somewhat similar palp (fig. 9) but the latter lacks setal tubercles on the ventral side of P-IV.

Bandakia elongata new species

(Figs. 2, 3, 5, 7, 9, 11, 14, 16)

Female.—Length of ventral shield 551μ (540μ-597μ), width 342μ (334μ-395μ); ventral shield elongate and oval, with numerous pores; anterior portion of ventral shield not separated from remainder of ventral shield; pigmented lateral eyes present; first coxae fused medially but with a slightly indicated suture line between them; second coxae separated medially; capitular bay relatively wide and shallow; medial margins of third coxae broad and almost touching each other; a suture line present on the third coxae slightly lateral to the gland openings; fourth coxae partially separated by the genital field; fourth coxae more or less triangular in shape (fig. 11); genital field 124μ (121μ-138μ) in length, 76μ (73μ-85μ) in width; three pairs of genital acetabula present, these occupying most of the space along the medial margins of the genital flaps; dorsal shield elongate and oval, slightly truncate at anterior end; dorsal shield bearing four pairs of glandularia; four pairs of very small glandularia platelets present in the soft integument near the periphery of the dorsal shield; integument without pigment, giving the animal a somewhat yellowish color.

Dorsal lengths of the palpal segments: P-I, 24μ (24μ-27μ); P-II, 125μ (107μ-133μ); P-III, 48μ (48μ-54μ) P-IV, 104μ (97μ-114μ); P-V, 21μ (19μ-28μ); ventral surface of P-II convex, bearing a small seta; P-IV comparatively long and slender, without setal tubercles (fig. 9); dorsal lengths of the distal segments of the first leg: I-Leg-4, 73μ (73μ-81μ); I-Leg-5, 83μ (83μ-87μ); I-Leg-6, 97μ (97μ-104μ); figure 18 illustrates the proportions and chaetotaxy of these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 90μ (90μ-97μ); IV-Leg-5, 107μ (105μ-114μ); IV-Leg-6, 93μ (93μ-100μ); well developed claws present at the tip of IV-Leg-6 (fig. 14); swimming hairs absent.

Male.—Length of ventral shield 494μ, width 342μ; ventral shield of male similar to female except genital field is proportionally shorter (fig. 5); genital field 104μ in length, 76μ in width; dorsal shield 486μ in length, 274μ in width; dorsal shield similar to that of female (fig. 3); integument without pigment.

Dorsal lengths of the palpal segments: P-I, 23μ; P-II, 114μ; P-III, 45μ; P-IV, 100μ; P-V, 23μ; dorsal lengths of the distal segments of the first leg: I-Leg-4, 69μ; I-Leg-5, 79μ; I-Leg-6, 87μ; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 86μ; IV-Leg-5, 97μ; IV-Leg-6, 88μ; proportions and chaetotaxy of palp and legs similar to female.

Nymph.—Length between anterior end of first coxae and posterior end of the provisional genital field 334μ, width of coxal area 319μ; first coxae fused medially, but with a distinct suture line between them; second coxae separated medially; third and fourth coxae separated medially; secondary sclerotization extending posteriorly from the fourth coxae to form a deep genital bay (fig. 7); suture line present on third coxae slightly lateral to the gland openings as in adults; provisional genital field triangular in shape, 111μ in length, 97μ in width; two pairs of genital acetabula present; provisional genital field bearing three pairs of small setae; excretory pore lying free in the soft integument immediately posterior to the provisional genital field; dorsal shield consisting of two plates, the anterior plate being the largest (fig. 2); dorsal shield 342μ in length, 232μ in width; anterior plate of dorsal shield 258μ in length; integument without pigment.

Dorsal lengths of the palpal segments: P-I, 17μ; P-II, 87μ; P-III, 35μ; P-IV, 76μ; P-V, 17μ; structure and proportions of palp similar to adults except seta on ventral side of P-II is absent.

Types.—Holotype, adult female, taken in a gravel bar in Ten Mile Creek (on U. S. 101, seven miles south of Yachats), Lane Co., Oregon, Aug. 13, 1961. Water temperature 14°C., bottom mostly rocks and gravel, with little vegetation present; Allotype, adult male, same data as holotype; Paratypes: three females, one nymph, same data as holotype: two females, collected in a sand bar in the Madison River (on U. S. 191 approximately four miles north of West Yellowstone), Gallatin Co., Montana, Sept. 1, 1961.

Discussion.—*Bandakia elongata* is most closely related to the species from the ground waters of Europe, *B. corsica* described by Angelier (1951) from Corsica. Viets (1953) proposed the name *B. speciosa* for the phreaticolous form from Germany. However, Schwoerbel (1959) has placed *speciosa* as a synonym of *corsica*. The North American species is similar in body proportions but differs from the European species in its possession of comparatively much longer and narrower palpal segments.

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THE HOST-PARASITE RELATIONSHIP OF XYLOCELIA VIRGINIANA ROHWER AND OMALUS INTERMEDIUS (AARON)

(HYMENOPTERA: SPHECIDAE, CHRYSIDIDAE)

There is a populous colony of the solitary, ground-nesting pemphredonine wasp, *Xylocelia virginiana* Rohwer, near the picnic table on Plummers Island, Maryland. Males frequent the foliage of a hop-hornbeam, *Ostrya virginiana* (Mill.) Koch, at the edge of the nesting site from late May to late June. For several years I have collected concurrently on this same foliage a number of males of the cuckoo wasp, *Omalus intermedius* (Aaron), and have suspected that *virginiana* served as the host for the chrysidid. Each of these wasps normally has only a single generation a year. However, I was never able to find *intermedius* females frequenting the nesting site, and, as a matter of fact, had never collected females of this species anywhere.

Early in the spring of 1963 I dug up two small areas in the *virginiana* colony site in an attempt to recover some wasp cocoons. The first digging on May 5 produced nothing. A second digging on May 12 yielded a single, light-tan, ovoid, silken cocoon (51263 A) 5 mm. long, at a depth of 2-5 cm. A female of *intermedius* emerged from this cocoon on May 23.

On June 16 I staked out several small areas containing nest entrances of *virginiana* females. I dug up two of these sites (61663 C, D) on July 21. In the 2-5 cm. layer I recovered two puparia of *Leucophora sociata* Meigen, an anthomyid parasite of *virginiana*, two cocoons containing resting larvae of *virginiana*, and one cocoon with a resting larva of *intermedius*.

There can be no doubt now that a host-parasite relationship exists between these two wasps. This is only the second published record for a species of *Omalus* parasitizing a ground-nesting pemphredonine wasp. The Peckhams (Bull. Wisc. Nat. Hist. Surv. 2: 104, 1898) recorded an *Omalus*, which was identified for them as *coruscans* (Norton), as a parasite of *Xylocelia americana* (Packard). It is probable that both of these wasps were misidentified specifically, but there is no reason to doubt the generic assignments. Other published host records establish that most species of *Omalus* parasitize twig- or wood-nesting pemphredonine wasps belonging to the genera *Stigmus*, *Pemphredon*, *Passaloecus* and *Diodontus*.

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MORPHOLOGY OF THE HEAD CAPSULE AND MOUTH PARTS OF CARYEDON GONAGRA FABRICIUS

(COLEOPTERA: BRUCHIDAE)

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INTRODUCTION

The general morphology of the different families of Coleoptera has been dealt with by Hayes (1922), Van Zwaluwenburg (1922), Korschelt (1923), Rivnay (1928) and Friend (1929). Some workers have made studies on the special structures of the order, like Sharp and Muir (1912), and Muir (1918) on the genitalia, Forbes (1922), and Graham (1922) on the wings, Stickney (1923) on the head capsule, Purthi (1925), and Tanner (1927) on the genitalia, and Williams (1938) on the mouth parts. But their work is too specialized in its scope to include the study of the coleopteran family Bruchidae. Thus, there is little work on the external morphology of bruchids save for a few scattered papers on the morphology of the male and female genitalia of a few species by Zacher (1930), Mukerji and Bhuya (1937), Mukerji (1949), Mukerji and Chatterji (1951), and Srivastava (1953). The present paper is a study of the morphology of the head capsule and mouth parts of *Caryedon gonagra*.

MATERIAL AND TECHNIQUE

The specimens of *Caryedon gonagra* were collected from the light domes along with other insects. They were preserved in 70% alcohol. For the detailed study, heads were severed from rest of the body and boiled in hot concentrated solution of potassium hydroxide till they were transparent. To study the various sclerites, dissections were made under a stereoscopic binocular microscope in a liquid medium with the help of two sharp needles. The different sclerites were stained in 1% solution of acid fuchsin and permanent mounts were made as usual. The figures were drawn with the help of a camera lucida.

HEAD CAPSULE
(Figs. 1 and 2)

The head is oblong, punctate, pubescent, strongly sclerotized and is capable of free movement. It is composed of several fused sclerites so that most of the sutures have disappeared. The mouth parts are of prognathous type. The posterior end is distinctly convex.

Dorsal aspect:—The dorsal surface of the epicranium can not be divided accurately into the recognized areas because of the absence of ridges and most of the sutures. The interantennal area is termed as frons. Due to the complete disappearance of the epicranial suture as in *Calopteron* and *Photinus* (Stickney, 1923), the frons is not delimited posteriorly. The posterior boundary of the frons is generally demarked by the arms of the epicranial suture, but when the latter is absent the posterior limits can be marked by drawing a line across the antennal fossae and at either end of this line another line drawn at an angle of 45 degrees represents the arm of the epicranial suture of its side. A well developed frontoclypeal suture or epistomal suture marks the anterior boundary of frons as in *Bruchus affinis* (Mathur and Dhadial, 1961). On the contrary Stickney (1923) did not observe frontoclypeal suture in any coleopteran heads studied by him. The frontoclypeal suture is slightly arched posteriorly and forms a corresponding ridge internally which serves as a brace between the mandibular articulations. From the lateral ends of this ridge in front of the antennae and near the dorsal articulations of the mandibles arise the anterior tentorial arms. The external pits of the anterior tentorial arms, the pretentorinae, lie in the lateral ends of the frontoclypeal suture.

Cephalad to frons and separated from it by the frontoclypeal suture is the clypeus. It is more or less rectangular sclerite slightly broader than long. There is a ridge running on the ventrolateral margins along the posterior two thirds of the clypeus. On either side, the posterolateral end of this ridge serves as the precoila with which articulates the dorsal articulatory process, the preartis, of the mandible of its side. There is no suture separating the clypeus into an ante- and a postclypeus.

Lateral to frons and in front of the emargination of the compound eyes are the genae. Each gena bears just cephalad to the compound eye an eleven segmented, serrate and hairy antenna. The antenna extends about two fifths of the length of elytra. The segments are longer than broad, increasing regularly in size from fourth segment onward. The antenna is expanded and compressed except the basal four joints. The fifth segment is noticeably more expanded apically than the fourth one. The first part of the antenna is the scape by which it attaches to the head, the second is the pedicel while the rest nine segments form the flagellum or clavola. The bulb of the scape fits into the antennal socket or antacava. There is no separate antennal sclerite or antennarium surrounding the antennal socket. A very small pivot-like process, the antacoila, or antennifer, represents the antennal sclerite. The antacoila fits into a slit at the base of the scape and helps in the free movement of the antenna. The base of each segment fits into the cavity found at the distal end of the preceding segment.

The area posterior to frons and between the compound eyes, is the vertex. The vertex is narrow at the anterior end and diverges posteriorly. It carries a median carina. The compound eyes are the most conspicuous structures of the head capsule and are located near the middle of the lateral margins of the head behind the antennae. They are convex, finely faceted and hardly emarginate. The emargination is less than one quarter of the entire length. There are no ocelli as in other beetles (Stickney, 1923). The vertex is not distinguished posteriorly from the occiput as the occipital suture is absent. However, the convex occiput is pinched off from the vertex by the lateral

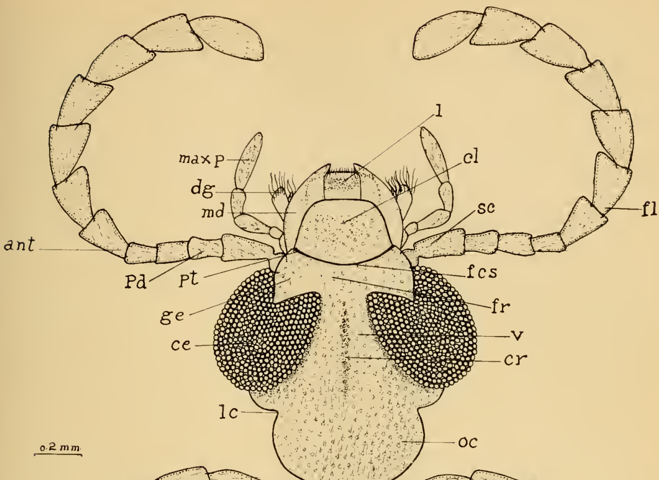

FIG 1

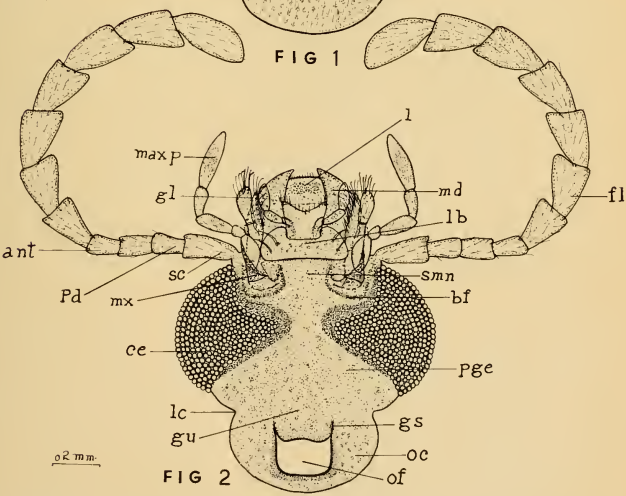

FIG 2

Fig. 1. Dorsal view of the head; fig. 2. Ventral view of the head.

constrictions present just caudad to the compound eyes. An imaginary line drawn across the two lateral constrictions represents the occipital suture. These constrictions merely mark the limits to which the head is telescoped into the prothorax in active state. The ventral fissure of Bridwell (1932), setting off the occiput from the vertex, is not observed here.

Ventral aspect:—The caudal end of the head is marked by the occipital foramen. The postocciput is hardly discernible and is nothing more than the slight thickness of the rim of the occipital foramen. The ventral part of this thickness forms internally a ridge on either side which can be termed as postoccipital ridge. From the distal ends of this ridge arise the posterior tentorial arms, their external pits, the metatentorinae, are not clearly marked externally. The cervix is attached to the occipital rim. The middle portion of the floor of the head capsule is formed by the gula. The gular sutures extend only up to a very short distance cephalad from the occipital foramen. Therefore, the rest of the gula is not demarked laterally from the epicranium. The gula extends forward between the compound eyes to receive the labium on its distal margin from which it is not separated by any suture, the gulomental suture being absent.

The portion of the epicranium laterad to the gula are the postgenae. The cephalic region of the postgena forms a U-shaped fissure, the buccal fissure (Bridwell, 1932). The inner arm of the "U" forms dorsally, the paracoila with which articulates the cardo of the maxilla by means of its cardocondyles. The laterocephalic end of each postgena bears a deep socket, the postcoila, into which fits the postartis of the mandible of its side.

Mouth Parts

(a) *Labrum:*—(Fig. 3) The labrum is an unpaired sclerite forming the roof of the preoral cavity. It lies ventral to the clypeus, therefore, the question of the presence of clypeolabral suture does not arise. According to Comstock and Kochi (1902) the labrum is the last in the series of unpaired sclerites between the epicranial suture and the mouth. The labrum is composed of two parts, the anterior antelabrum and the posterior postlabrum. The highly sclerotized antelabrum is nearly three times broader than long. Its distal margin is fringed with strong setae which are more long toward the lateral sides. The dorsal surface bears sparsely arranged setae. The antelabrum is the free and movable portion of the labrum and is not covered by the dorsally placed clypeus. The membranous postlabrum is completely covered by the clypeus.

From the middle of the caudal end of the antelabrum arises a thin Y-shaped ridge. It runs along the ventral surface of the postlabrum. Each arm of the 'Y' gives a lateral branch before it terminates which runs horizontally for some distance and then bends backward at right angles and continues as the marginal ridge. The marginal ridges guard the sides of the delicate postlabrum. On the ventral side between the arms of the Y-shaped ridge is a lobe-like structure, the epipharyngeal lobe with strong hairs. The epipharyngeal lobe represents the epipharynx.

(b) *Mandibles:*—(Fig. 4) The mandibles lie in front of and dorsal to the maxillae. They are highly sclerotized appendages capable of great freedom of movement both by the nature of their attachment and the possession of great adductor and abductor muscles.

The outer margin of each mandible is entire while the mesal or inner margin is differentiated into a distal mesally curved incisor lobe and proximal or basal molar mass provided with irregular, dentate and highly sclerotized surface. The incisor lobe forms the cutting organ whereas the basal molar mass forms an efficient grinder. The number and arrangement of incisors and molars are same in the right and the left mandible.

A membranous flap extends between the incisor and molar mass (Bridwell, 1932) of each mandible. Just in front of the membranous flap is a comb-like structure with thick hairs directed mesally. Dor-

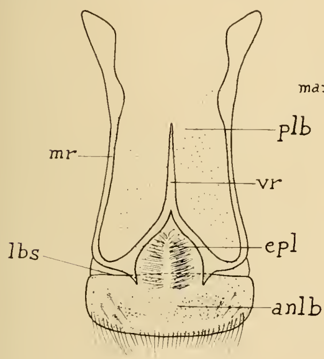

FIG 3

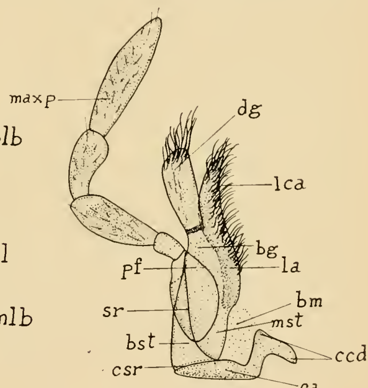

FIG 5

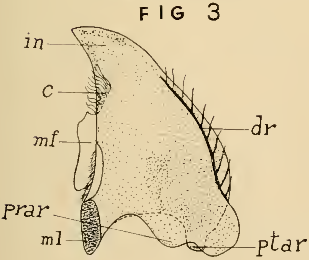

FIG 4

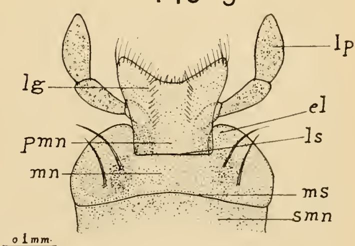

FIG 6

Fig. 3. Ventral view of the labrum; fig. 4. Dorsal view of the right mandible; fig. 5. Dorsal view of the left maxilla; fig. 6. Ventral view of the labium.

sally, along the outer margin of the mandible up to two thirds of the distance runs a ridge, the dorsal ridge. The dorsal ridge bears long bristles directed outwardly.

Each mandible articulates with the head capsule by two articulatory processes, a dorsal one, the preartis, which articulates with the precoila of the clypeus and a ventral one, the postartis, a well developed ocondyle which fits into the postcoila of the postgena. The preartis lies nearer to the postartis.

There are two large apodemes attached to the inner and outer angles of the mandibular base for the insertion of their respective muscles. The inner apodeme is the adductor apodeme and the outer one is the abductor apodeme.

(c) *Maxillae:*—(Fig. 5) The maxilla is regarded as the highly modified derivative of a walking limb. It consists of the cardo, stipes, palpifer, galea, lacinia and maxillary palpus. Each maxilla is articulated to the head capsule by its two cardocondyles. The space between the cardocondyles serves as a pivot against the paracoila. The cardotendons (Crampton, 1929b) or the promoter apodemes (Misra, 1945) are attached, one to the outer cardocondyle and two to the inner cardocondyle for the attachment of their respective muscles.

The cardo is an elongated structure which shows no division into basicardo and disticardo as in most of the other beetles (Williams, 1938). The distal portion of the cardo is placed horizontally at right angles to the stipes and the proximal part is deflected dorsally at right angles to the distal part. The cardo along with the proximal portion of the stipes takes more or less an U-shaped form which rests in the buccal fissure of the head capsule. The inner portion of the buccal fissure forms dorsally the paracoila with which articulate the cardocondyles of the cardo. The paracoila is not seen in the ventral view. The next division of the maxilla is the stipes. The stipes forms the major portion of the maxilla and is separated from the cardo by a transverse cardostipital ridge. It is composed of two sclerites, the basal triangular basistipes and mesal irregular mediostipes. An oblique stipital ridge very clearly demarks these two sclerites from each other. The dististipes, a small membranous area between the basigalea and basistipes, is absent. It is found to be present in many coleopteran beetles (Williams, 1938). Distal half of the stipes bears another distinct sclerite, the palpifer. The palpifer supports a four segmented maxillary palpus on its distal end. The first segment of palpus is the shortest of all and the terminal one is the longest. The palpus bears scattered setae. The mediostipes bears two distal lobes of the maxilla. The inner knife-like lacinia and the outer elongated galea. The distal and inner margins of the lacinia bear a row of long setae, the lacinarastra (Yuasa, 1920). The lacinia is demarked distinctly from the mediostipes, the former being more sclerotized. The galea is two segmented basal, the basigalea and distal, the distigalea. The distigalea as in *Silpha* (Williams, 1938) is tipped with long setae. The basigalea is small and is not distinguished from the mediostipes. Dorsally, the galea partially overlaps the lacinia. The basimaxillary membrane extends between the cardo and the mediostipes up to the base of the lacinia.

(d) *Labium:*—(Fig. 6) The labium forms the floor of the preoral cavity and lies in front of the gula between the maxillae. It is composed of the submentum, mentum, prementum, ligula (fused glossae and paraglossae), palpigers and labial palpi. Primarily the labium is divided into a proximal postmentum and a distal permentum, the line of division between the two being the labial suture. The mental suture demarks the distal sclerite of the postmentum as the mentum and the proximal one as the submentum. The gulomental suture which separates the submentum from the caudally placed gula is absent. Externally, the posterior boundary of the submentum is more or less arbitrarily marked by an imaginary line across the basal articulations of the cardines. The criterion of judging the posterior limits of the submentum by a line drawn across the gular pits does not apply in this case as the gular pits or the metatentorinae are not clearly seen. Moreover, their supposed position is near the occipital foramen whereas the cardines lie quite anteriorly. The basal articulations of cardines are more satisfactory landmarks for determining the posterior boundary of the submentum. The posterolateral areas of the submentum participate in the formation of inner arms of the buccal fissures.

The submentum is separated from the bilobed mentum by the mental suture. The mentum bears long bristles. It receives the prementum or eulabium of Crampton (1928) between its two lobes. The prementum is demarked from the mentum by a distinct labial suture. The palpigers are not distinguished from the prementum. Probably the fusion of the palpigers form the prementum. Ventrally, the prementum bears three segmented labial palpi on either side. The palpi bear sparsely arranged setae. The paraglossae and glossae have fused to form a bilobed ligula. The ligula is anterior most region of the labium. It bears setae of different sizes on its distal margin. The mental membrane of Williams (1938) is not seen here. It may be confluent with the mentum.

(e) *Hypopharynx.*—The hypopharynx is a thin membranous structure which remains closely applied to the dorsal side of the prementum and the ligula.

Tentorium

The tentorium is a U-shaped, thin and weakly chitinized structure. It is composed of the anterior tentorial arms and the posterior tentorial arms. Due to the fusion of the sclerites and absence of most of the sutures of the head, the tentorium is reduced in size. The anterior tentorial arms arise from the lateral ends of the frontoclypeal ridge, their pits, the pretentorinae lie in the corresponding suture. The long and thin anterior tentorial arms are posteriorly attached to the distal ends of the postoccipital ridge. The posterior tentorial arms unite to form a delicate transverse bar, the tentorial bridge. The external pits of the posterior tentorial arms, the metatentorinae, are not clear externally.

Summary

The present paper is a study on the morphology of head capsule and mouth parts of *Caryedon gonagra*.

The oblong, punctate, and pubescent head is composed of several fused sclerites so that most of the sutures have disappeared. The mouth parts are of prognathous type. The epicranial suture is absent. The frontoclypeal suture or the epistomal suture separates the frons from the anteriorly placed clypeus. The clypeus is not divided into an ante- and a postclypeus. The lateral margins of each gena bears an eleven jointed serrate antenna. The vertex bears a median carina. The compound eyes are very prominent and the emargination is less than one quarter of the entire length. There are no ocelli. The occiput is pinched off from the vertex by the lateral constrictions. The postocciput is hardly discernible. The gular sutures extend up to a very short distance cephalad from the occipital foramen. The cephalic region of the postgena forms a U-shaped buccal fissure with which articulates the cardo of the maxilla. The labrum is composed of an ante- and a postlabrum. A membranous flap extends between the incisor and molar mass of each mandible. The dorsal ridge bears long bristles. The cardo along with the proximal portion of the stipes takes more or less a U-shaped form and rests in the buccal fissure. The gulomental suture is absent. The thin membranous hypopharynx remains closely applied to the dorsal wall of the prementum and the ligula. The tentorium is a thin U-shaped structure.

Acknowledgements

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List of Abbreviations

anlb, antelabrum; ant, antenna; bf, buccal fissure; bm, basimaxillary membrane; bst, basistipes; c, comb-like structure; ca, cardo; ccd, cardocondyles; ce, compound eye; cl, clypeus; cr, carina; csr, cardostipital ridge; dg, distigalea; dr, dorsal ridge; el, epilobe; epl, epipharyngeal lobe; fcs, frontoclypeal suture; fl, flagellum; fr, frons; ge, gena; gs, sular suture; gl, galea; gu, gula; in, incisor; l, labrum; la, lacinia; lb, labium; lbs, labral suture; lc, lateral constriction; lca, lacinarastra; lg, ligula; lp, labial palpus; ls, labial sutre; max p, maxillary palpus; md, mandible; mf, membranous flap; ml, molar; mn, mentum; mr, marginal ridge; ms, mental suture; mst, mediostipes; mx, maxilla; of, occipital foramen; oc, occiput; pd, pedicel; pf, palpifer; pge, postgena; plb, postlabrum; pmn, prementum; prar, preartis; ptar, postartis; pt, pretentorina; sc, scape; smn, submentum; sr, stipital ridge; v, vertex; vr, Y-shaped ridge.

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A NEW GENUS OF CHYTODESMID MILLIPEDS FROM PERU[1]

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The milliped described below was represented in a collection of species taken by Plant Quarantine inspectors of the Agricultural Research Service, and sent to me for determination by Dr. Ralph E. Crabill, Jr.

The naming of a single species or even a genus from any tropical country contributes very little to an understanding of the total diplopod fauna of the region, and the recent series of papers on Peruvian millipeds by Chamberlin (1941, 1955) and Kraus (1954-60) give an indication of the profusion of Andean species. I am proposing the present new names because of an interesting structural departure which I do not know in any other known forms, and because of the opportunity to express an opinion on the family name Chytodesmidae, a group which has been disregarded by virtually all recent students of the Diplopoda.

Probolocryptus, new genus

Type species: P. krausi, new species.

Diagnosis: A chytodesmid genus characterized by the form of the paranota of segment 18, which are acutely produced cephalad while the caudal corners of these paranota, normally produced caudad in most polydesmoids, are rounded off completely. The partial coalescence of two of the posterior paranotal lobes of most segments appears to be also diagnostic. The gonopods bear a resemblance to those of *Docodesmus.*

Body composed of head and 20 segments, the collum enlarged to cover the head, its margin 12-lobed; paranota of 2nd segment larger than the others; body broad in proportion to length, the W/L ratio about 28 per cent. Surface of metatergites densely granular, most segments with four longitudinal rows each composed of two enlarged tubercules; on posterior segments a third tubercule is added to each series. Segment 19 reduced in size, its paranota narrow and without definite lateral and posterior sides; segment 20 small, partially concealed by 19th, the conic-rounded epiproct nearly hidden by two large paramedian tubercules. Ozopores tiny, difficult to observe, located near the center of the paranota of segments 5, 7, 9, 10, 12, 13, 15-19.

Legs relatively long and slender, not originating from elevated podosterna, their bases approximate, the sternal areas glabrous and unmodified. Stigmata tiny, round, without elevated rims. Neither anterior legs nor sterna specially modified in males. Vasa deferentia open through small pores flush with coxal surface, no produced seminal processes present.

Gonopod aperture large, transversely oval, the rim slightly thickened but not particularly elevated or flared, both anterior and posterior margins slightly produced at midline, causing a distinct median constriction of the opening. Gonopods large, the coxae produced mesiad and in contact over a short distance but not fused to any extent; ventral surface of coxae densely granulose-setose; no coxal

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apophyses developed. Telopodite consisting largely of a setose prefemoral region terminating distally in (1) a slender, simple, falcate branch and (2) a short, membranous, digitiform prefemoral process. No distinct femoral and tibiotarsal regions evident beyond prefemur, only a slender, simple branch which carries the seminal groove.

Sternum of 3rd segment of females with a simple, erect, thin crest concealing the bases of the second pair of legs.

Distribution: Peru.

Probolocryptus krausi, new species
(Figures 1-6)

Type specimens: Male holotype and female paratype, U. S. Nat. Mus. 2930, taken from an air shipment of bromeliads from Peru by Plant Quarantine inspector A. S. Mills at Miami, Florida. Precise origin of the shipment is unknown.

Diagnosis: With the characters of the genus; specific features probably occur in shape of the male gonopods and of the limbus.

Description of holotype: Adult male, 13.0 mm long, maximum width across metatergites 3.6 mm, with W/L ratio about 28 per cent. Body outline essentially parallel over segments 4-16, the widths of selected segments as follows:

Collum	2.4 mm	12th	3.4 mm
2nd	3.0	16th	3.3
4th	3.5	18th	2.9
6th	3.6	19th	1.5
8th	3.5		

Head (figure 1) reflexed caudoventrad, nearly horizontal, the vertex densely granulate, with deep median depression and pronounced supraantennal shelf on each side. Genae convex, not margined, both genae and frons smooth, setose. Clypeus smooth, distinctly elevated as a transverse facial ridge; labrum smooth, depressed, with 8 labral setae.

Antennae relatively long and slender for a cryptodesmoid species (fig. 1), all of the articles distinctly longer than broad, the 5th largest as usual in this group, all articles setose but none with evident sensory areas. Length relationships: $5 > 3 > 4 = 3 = 2 > 7 > 1$. Terminal sensory cones long and slender, widely separated basally.

Collum (fig. 2) distinctly broader than head, which it completely conceals. Upper surface irregularly granulate-tuberculate, the discal area convexly elevated; front and side areas depressed, paranota horizontal; anterior edge 12-lobed; caudal edge nearly straight, entire, with a small but distinctly elevated marginal ridge. Outline of collum subtrapezoidal, the sides convergent anteriorly, the front edge nearly transverse and with the incisions less distinct.

Segments 2-16 subsimilar: dorsum slightly arched, paranota broad and slightly depressed from the horizontal, each paranotum about as wide as diameter of body cavity. Metatergites very abruptly elevated above level of interzonal furrow and the following prozonite, this elevated surface wider distally than at its base thus forming an overhang at each edge. Surface of metatergites rough, not encrusted with earth particles, each segment with four longitudinal rows of two tubercules each, those of the paramedian series are set in a straight line; in the outer series the anterior tubercule is slightly laterad of the posterior. Surface of segments with numerous small conical granules between the seriate tubercules, these granules becoming larger and more conspicuous on the paranota. Interzonal furrow shallow but sharply defined, its surface smooth; surface of prozonites finely reticulate. Limbus (fig. 6) consisting of long, slender, digitiform lobes basally connected by minutely fringed webbing; each process contains a medial canal, often branched, each canal is tipped with a tiny globule (?secretion) where it meets the surface of the process.

Segments 15-19 becoming progressively narrower and more strongly ornamented dorsally. A third transverse row of tubercules is added on the caudal margin of the metatergites, this marginal row becoming elongate-conical and quite prominent on segments 18-19 (fig. 3).

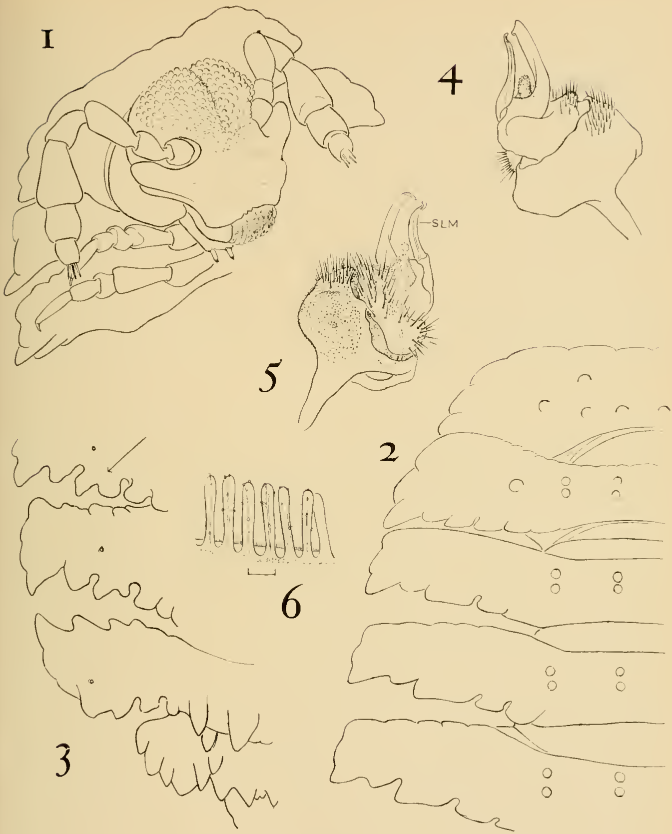
Paranota of 2nd segment largest, the anterior edge curved forward and slightly crenulate, posterior edge nearly transverse, 4-lobed, caudolateral corner prolonged conically. Paranota of most following segments transverse, narrower than the 2nd, and with the anterior margin becoming more distinctly lobed, posterior edge incised into four distinct lobes back to segment 17; of these lobes, the 2nd and 3rd are distinctly largest, and only partially separated from each other by a shallow notch, imparting a characteristic shape indicated by the arrow in figure 3. Paranota of segment 18 unusual in form, directed cephalad, and with the caudolateral corners rounded off so that both the corner and the 4th posterior lobe are missing. Lateral ends of most paranota indistinctly 3-lobed. Ozopores very small, difficult to observe, located at base of lobe 3 nearly at center of the dorsal paranotal surface (fig. 3).

Epiproct small, almost concealed by the projecting tubercules of segment 19, its dorsal surface produced into 6 large tubercules in a transverse row, the two median tubercules larger and projecting beyond apex of epiproct, latter rounded, with four terminal setae. Proctodeum everted and concealing appearance of paraprocts and hypoproct, but latter seems to be of normal polydesmoid form, a transversely elongate, convex plate, with distinct median apical projection.

Legs attached to elevated, contiguous, glabrous subcoxal swellings, no distinct podosterna formed. Legs long and slender, most of tarsus visible beyond ends of paranota when extended laterad; podomeres smooth, sparsely setose on ventral surfaces, the distalmost podomeres setose dorsally as well. Length relationships: $6 = 3 = 2 > 5 > 4 > 1$. No special lobes, hairs, or processes on any of the legs. Pleural surfaces of metazonites finely granular. Stigmata tiny circular pores, flush with surface, both located near upper end of anterior coxal socket, similar in size and shape.

Sternum of 2nd pair of legs fused firmly with pleurotergite of 3rd segment. Coxae without seminal processes, the vasa deferentia open through tiny round pores flush with the surface. Anterior legs and sterna unmodified.

Gonopod aperture large, transversely oval, extending laterad well beyond ends of coxal sockets of 7th segment, both anterior and posterior edges are slightly produced at the midline, causing a median constriction of the aperture. Gonopods relatively large, most of the coxae visible in situ, no particular sternal element present between them. Surface of coxae finely and densely granulate, the distal surfaces also densely setose. Telopodite set at end of coxa, essentially in the same plane with it. Prefemur setose as usual, about half the telopodite length, distally produced into a submembranous tuberculate process. Two distal elements beyond the prefemur, a slender, nearly straight, unbranched process carrying the seminal groove (fig. 5, SLM), and a parallel, slightly broader branch just laterad



Figs. 1-6. **Probolocryptus krausi,** new species. Fig. 1. Ventrolateral aspect of anterior end of body, showing head and first three body segments; fig. 2. Dorsal aspect of left side of first five body segments, to show relative size and shape of paranota, and major dorsal tubercules; fig. 3. Oblique dorsolateral aspect of posterior end of body, showing outlines of paranota 16-19, also a few of the larger dorsal tubercules. The arrow points out the peculiar, incompletely separated 2nd and 3rd lobes of the posterior paranotal margin; fig. 4. Left gonopod of holotype, oral aspect, tuberculation of coxa not shown; fig. 5. Left gonopod of holotype, aboral aspect. SLM: solenomerite; fig. 6. Portion of limbus from dorsal side of a midbody segment. The scale represents 20 microns.

to it, this branch may be a second prefemoral process, or might be interpreted as being femoral or postfemoral in its homology.

Dorsal surface of metatergites and vertex of head brownish-black. Prozonites, frons, clypeus, and dorsal tubercules whitish-pink. Legs testaceous to light brown. Paranota of segments 5, 7, 9, 10, 12, 13, 15-17 with a large, central whitish area just cephalad to the ozopore and thus roughly approximating location of the internal gland.

Female paratype: Slightly larger than male, width to 3.8 mm., but otherwise agreeing closely in structural details. Elevation of the clypeus not so pronounced as in the male, and body cavity slightly greater in proportion to total width across paranota. Segment 3 with a high, thin, median epigymal crest, its edge smooth and unmodified, this crest extends distad about halfway to end of the femoral segment of the 2nd legs.

Name: The generic name alludes to the anteriorly projecting paranota of segment 18, which so far as I know is unique to the present species. The specific name is proposed in recognition of the numerous contributions of my friend and colleague, Dr. Otto Kraus, the leading authority on Peruvian Diplopoda.

Classification

The correct systematic position of this genus is not easy to determine. Following the tradition of Attems, it would be placed in the "family" Cryptodesmidae, the limbo for all small polydesmoids with an enlarged flabellate collum. In my opinion, however, the group so defined is hopelessly heterogeneous, and should be dismembered into a number of smaller and more compact natural groups. Such a partition cannot, I think, be effectively achieved unless genera are compared and associated on the basis of all available characters, not merely isolated features such as gonopods, nature of the ozopores, shape of the epiproct, and so forth.

Beginning in 1896, O. F. Cook proposed a considerable number of family names for the so-called cryptodesmids, but owing to the very unsatisfactory original descriptions the Cook names have never been generally accepted. Only H. F. Loomis, in numerous papers on Neotropical forms, has followed Cook's classification. I have become convinced that Cook's families do represent natural and valid groups of genera; whether these groups should be regarded as families, subfamilies, or tribes is a subjective matter and of no real importance in the present state of our knowledge. What is important, I think, is that the groups appear to be homogeneous and made up of obviously related genera. This is much more than can be said for the systems proposed by other workers.

So far, the nominal families Cryptodesmidae, Decaporodesmidae, Stiodesmidae, Hercodesmidae, Chytodesmidae, Stylodesmidae, Peridontodesmidae, Eoromidae, and Ceratesmidae have been proposed for "cryptodesmoid" genera occurring in the New World tropics, most of the names authored by Cook.

The oldest name is Cryptodesmidae, proposed by Karsch in 1879 on the basis of an erroneous observation (the ozopores were thought to be absent). In his somewhat devious essay "Cryptodesmus and its allies" Cook (1896) narrowly limited the scope of the family, after having studied the original type of *Cryptodesmus olfersi* (Brandt) in the Berlin Museum. The following notes were given:

"The antennae are distinctly clavate; the first segment widely exceeds the head, and has the anterior edge even, but with a regular row of flattish granules just behind the margin all around; it is as wide as the second segment. Segments dorsally ornamented with three regular, transverse rows of small though distinct subconic granules, each provided with a hair; the lateral and posterior margins are sinuate-dentate. Pores of the usual distribution, distinct, submarginal, located near the middle of the lateral edge on anterior segments, more remote and farther back on posterior."

In a subsequent paper (1911) Cook published some additional notes on *Cryptodesmus*, and three figures drawn from the type of *olfersi*. Cook nowhere referred directly to the form of the gonopods in this genus, but on page 460 of his 1911 essay, there is an indirect statement that the coxae are not globosely enlarged to accommodate the telopodites as is the case of various other groups. But in emphasizing the close relationship of *C. olfersi* to another Brasilian species, *Aponus pusillus* (Attems), Cook provided a basis for comparison with forms in which the gonopods are now well-known. In recent years a number of additional genera and species have been described by Dr. Otto Schubart, these seem all to be confamilial with *Cryptodesmus* in the strict sense.

In my opinion, the family Cryptodesmidae can be recognized by the characters cited by Cook for *Cryptodesmus*, with the addition of the peculiar gonopods. The location of the ozopores in a normal, marginal peritrematic swelling appears to be a ready key character. I must agree entirely with the opinion of Cook that *Peridontodesmus* is quite closely related to *Cryptodesmus*, and doubt that the family name *Peridontodesmidae* can be defended.

The status of the other families mentioned above is much less easy to evaluate, particularly the four names Stylodesmidae-Hercodesmidae-Chytodesmidae-Stiodesmidae. The first was based upon the occurrence of ozopores upon long erect processes, the second was separated from the otherwise similar Stiodesmidae because of the concealment of the epiproct. Both of these two characters are now known to be very mutable, in fact the pores may be on stalks, or flush with the surface, or even absent, in species which are otherwise almost identical. In recent years I have published redescriptions of *Stylodesmus* and *Hercodesmus*, both African genera, but so far the characters of both *Chytodesmus* and *Stiodesmus* remain largely unknown, at least as regards the type species. Until this deficiency can be corrected, there seems to be little hope of putting the confusion to rights. I venture the opinion, however, that Cook's original groupings will be largely vindicated, and set forth below a list of the genera known to me which appear to form a natural group that can be designated by the name *Chytodesmidae*. In this case the group must be, for the time being, defined by the characters of its component genera, but this should provide no difficulty to workers familiar with Neotropical polydesmoids. The generic names are listed chronologically by date of publication, and each is followed by the name of the type species and its place of origin. The list obviously is incomplete, and perhaps one or two of the names might better be transferred out to a different family.

Chytodesmidae Cook, 1896

Chytodesmus Cook, 1896 [**laqueatus** Karsch, Cuba].
Tridesmus Cook, 1896 [**sectilis** Cook, Porto Rico].
Docodesmus Cook, 1896 [**vincenti** Pocock, St. Vincent].
Stictodesmus Cook, 1896 [**creper** Cook, Colombia].
Iomus Cook, 1911 [**incisus** Cook, Porto Rico].
?**Choridesmus** Cook, 1896 [**citus** Cook, Liberia, perhaps not chytodesmid].
Corypherepsis Attems, 1914 [**lacertosus** Brolemann, Venezuela].
Iomoides Loomis, 1934 [**hispidus** Loomis, Hispaniola].
Lobodesmus Loomis, 1936 [**granosus** Loomis, Hispaniola].
Cyphotylus Loomis, 1936 [**prolatus** Loomis, Hispaniola].
Coccoelasma Loomis, 1936 [**incisura** Loomis, Hispaniola].
Henicomus Loomis, 1941 [**septiporus** Loomis, Hispaniola].
Jeekelia Loomis, 1950 [**granulosa** Loomis, Hispaniola].
Liomus Chamberlin, 1950 [**albanus** Chamberlin, Porto Rico].
Tarmadesmus Kraus, 1959 [**azacurensis** Kraus, Peru].
Docodesmiella Loomis, 1961 [**insularis** Loomis, Panama].

Important substantiation to the validity of the foregoing group of genera is suggested by the geographic distribution: the northern Andean region and the West Indies. Species of the Chytodesmidae occur over almost the same areas as millipeds of the families Epinannolenidae, Stemmiulidae, Platyrachidae as well as various genera in other families, such as *Microspirobolus*. The relationship between various genera and particular geographic regions is so constant and pervasive, especially in diplopods, as to compel of itself a search for structural affinities even when these may be unsuspected. In the present case, species of the genera listed have ample similarity, even without the confirmation of occurring in a natural and cohesive distributional pattern.

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Cook, O. F. 1896. *Cryptodesmus* and its allies. Brandtia, no. 5, pp. 19-28 [contains the original diagnoses of Hercodesmidae, Chytodesmidae, and Stiodesmidae, and a redefinition of Cryptodesmidae, all are very brief and phrased in general terms only].

————. 1911. New tropical millipeds of the order Merocheta, with an example of kinetic evolution. Proc. U. S. Nat. Mus., vol. 40, pp. 451-473 [a number of disconnected short essays on the status of various Neotropical chytodesmid and cryptodesmid forms, interspersed with the diagnoses of a number of new species, two new genera, and a new family].

Loomis, H. F. 1936. The millipeds of Hispaniola, with descriptions of a new family, new genera, and new species. Bull. Mus. Comp. Zool., vol. 80, no. 1, pp. 1-191 [key to Hispaniolan polydesmoid families, page 78, separates the Eoromidae, Hercodesmidae, Stiodesmidae, and Chytodesmidae].

————. 1941. Millipeds collected in Puerto Rico and the Dominican Republic by Dr. P. J. Darlington in 1938. Bull. Mus. Comp. Zool., vol. 88, no. 2, pp. 17-80 [key, page 67, to the West Indian genera of Chytodesmidae, includes nine genera. Loomis is the only recent worker to consistently recognize Cook's family names].

NOTES ON AMERICAN MOSQUITO PUPAE. III. DESCRIPTION OF NEARCTIC SUBGENUS MANSONIA AND KEY TO ALL NEARCTIC SPECIES OF THE GENUS MANSONIA[1]

FREDERICK W. KUTZ *and* RICHARD F. DARSIE, JR.[2]

Mosquitoes of the genus *Mansonia* Blanchard are among the most fierce biters of all the mosquito pests (Pratt, 1953). Medically, *Mansonia perturbans* (Walker) has been incriminated as a vector of eastern encephalitis by Howitt *et al.* (1949), while Gilyard (1945) stated that *Mansonia titillans* (Walker) could be a possible vector of Venezuelan equine encephalitis. Therefore it is important to be able to recognize all stages of these important species, including the pupae, here described.

The objectives of this study are two-fold: (1) to completely describe the chaetotaxy and other taxonomic characters, *e.g.*, trumpet and paddle, of the pupae of the subgenus *Mansonia* Blanchard of the Nearctic region and (2) to formulate an identification key to all the Nearctic species of the genus *Mansonia*.

REVIEW OF LITERATURE

A partial description of the pupae of *Mansonia indubitans* (Dyar and Shannon) was published by Pratt (1945). In 1953 Pratt described three groups of *Mansonia* mosquitoes: the *indubitans* group, the *flaveolus* group and the *titillans* group. He included some information about the chaetotaxy of the pupae, but used only trumpet and paddle characters for the separation of major groups. Perez Vigueras (1948) presented a lateral drawing of the pupa of *M. titillans*, but no description of the chaetotaxy of the pupa was included. Darsie (1951) has published a complete description of *M. perturbans* and the reader is referred to this for limited information concerning the subgenus *Coquillettidia* Dyar. Lane (1953) characterized the pupae of the genus *Mansonia*, but included no description of the chaetotaxy.

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[2] Research Fellow and Associate Professor, respectively, Department of Entomology, University of Delaware, Newark. The junior author resigned September, 1962 and now is Malaria Specialist, A.I.D., U. S. State Department. The authors are indebted to Dr. Harold C. Chapman, of the U. S. Department of Agriculture, 5545 East Shields Ave., Fresno, Calif., for furnishing the pupal exuviae used in this study.

The revised system of nomenclature, which was set forth by Belkin (1952, 1953) and modified by Barr and Myers (1962), is used in this paper.

Pupal Characters of the Genus Mansonia

Edwards (1941) stated that the pupae of the geuns Mansonia (= *Taeniorhynchus* Lynch-Arribaezaga) are easily recognized by the special adaptation of the respiratory trumpet for piercing plants. He and also Lane (1953) specified that the dendritic tuft (seta 1) on abdominal segment 1 is absent, replaced by a simple seta. Characters on the paddle are also diagnostic. This organ is oblong to lanceolate, notched apically or medio-apically, and with small, irregular denticles on the margins (Edwards, 1941; Darsie, 1951).

The genus *Mansonia* is further divided taxonomically into four subgenera, two of which occur in the Nearctic region: *Coquillettidia* Dyar and *Mansonia* Blanchard. The subgenus *Coquillettidia* is characterized by having all abdominal setae weak and simple and in the Nearctic species by having seta 9 on the cephalothorax double, seldom single. The only species of this subgenus found in the Nearctic region is *M. perturbans*. The subgenus *Mansonia* is distinguished by having several setae on abdominal tergites II-VII long and stout and in the Nearctic species by having seta 9 on the cephalothorax single. The species of this subgenus found in the Nearctic region are *M. titillans* and *M. indubitans*.

Description of the Pupae

A dark-contrast phase, compound microscope was used to examine the pupal exuviae in this study, which were mounted in Canada balsam using the technique of Darsie (1951).

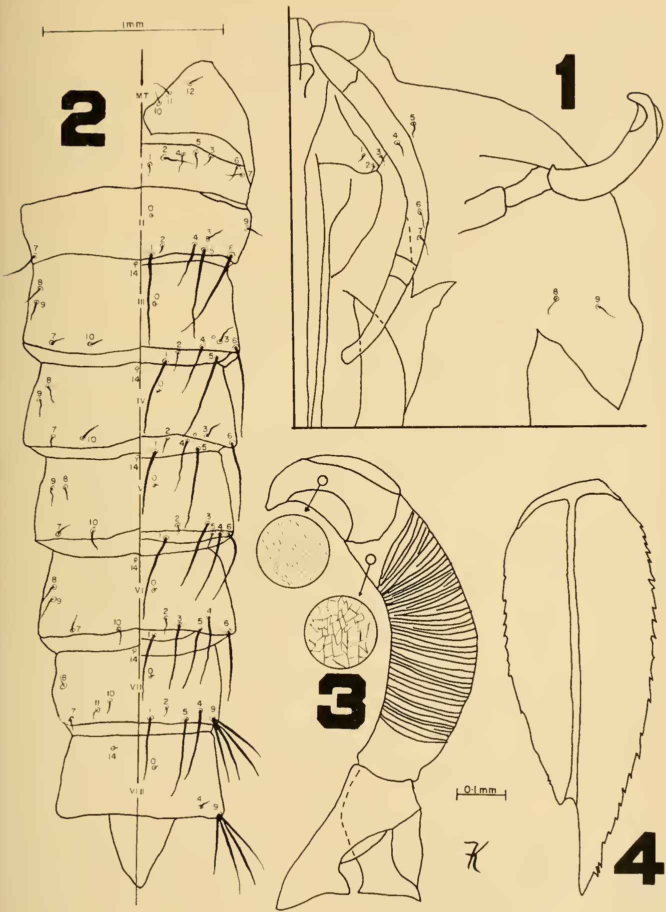
In order to give the reader an idea of the meaning of terms used in describing seta size, the following approximate measurements were used in the descriptions: minute—less than 5 microns, short—6 to 30 microns, medium—31 to 100 microns, and long—over 100 microns.

Mansonia (*Mansonia*) *titillans* (Walker)

Cephalothorax: (Figure 1) Full complement of nine pairs of setae present, all single. Setae 1, 2 and 3 short to medium; others, medium. *Trumpet:* (Figure 3) thick, length usually five or fewer times its greatest diameter, ranging from 4.75 to 5.2, average 4.8. Terminal portion with a pronounced hook. Trumpet three times or more as long as apical plant-piercing structure, ranging from 3.14 to 3.95, average 3.4.

Metathorax: (Figure 2) Three pairs of setae present and single. Setae 10 and 12 medium; seta 11 short to medium, less than one-half (one-sixth to one twelfth) as long as the anteroposterior length of abdominal tergum 1.

Abdomen: (Figure 2) All abdominal setae single with the exception of 9 on VII and VIII. Setae 0 minute on on II-VIII. Setae 1 medium on I; long and stout on II-VII. Setae 2 medium to long on I, thin, generally ¼ to ½ as long as the anteroposterior length of tergum I; medium on II-VII. Seta 3 medium on I, medium to long on II-IV; long, but not so stout on V and VI. Seta 4 medium on I and VIII; long, but not so stout on II-V; long and stout on VI and VII. Setae 5 and 6 medium on I; long and stout on II-VII, excepting 6



(Figures 1-4) **Mansonia titillans.** 1. Portion of the cephalothorax showing setae; 2. Metathorax and abdomen, showing dorsal setae right and ventral setae left; 3. Respiratory trumpet (Camera lucida); 4. Paddle (Camera lucida) (Authors' Coll. No. 1♂).

which is absent on VII. Setae **7** and **8** medium on II-VII. Seta **9** short on I-VI; long and stout, generally 2- to 3-branched (2-5) on VII; long and stout, usually 3- to 4-branched (2-4) on VIII. Seta **10** medium on III-VII. Seta **11** medium on VII. Seta **14** minute on III-VIII. *Paddle:* (Figure 4) lanceolate, pointed apically, shallowly notched medio-apically, margins irregularly denticulate; usually three or fewer times as long as wide, index ranging from 2.7 to 3.2, average 2.9.

This description is based on 2 ♀♀ collected at Boca Raton, Fla. and 1 ♂ from Okeechobee, Fla. (H. C. Chapman).

Mansonia (Mansonia) indubitans (Dyar and Shannon)

Cephalothorax: (Figure 5) Nine pairs of setae present, all single. Setae **1**, **2** and **3** short to medium; others, medium. *Trumpet:* (Figure 7) Long and not so thick, length usually six or more times its greatest width, ranging from 6.3 to 9.6, average 8.3. Terminal portion slightly curved, but without a pronounced hook. Trumpet 2.5 or fewer times as long as apical plant-piercing structure, ranging from 2.02 to 2.42, average 2.25.

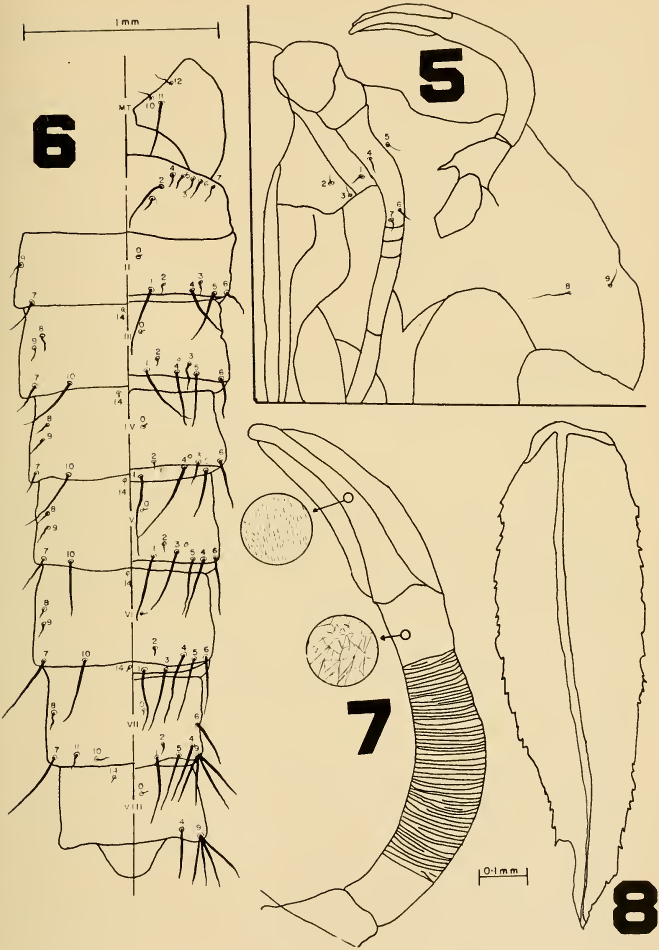
Metathorax: (Figure 6) Three pairs of setae present and single. Setae **10** and **12** medium; Seta **11** stout, long, subequal to the anteroposterior length of tergum I.

Abdomen: (Figure 6) All abdominal setae single with the exception of 9 on VII and VIII. Seta **0** minute on II-VIII. Seta **1** medium on I; long and stout on II-VII. Seta **2** long and stout on I, length subequal to the anteroposterior length of tergum I; medium on II-VII. Seta **3** short on I; medium on II-IV; long and stout on V-VII. Seta **4** medium on I; long and stout on IV-VIII; long, but not as stout on II and III. Seta **5** medium on I; medium to long on II; long and stout on III-VII. Seta **6** medium to long on I and II; long and stout on III-VI; present on VII, medium to long, single. Seta **7** medium to long on II-V; long and stout on VI and VII. Seta **8** medium on III-VII. Seta **9** short on I-VI; long and stout, generally 3- to 4-branched (2-4) on VII; long and stout, usually 4- to 5-branched on VIII. Seta **10** long and stout on III-V; medium to long on VI; medium on VII. Seta **11** medium on VII. Seta **14** minute on III-VIII. *Paddle:* (Figure 8) lanceolate, pointed apically, shallowly notched medio-apically, margins irregularly denticulate. Paddle usually three or more times as long as wide, index ranging from 2.9 to 3.8, average 3.4.

This description is based on 2 ♀♀ and 2 ♂♂ collected at Boca Raton, Fla. and 1 ♀ from Okeechobee, Fla. (H. C. Chapman).

Discussion

The pupa of *M. titillans* is characterized by its relatively short, thick, respiratory trumpet, which is five or fewer times as long as its greatest diameter, and terminates in a pronounced hook. The trumpet of *M. indubitans* is longer, not so thick, and the length is usually six or more times its greatest width. The terminal portion of its trumpet is slightly curved, but lacks a pronounced hook. The chaetotaxy of the two species differs in some respects. Seta 11 on the metathorax and seta 2 on abdominal segment I of *M. titillans* is short to medium, no more than half the anteroposterior length of tergum I. The same setae on *M. indubitans* are markedly longer, subequal to the anterposterior length of abdominal tergum I. Ventral seta 10 on abdominal segments III and IV on *M. titillans* is short, while the same seta is



(Figures 5-8) **Mansonia indubitans.** 5. Portion of the cephalothorax showing setae; 6. Metathorax and abdomen, showing dorsal setae right and ventral setae left (Authors' Coll. No. 2 ♀); 7. Respiratory trumpet (Camera lucida); 8. Paddle (Camera lucida) (Authors' Coll. No. 3 ♀).

long and stout on *M. indubitans*. Seta on abdominal segment VII is absent on *M. titillans*, whereas it is present and medium to long on *M. indubitans*, occurring dorsolaterally on the segment and medio-anterior to seta 9.

Key to the Pupae of the Nearctic Species of the Genus Mansonia

1. All abdominal setae weak and simple, seta 9 on the cephalothorax double, seldom single (Subgenus **Coquillettidia**) .... **perturbans** (Walker)
   Abdominal segments II-VII with some long, very stout setae dorsally, seta 9 on the cephalothorax single (Subgenus **Mansonia**) 2
2. Trumpet thicker and not so long, length usually less than six times its greatest width, terminal portion with a pronounced hook; seta 6 on VII absent; seta 11 on the metathorax and seta 2 on abdominal segment I short to medium, no more than half the length of abdominal tergum I; ventral abdominal seta 10 on III and IV short .... **titillans** (Walker)
   Trumpet longer and thinner, length at least seven or more times its greatest width, terminal portion without a pronounced hook; seta 6 on VII present, medium to long; seta 11 on the metathorax and seta 2 on abdominal segment I long, subequal to abdominal tergum I; ventral abdominal seta 10 on III and IV long and stout .... **indubitans** (Dyar and Shannon)

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OBSERVATIONS ON HISTIOSTOMA GORDIUS (VITZ.) (ANOETIDAE) AND OTHER MITES ASSOCIATED WITH IPS BEETLES[1,2]

Preston E. Hunter *and* Robert Davis[3]

The mites associated with bark beetles of the genus *Ips* have not been extensively investigated. An indication of the biological importance of some of the mite species associated with these beetles is shown by the work of Leach *et al.* (1934) and by Lindquist and Bedard (1961). Leach *et al.* reported that the mites associated with *Ips* beetles were important in the dissemination of blue-staining fungus; however, the mites involved are not known, as neither a family or species name was given. Lindquist and Bedard studied four species of *Tarsonemoides* (Tarsonemidae) mites associated with *Ips* beetles on the West Coast and found that the female mites were predators on *Ips* eggs.

Other than the above studies, very few papers have been published on the mites associated with *Ips* beetles in North America. Ewing (1939) described a Tarsonemidae mite taken from *Ips* beetles from Idaho, but Lindquist and Bedard found Ewing's species to be a complex of at least four species. An anoetid mite, *Histiostoma gordius* (Vitz.), originally described from *Ips* beetles from Europe, has been collected in the United States on *Ips* from Virginia and Florida (Hughes and Jackson, 1958).

The present paper reports the results of a study of the mites associated with some *Ips* beetles from the Southeastern U. S., primarily from Georgia. Biological studies of *Histiostoma gordius* are also given.

The three species of *Ips* occurring in Georgia are *avulsus* (Eichh.), *grandicollis* (Eichh.) and *calligraphus* (Germ.). Adults of all three species were obtained in large numbers for this study by collecting them from under the bark of pine logs, and by bringing infested pine bolts into the laboratory and collecting the emerging beetles. The beetles were checked under a microscope and, for those beetles with mites, the kind, developmental stage, number, and place of attachment of the mites were recorded. Collections of mites were also made from the tunnels of *Ips* beetles by bringing infested pine bolts into the laboratory and checking the tunnels and their contents for mites. Pinned specimens of the local species and other species of *Ips* in the University of Georgia Department of Entomology Insect Collection were also checked for mites.

Six species of mites, representing six families were recovered from eight of 14 species of *Ips* beetles examined. The mite species, the developmental stages found on the beetle, and the host beetle and collection locality are given in Table 1. Two specimens of *Cheyletia*

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virginiensis Baker were found on *Ips* beetles that emerged from pine bolts held in a cage in the laboratory. This mite species was not included in Table I since it is not known if the mite is an inhabitant of the beetle tunnels, or if it was brought in with the bolts and attached when the beetles were on the floor of the cage. On the several hundred *Ips* beetles checked, only two specimens of this mite were found. In its original collection (Baker, 1949), this mite was associated with *Dendroctonus frontalis* Zimm.

Tarsonemidae

Specimens of the species representing this family were sent to Dr. E. E. Lindquist, who kindly compared them with the *Tarsonemoides* species he described from West Coast *Ips* beetles. Dr. Lindquist stated (personal communication) that the specimens represented an undescribed species of the *Tarsonemoides confusus* group. In our biological observations, it was noted that the *Tarsonemoides* mites were often seen at the entrance holes to the *Ips* tunnels and were also found in the frass material pushed out of the tunnels by the adult beetles, particularly in frass from *I. avulsus* tunnels.

The *Tarsonemoides* mites usually attached in the elytra declivities of the beetles and were found about evenly distributed on the two elytra. These mites were not easily dislodged from the beetle and could be found on pinned museum specimens.

Pyemotidae

It was not possible to associate the *Pygmephorus* mite with a known species, and it probably represents an undescribed species.

The *Pygmephorus* mites attached by their strongly developed first pair of legs to the setae between the beetle's first and second pairs of legs. Specimens of this mite were taken only from living beetles. General observations indicated that almost all beetles from some logs would have these mites while they would be absent on beetles from other logs.

Uropodidae

The uropodid nymphs taken from *Ips* beetles were attached by an anal pedicel to the elytrae declivities. These are large mites, when compared to the beetles, and usually never more than 2-3 nymphs were found per beetle. They were present on a rather small percentage of the beetles collected.

Ereynetidae

Not all of the mite species listed in Table I attach firmly to the *Ips* beetles. The *Ereynetoides* species collected was rather common in old beetle tunnels but was only rarely found on the beetles. The species collected here is undescribed and will be described in a later paper by the senior author.

Digamasellidae

One species of Digamasellidae, a *Dendrolaelaps* species, was taken from the beetles. This species appears identical to the illustrations of *D. quadrisetus* (Berlese) given by Hirschmann (1960) and is listed by him from *Ips* and other bark beetles.

Only nymphs of this mite were taken from the beetles but adult mites were found in the beetle tunnels. The nymphs do not actually attach but rather cling to the *Ips* beetles. These mites are easily dislodged and will readily move from one part of the beetle to another when disturbed. They are quite common, sometimes with 4-6 mites per beetle on living beetles but they usually fall off when the beetles are killed. When these mites were confined with mite-free beetles in frass material, the mites would very quickly climb onto the legs of moving beetles and then move to other areas of the beetle's body. Although the mites would often crawl under a non-moving beetle, possibly to get out of the light, they were never seen going onto a beetle that was not moving.

Anoetidae

Histiostoma gordius (Vitz.) was the only Anoetidae species found on the beetles examined; however, this was the most commonly found and abundant mite on the *Ips* beetles. Only the hypopi were found on the beetles and these attached primarily in the elytral declivity. Occasionally hypopi were found attached to the dorsal surface of the elytra or to the thorax. In the elytral declivity the mites were usually about equally divided on the two elytra. The hypopi, which attach by their suctorial plate, are not easily dislodged and commonly remain attached to beetles killed in cyanide jars.

The different species of host beetles carrying *H. gordius* hypopi are listed in Table I. These seven species are rather scattered geographically; however, some of the species studied do have overlapping ranges (see Chamberlain, 1939).

Biological investigations of the association between this mite and the three *Ips* species occurring in Georgia were undertaken to obtain information on the probable food, where mite development occurs, and when the hypopi attach to the beetles. *H. gordius* was reared in the laboratory using plastic dishes containing a charcoal plaster-of-Paris substrate. Strips of pine phloem and *Ips* beetles with hypopi attached were put in the dishes. A high relative humidity was maintained by adding a few drops of water to each dish. In later work mites were reared using a rather dry *Drosophila* larval medium.

Mite reproduction occurred in the plaster-of-Paris dishes; however, large populations never developed under these rearing conditions. It was not necessary to have a beetle in the dish for reproduction to take place. Rearings using the *Drosophila* larval medium were quite successful if the yeast growth on the surface of the medium was not too heavy so that the mites did not become trapped in a slime layer. These rearings indicate that the mites are probably yeast or fungus feeders.

Investigations were carried out to determine where *H. gordius* was found in nature by checking the adult and larval *Ips* beetle tunnels. This mite was found in the beetle larval tunnels and pupal chambers only in cases where the log had decayed to the extent that the bark had separated from the wood, allowing the mites to move freely over the surface of the wood. Under such conditions hypopi were found attached to *Ips* beetles and in addition to clerid beetle larvae, curculionid beetle larvae, nitidulid beetles, uropodid and *Dendrolaelaps* mites, and occasionally to dipterous larvae.

When the bark was still tight on the log or tree *H. gordius* was restricted in its distribution under the bark. Under these conditions *Ips* pupae were consistently free of hypopi and hypopi were not found in the larval tunnels, pupal chambers or adult tunnels when the tunnels were clear of frass. Developmental stages of the mite were often found in tunnel areas packed with frass and having a whitish fungus or yeast growing between the frass particles.

Examination of *Ips'* entrance holes, vent holes, and emergence holes on logs with tight bark often revealed hypopi in the bark crevices immediately around the holes as well as on the walls of the holes. When *Ips* infested logs were held in the laboratory in large glass jars, hypopi of *H. gordius* were found in frass collected from the bottom of the jars, although no beetles had emerged from the logs. Apparently some hypopi around the entrance holes were dislodged and pushed out with the frass material. When the beetles were put in petri dishes containing this frass material with hypopi, the hypopi readily attached to the beetles.

Some experiments were carried out to obtain more detail information on exactly where in the beetle tunnel *H. gordius* develops. A beetle-free freshly cut pine log was cut into short bolts and the ends waxed to prevent drying. *Ips* beetles with hypopi attached were then confined on the bark of these logs using the method given by Hopping (1961). Nine replicates of this experiment were set up using 3 to 5 beetles per replicate. At weekly intervals bark covering three of these tunnels was removed and the tunnels examined under the microscope for *H. gordius* mites.

In all tunnels examined mite populations were found only when the beetles died after making a short tunnel, or when a tunnel coming off the beetle's turning-chamber was no longer occupied by a beetle. Developmental stages of the mites in these tunnels were always found in association with fungus or yeast covered areas. The largest mite populations developed in those tunnels least disturbed by the beetles but especially in tunnels where the beetle had been dead for some time.

Mite populations were not found in those tunnels free of frass and in use by the beetle. In these tunnels the hypopi were still attached to the beetle up to three weeks after the start of the experiment. Throughout the experiment some live hypopi were found attached to dead beetles; however, live hypopi were never found attached to beetles that had been dead long enough that the body tissues were beginning to break down.

Table I. Kind and stage of development of mites removed from various species of *Ips*.

Ips spp.	State Collected In	*Histiostoma gordius* (Anoetidae)	*Dendrolaelaps quadrisetus?* (Digamasellidae)	*Tarsonemoides* sp. (Tarsonemidae)	*Ereynetoides* sp. (Ereynetidae)	*Uropodids* (Uropodidae)	*Pygmephorus* sp. (Pyemotidae)
avulsus (Eichh.)	Georgia	hypopi	nymph	female		nymph	adults
calligraphus (Germ.)	Georgia	hypopi	nymph	female	female	nymph	adults
grandicollis (Germ.)	Georgia	hypopi	nymph	female		nymph	adults
chagnoni Sw.	Minnesota	hypopi					
emarginatus (LeC.)	Colorado	hypopi	nymph	female		nymph	
perturbatus (Eichh.)	Minnesota	hypopi		female		nymph	
pini (Say)	Minnesota	hypopi					
ponderosae Sw.	Colorado	hypopi					

Discussion

The mites listed in Table I apparently have a close association with *Ips* beetles. The beetles provide transportation of the mite to new areas and habitat niches for those mites living on the microflora of the *Ips* tunnels. Based on the findings of Lindquist and Bedard (1961) for Western species, the *Tarsonemoides* mite may be predatory upon *Ips* eggs.

In this work *Histiostoma gordius* was the most commonly encountered mite on the *Ips* beetles. From the biological studies carried out, it is possible to draw some general conclusions regarding this mite in nature.

H. gordius is apparently a fungus or yeast feeder. These mites were found developing in the *Ips* beetle's tunnels only in areas where yeast or fungus growth occurred. The movement of the beetle up and down the tunnel probably inhibits microfloral growth and this may account for the mites being found only in unused areas of the tunnels. The hypopi are probably stimulated to leave the beetle by a chemical attrahent associated with fungus or yeast growth. This might explain why hypopi were found still attached to live beetles after three weeks in well used tunnels cleared of frass and microfloral growth.

The hypopi have an opportunity to attach to a phoretic host in one of two ways. Probably the most important is the access to the hosts afforded by the loosening of the bark with decaying of the logs. The fact that hypopi were found on a variety of arthropods living under the decaying bark would indicate movement of the hypopi between the bark and the wood. Hypopi attaching to *Ips* beetles or other arthropods at this time could be carried to new logs.

A second way this mite may be transferred to new logs is by the hypopi around emergence, vent, and entrance holes of the beetle tunnels attaching to hosts. The hypopi pushed out of the tunnels with the frass material could also be transferred in this manner. In laboratory observation it was noted that newly emerged *Ips* beetles would regularly wander around on the surface of the bark in the area of emergence and sometimes partially enter old holes, thus providing an opportunity for hypopi around these holes to attach to the beetles. Hypopi in and around such holes probably came from unused tunnels or sections of tunnels where mite populations were developing. Cases were found in the laboratory experiments where more than one tunnel had been started off the turning chamber and the female beetle died in one of these tunnels. Microfloral growth and mite populations were usualy found in such tunnels. Hypopi wandering from these areas into the used portions of the tunnels could be pushed out with the frass by the beetle or could migrate to one of the various exterior tunnel openings.

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A REINTERPRETATION OF CERTAIN HEAD STRUCTURES IN CALYPTRATE DIPTERA

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Certain hypotheses on the extension of the calyptrate proboscis were proposed at an early date and repeated so often that they are no longer questioned. But the facts necessitate modifications of these hypotheses. These facts are presented below togther with a few comments on other structures misinterpreted by some authors.

Rostral Protractor Muscles

The proboscis of the calyptrate Diptera consists of three main sections: the basal section, or rostrum; the middle section, or haustellum; and the terminal section, or labellum (Fig. 1). When the proboscis is retracted, the haustellum is jackknifed against the rostrum with the 'elbow' posterior, and both sections are roughly in a horizontal position. At this time the rostrum is withdrawn to a considerable extent into the head capsule (Fig. 2). During extension of the proboscis the haustellum separates anteriorly from the rostrum, and the 'elbow' moves downward. This downward extension of the rostrum has been ascribed to the 'distension' of air sacs in the head proper or rostrum and to increased blood pressure (Bletchly, 1953, p. 161; Dethier, 1959, p. 169; Graham-Smith, 1930, p. 49; and others). I should like to show here that increased pressures in the air sacs or blood system in the head of calyptrates (and probably all Cyclorrhapha) do not account for the normal protraction of the rostrum, but that direct muscle action is responsible.

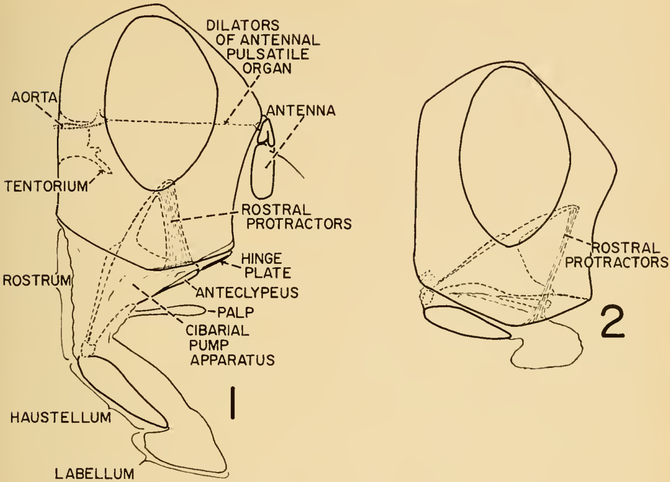
Gleichen (1764) is probably the author of the hypothesis that air pressure brings about the extension of the proboscis. His original German is given in Dimmock (1881, p. 32) with the following translation: "The extension of the proboscis probably arises from the air which is driven by the fly into the sac, and from this into the middle tube, finally into the lips. . ." Dimmock seems to accept this, since on p. 33 he says: ". . . I think that an important factor in the cause of the extension of the proboscis of *Musca* is the injection of air into it." However, on p. 39 he says: "On the posterior ventral processes of the fulcrum (pl. 4, fig. 2 and 3, *z*) are inserted muscles, which have their origins in the anterior, lateral part of the head; these muscles, by their contraction, project the base of the proboscis, by revolving the fulcrum about the point *d*, where it is attached." The muscles he refers to are those I have identified as the rostral protractors, so Dimmock apparently regards the extension of the proboscis as a result of both direct muscle action and higher internal air pressures.

Schiemenz (1957, p. 310) has suggested a very similar mechanism for *Eristalis arbustorum* Meigen (Syrphidae), the extension being accomplished by the same muscles in conjunction with increased blood rather than air pressure. This species is not a calyptrate, but its proboscis probably functions very much like that of calyptrates.

Contrary opinions on the extension of the proboscis were expressed by Suffolk (1869, p. 332), who simply remarks regarding Gleichen: "It is most probable that the structure of the interior of the proboscis was unknown to this author, as the extension of the organ is attributed to inflation, and not to muscular action." In addition, Lowne (1870, p. 42) described the "exserter muscles" (rostral protractors), but did not mention any air or blood pressure mechanisms for protracting the proboscis.

By 1893 Lowne had changed his mind, and identified the "exserter muscles" as the "retractors of the fulcrum" (p. 391). On p. 395, he says further: ". . . it is also very evident that there are no muscles capable of exserting the proboscis." Lowne was evidently influenced by four authors (whom he cites on p. 395-396), all of which favor air pressure mechanisms. Macloskie (1880, p. 157) especially gives a strong argument in his rebuttal of "Mr. Suffolk's hasty criticism" of Gleichen's air pressure hypothesis. Nevertheless, Macloskie's argument appears to depend only on the observation that the proboscis can be protruded from the head of a fly, boiled in potassium hydroxide solution, by squeezing the head; and Macloskie does allow for aid in this protrusion from certain muscles which swing out the 'fulcrum' (cibarial pump apparatus).

With the exception of Schiemenz (1957), Lowne (1890-1895) and all subsequent authors have identified the rostral protractors of calyptrates as retractor muscles. The contradictory interpretations can be resolved by careful attention to certain relevant facts. The cibarial pump apparatus lies rather freely within the rostrum; and is connected only indirectly with the membrane of the proboscis, except for its anterior face, which constitutes a sclerite (the anteclypeus) on the



Lateral views of calyptrate head (based mostly on *Wohlfahrtia vigil*) showing the relationships of certain internal parts. Fig. 1, head with proboscis extended, rostral protractor muscles contracted; fig. 2, head with proboscis retracted, rostral protractors elongated.

front surface of the proboscis. At its dorsal edge the anteclypeus articulates with the hinge plate, which in turn articulates at its dorsal edge with the facial plate. The hinge plate functions as a physical fulcrum (not the fulcrum in the sense of the cibarial pump apparatus) about which the rostrum moves in the sagittal plane of the head. The muscles in question originate on the anteroventral edges of the head capsule, and insert on the dorsal cornua of the cibarial pump apparatus. In contracting they pull the dorsal cornua ventrally; and on this fact there is no disagreement. To be retractor muscles, however, these muscles would have to rotate the ventral end of the cibarial pump apparatus dorsally—which they cannot do since their line of action lies posterior to the hinges of the hinge plate (as shown in figs. 1 and 2). On the contrary, they can obviously only force the whole cibarial pump apparatus ventrally: a movement of protraction.

Support for this last interpretation comes from dissections of *Wohlfahritia vigil* (Walker) (Sarcophagidae), from which Figs. 1 and 2 are drawn: in those heads with extended proboscides the rostral protractors were short and thick (Fig. 1); heads with the proboscides retracted showed the protractor muscles in a long, thin condition (Fig. 2)—all of which accords with their interpretation as rostral protractors.

Evidence against air or blood pressure mechanisms is easy to obtain. During normal extension in an intact fly, the membranes do not bulge. As a matter of fact, observations on *Sarcophaga bullata* Parker (Sarcophagidae) and *Calliphora vicina* R.-D. (Calliphoridae) show the membranes of the proboscis sunken in and clinging even more closely to the proboscis during its extension, indicating that the extension of the proboscis may actually create some negative pressures inside the head. Furthermore, there is a time during which internal pressures might bring about the extension of the proboscis. This occurs when the fly has just hatched from the puparium, and is expanding its wings and body volume by swallowing air. The proboscis is extended at this time, although not fully; but its membranes also give convincing evidence of the internal pressures by their conspicuously swollen condition—something not observed during normal extension later on.

The extension of the proboscis is a quick movement; and blood or air pressures might conceivably bring this about if some large compressor aparatus, such as the whole abdomen, were to contract suddenly. The protrusion of the ptilinum is accomplished by such means; but in view of the fact that ptilinal protrusion is such a deliberate movement, even this method for extending the proboscis is unlikely.

Lowne (1893, p. 396) described a valve in the tracheal system in the neck region of *Calliphora vicina* R.-D. (cited as *Calliphora erythrocephala*), but I have been unable in a few dissections to find it either in the same species or in *Pollenia rudis* (Fab.) (Calliphoridae). According to Lowne's Fig. 51, p. 396, the dimensions of the valve are considerable; and the only obvious structure of comparable size in what seems to be the same region, is the tentorium. The tentorium would have roughly the same shape in cross-section as the lower arm of Lowne's 'valve,' and the main tracheal air trunks leading into the head lie in contact with the upper surface of the tentorium, which fits in with Lowne's Fig. 51. There does not seem to be anything equivalent to the upper arm of the valve with its muscle, however, although there are muscles nearby. A thorough study of the calyptrate neck region would clear this matter up.

Dethier (1959, p. 169) says that if the large air sacs in the rostrum are punctured, or the neck is ligatured, the fly is prevented from extending its proboscis. The effect of ligatures does not rule out either theory of protraction. The proboscis in its retracted condition occupies such a large volume that the protractor muscles might have to operate against negative pressures in the head, unless something could be added to fill the space vacated by the protracted proboscis. That is, the rostral and head air sacs may play a role as passive, 'space fillers' rather than pressure sacs.

The effect obtained by puncturing the rostral air sacs appears to favor the air or blood pressure theory, but I believe that the extension reflex was more likely inhibited by side effects of the operation or possibly other conditions. In both *Sarcophaga bullata* and *Phormia regina* (Meigen) (Calliphoridae) decapitated by scissors, the separated heads will often extend the proboscis fully when the labellar hairs are touched with a sugar solution. This certainly rules out the thoracic or abdominal pump, usually assumed to be the protractor organ for the rostrum.

Dilators of the Antennal Pulsatile Organ

Most authors do not mention the very delicate muscles which attach at one end between the antennae, and which course posteriorly through the opening between the circumesophageal connectives under the brain. Dethier, however (1959, p. 162), suggests that these may be the "retractors of the esophagus" of Graham-Smith; but notes that these would seem to be protractors rather than retractors of the esophagus. In sarcophagids and probably all the 'higher' Diptera these muscles do not attach directly to the cuticle between the antennae, but to the point of a pyramidal tent-like structure, which is the antennal pulsatile organ. Their origin is on the aorta behind the brain, and not on the muscle wall of the esophagus, as mentioned by Dethier. Clements (1956, p. 7) describes the antennal pulsatile organ of "mosquitoes and other Nematocera," with muscles having basically the same points of origin and insertion as in sarcophagids (according to Clements, the aorta and the integument beteen the compound eyes and the antennae).

'Retractors of the Esophagus'

Dethier was unable to find these muscles (although he suggested that the dilators of the antennal pulsatile organ might be them). Lowne calls them the retractors of the fulcrum (1893, p. 392), and both he and Graham-Smith describe them as attached to the ptilinum at one end and to the esophagus at the other. The absence of these muscles in Dethier's specimens can be explained by the fact that the so-called retractors of the esophagus belong to the set of temporary 'hatching' muscles of the head. These particular muscles are retractors of the ptilinum, not the esophagus. The temporary muscles of *Calliphora vicina* (*Calliphora erythrocephala*) have been described by Laing (1935); who points out that these muscles disappear after the fly has expanded itself. Whether or not one finds these muscles depends on how soon after wing expansion the flies are preserved or dissected. The few fibers shown by Graham-Smith (1930, p. 71) probably represent a stage in which the temporary muscles have largely but not completely disappeared. I have not examined *Calliphora vicina* for these muscles, but in *Sarcophaga bullata* and *Phormia regina* the change between a newly emerged fly and an older one is astounding: the volume of muscle which disappears exceeds that which remains (in the head).

Conclusions

1. The rostrum of calyptrate Diptera is protracted by direct action of a pair of muscles, the rostral protractors. Neither air nor blood pressures play any role in such protraction.
2. A pair of very slender muscles attaching between the antennae,

originate on the aorta, not the esophagus. They function as dilators of the antennal pulsatile organ, and neither retract nor protract the esophagus.

3. The muscle, attaching at one end of the ptilinum and at the other to the esophagus, is a ptilinal retractor muscle, not a retractor of the fulcrum. This muscle disappears soon after the fly has emerged from the puparium, which accounts for the failure of some authors to find this muscle: they have used older flies for their dissections.

Acknowledgments

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NOTES ON THE LEAF-CUTTING ANTS, ATTA SPP., OF THE UNITED STATES AND MEXICO

(HYMENOPTERA: FORMICIDAE)

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This article discusses and keys the species of *Atta* that occur in the United States and Mexico, makes pertinent comments on their biology and other matters, and gives the known distribution records. A key based on major workers is presented for the identification of the species. Keys are not offered, however, for the identification of intermediate workers, females and males, since these castes are much more difficult to identify. Anyone attempting to collect or study *Atta* is urged to secure especially major workers, although it may be necessary to dig deeply into a nest to secure these individuals.

For many years the various species of *Atta* were badly confused by students of this group of ants; one was therefore reluctant to accept unquestionably all identifications or distribution records. However, it is now possible, with Borgmeier's (1959) excellent revision, to identify the various species with ease and accuracy.

Two species of *Atta* are known to occur in the United States: The common *texana* (Buckley); and *mexicana* (F. Sm.), which barely enters its southern border in Arizona. Mexico has three species: The common *mexicana; texana*, which occurs in at least two of its northeastern States; and *cephalotes* (L.), a Neotropical species which occurs in two of the more southern States. As far as known, Veracruz is the only State in which all three of the species have been found.

KEY TO THE SPECIES

(for the identification of major workers)

1. Each side of front of head bearing a dense clump or mass of rather long, yellowish or golden, woolly hairs; anterior end of frontal groove usually with a distinct or prominent ocellus. Southern Mexico through Central America to Bolivia and Brazil; a common and widely distributed Neotropical species .... **cephalotes** (L.)

   Each side of front of head not bearing a dense clump or mass of rather long, yellowish or golden, woolly hairs 2

2. Posterior portion of head (including occipital lobes and vertex) with a smooth and shiny appearance and either naked or almost free of hairs; first gastric segment similar; frontal groove of head shallow. United States (extreme southern Arizona) through Mexico to Honduras, Guatemala, and El Salvador; the most common and widely distributed species in Mexico .... **mexicana** (F. Sm.)

   Posterior portion of head and entire first gastric segment opaque, not naked; frontal groove of head rather strongly defined. United States (13 parishes in western Louisiana and much of the eastern part of Texas to approximately 101 degrees of longitude), and northeastern Mexico (States of Tamaulipas and Veracruz) .... **texana** (Buckley)

Atta texana (Buckley)

So far as known, the Texas leaf-cutting ant in the United States is confined to Texas and Louisiana. Its exact and detailed range has not yet been mapped. The ant may be said to occupy much of the area of Texas and Louisiana lying between the 101st degree of longitude in Texas and the 92.5th degree of longitude in Louisiana. In Texas this would include much of the area east of the 101st degree of longitude from the extreme southern border to almost the Oklahoma boundary line, with an extension into at least two States in northeastern Mexico. In Louisiana the following 13 parishes are definitely known to be infested: Bienville, Webster, Sabine, Vernon, Beauregard, Allen, Calcasieu, Jefferson Davis, Rapides, Natchitoches, Grant, Lasalle, and Winn. In Mexico, the species is known from *Tamaulipas:* Matamoros (R. L. McGarr). *Veracruz:* Veracruz (N. L. H. Krauss); 2 miles south of Mocambo (D. H. Janzen); Tecolutla (collector?).

A. texana does not have the wide distribution nor the great adaptability to various environments that *mexicana* has. It seems to show a decided preference for nesting in sandy or sandy loam soils but is also capable of nesting in heavy soils and in those of limestone origin. As early as 1907, Wheeler published excellent descriptions and figures of most castes of this ant and also gave an interesting account of certain phases of its general biology. Although *texana* has been known for many years to have habits similar to the Neotropical species of *Atta*, very little research has been done or published on *texana* by State and Federal agencies until recent years.

About 1935 the Southern Forest Experiment Station, U. S. Forest Service, New Orleans, Louisiana, began control work on this ant in the Kisatchie National Forest of Louisiana after recognizing it as an important pest of young pines, especially those used in reforestation. Begun under the direction of T. E. Snyder, these investigations resulted in publications by him (1937 and by M. R. Smith (1939). A more comprehensive paper on the biology and control of this ant was prepared by Walter, Seaton, and Mathewson (1938) of the Entomology Research Division, U. S. Department of Agriculture. Investigational and control work is being continued in the Kisatchie National Forest; much of the research work on biology is under the field direction of J. C. Moser. In early control work carbon bisulphide was used as a nest fumigant with considerable success. The chemical, however, had to be applied from late fall to early spring when the ants were concentrated in their nests and inactive. Johnson (1944) recommended methyl bromide as an even more effective nest fumigant. This method of control is now universally employed.

Atta mexicana (F. Sm.)

This species is known from only one locality in the United States, the Organ Pipe Cactus National Monument in Arizona (Byars, 1949). It was found in March 1946 near a gravel pit 5 miles north of the

Mexican boundary and 1 mile north of the Monument. *A. mexicana* is the most common species in Mexico and might well be called the Mexican leaf-cutting ant. It ranges from extreme southern Arizona through most, if not all, of Mexico to at least as far south as Honduras, Guatemala, and El Salvador. In Mexico the species is known from the following States and localities: *Jalisco:* Guadalajara (J. F. McClendon); 73 miles southeast of Guadalajara (H. A. Scullen); 10 miles south of Guadalajara (H. A. Scullen); 16 miles south of Encarnacion, 6,600 ft. (W. S. Creighton. *Durango* (all W. S. Creighton): Durango, 6,200 ft.; 25 miles south of Durango, 6,300 ft.; 10 miles south of Durango, 6,800 ft.; 7 miles east of Durango, 6,200 ft.; Rio Mexquital, Nombre de Dios, 5,900 ft. *Hidalgo* (all W. S. Creighton): Chapuhualcan, 2,600 ft.; Chapuhualcan, 3,500 ft.; 7 miles east of Jacala, 5,200 ft. *Sonora:* 10 miles south of Sonoyta, 1,400 ft. (W. S. Creighton); near La Casita, 3,500 ft. (L. F. Byars); near Magdalena, 2,460 ft. (L. F. Byars). *San Luis Potosi* (all W. S. Creighton): Tamazunchale, 600 ft.; Tamuin, 200 ft.; 2 miles east of Xilitla, 1,700 ft. *Nuevo Leon:* El Pastor (Montemorelos), 2,200 ft. (W. S. Creighton); Linares (Phil Rau). *Queretaro:* Queretaro (W. M. Wheeler; 27 miles east of Queretaro, 6,200 ft. (W. S. Creighton). *Tamaulipas:* 16 miles west of Altamira, 500 ft. (W. S. Creighton); Ciudad Victoria (V. E. Shelford); Llera (V. E. Shelford); Santander Jiminez (V. E. Shelford); Tampico (Locke). *Aguascalientes:* 19 miles north of Aguascalientes, 6,300 ft. (W .S. Creighton). *Guanajuato:* Irapuato (C. H. T. Townsend); 5 miles north of Irapuato, 6,900 ft. (W. S. Creighton). *Nayarit:* Escuinapa (J. H. Battey); Tepic (G. Eisen and F. H. Vaslit). *Morelos:* Cuernavaca (W. M. Wheeler), (I. A. Madariaga), (N. L. H. Krauss). *Veracruz:* Jalapa (A. L. Herrara); San Rafael (T. Pergande collection); Tuxpan ("American Consul"); Campo Cotaxtla, 22 miles west of Veracruz (D. H. Janzen). *Distrito Federal:* Mexico City (C. Hibinger).

In Central America the species is known from the following places. *Honduras:* Tegucigalpa (D. Iseley). *Guatemala:* Guatemala City (F. Schwerdtteger); Yepocapa (H. T. Dalmat). *El Salvador:* San Salvador (O. L. Cartwright) (S. Calderon); San Andrés (E. J. Hambleton).

Concerning the high adaptability of this ant to its environment, W. S. Creighton *in litt.* remarks as follows ". . . The ant must have a very wide tolerance for different sorts of environments. The specimens which came from Sonora (10 miles south of Sonoyta, in a place locally known as Pozo Cypriano, which is to say Venus' puddle) were living in a thicket in the middle of a stretch of howling desert. There are few areas any less verdant than the region between Sonoyta and Puerto Penasco. So that particular station enables *mexicana* to rank with the most hardened xerophiles. But the colony from the station of Xilitla was living in a dense cloud forest, as were those from Tamazunchale and Chapuhualcan. The colony taken west of Jacala was in open deciduous woods that superficialy resembled those of the southern Appalachians. The colony taken west of Queretaro was in typical upland live-oak country. The colonies from Nombre de Dios, Irapuato and Aguascalientes were all in stream bottoms where trees of one sort or another were present, but the colony taken east of Durango was living on gravelly, outwash bajada where there were no trees at all, only thickets.—It is obvious that the type of environment means little to this species. It makes you wonder if *mexicana* may not have largely freed itself from a dependence on a particular type of environment because of its ability to 'air condition' its nests, coupled with the obvious fact that they can grow their fungus gardens on a wide variety of vegetable substances." It is also evident from the distribution records and data on altitudes that *mexicana* can inhabit areas from approximately sea level to at least 7,000 ft.

Atta cephalotes (L.)

In Mexico this species is known from the follwing places, *Oaxaca:* Tuxtepec (Dampf). *Veracruz:* Pueblo Nuevo (E. O. Wilson); Cordoba (Dampf).

This well-known Neotropical species extends from the southern part of Mexico through Central America as far south as Brazil and Bolivia. It is recorded by Borgmeier from Guatemala, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru, Bolivia, Surinam, British Guiana, Trinidad, Venezuela and Brazil. It is not listed by him from British Honduras, Honduras, El Salvador, nor from French Guiana but probably occurs in these countries. Except for *sexdens* (L.), it is probably the most widely distributed species of *Atta*. Much of the literature on this species is in Portuguese or Spanish and is not readily available to many readers. Considerable investigational or control work on *cephalotes* has been conducted in Brazil, Surinam, and Trinidad.

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A NEW SPECIES OF CRASIMORPHA REARED FROM SCHINUS

(Lepidoptera: Gelechiidae)

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N. L. H. Krauss reared specimens of a new species of *Crasimorpha* from the stems of *Schinus terebinthifolius* Raddi in Brazil. This species is being laboratory reared on *Schinus* sp. in Hawaii.

Crasimorpha infuscata, n. sp.
(Figs. 1, 3, 4)

Head, thorax, fore wings, and legs steel-gray. Second segment of labial palpus with a long, triangular tuft; outer surface of tuft with deep steel-gray reflections, narrowly margined dorsally with pale gray-tipped scales; inner surface pale gray from base to apex, becoming dark anteriorly. Third segment of labial palpus with pale gray-tipped scales. Fore wing (Fig. 4) with a dark-brown triangular patch on costa at base (continuation of brown on base of patagium); costal margin slightly darker than rest of wing (specimens become greasy with this area appearing much darker); a few black-tipped scales along some veins apically and on fold; three patches of black-tipped, raised scales, one on fold at one third; another slightly beyond first between costa and fold, and a third at end of cell; cilia slightly brownish in tornal area. Hind wing shining gray-buff; cilia gray apically, buff elsewhere. Legs: Scales dark gray, pale gray-tipped; apices of tarsal segments pale gray; meso and metathoracic tibiae with long dorsal scales. Abdomen buff on dorsal surface basally, becoming brown-black apically; ventral surface brown-black. Male genitalia: As in Fig. 3 (R.W.H. slide 2025). Left half of vinculum omitted in drawing for clarity. Female genitalia: As in Fig. 1 (R.W.H. slide 2026). Alar expanse: 20.5-26 mm.

Type: ♂, emerged "V 1962," bred *ex Schinus* sp., Honolulu, Hawaii [USNM Type No. 66590].

Paratypes: 3 ♂♂, 7 ♀♀, same data as for type (R.W.H. wing slide 49) [Bernice P. Bishop Museum, BM(NH), USNM]. 1 ♂, 2 ♀, Rio de Janeiro, Brazil, "VIII-'54," *ex Schinus terebinthifolius* stem (N. L. H. Krauss), R.W.H. slide 2025, and 2026; wing slide 51) [USNM]. 1 ♂, Sao Paulo, Brazil, "7-3-'54," stem borer, *ex Schinus terebinthifolius* (N. L. H. Krauss), (J. F. G. Clarke slide 10464) [USNM].

We have a male of what we presume to be *Crasimorpha peragrata* Meyrick (1923) from Alhajuelo, Panama. The venation of this specimen differs from that of the type female of *peragrata* in having 3 and 4 of the fore and hind wings connate rather than stalked. Both sexes of infuscata have the same venation as the male of ?*peragrata*. Until both sexes of *peragrata* can be definitely associated, it is impossible to state whether the venational differences are merely a sexual modification or that two species are involved. The males of ?*peragrata* and *infuscata* have a dorsal hair pencil at the base of the hind wing just below the costa.

C. infuscata may be separated from *peragrata* as follows: 1. *C. infuscata* has steel-gray fore wings with three patches of black-tipped

Ventral views of genitalia. Fig. 1, *Crasimorpha infuscata*, n. sp., female; fig. 2, *C. ?peragrata* Meyrick, male; fig. 3, *C. infuscata*, n. sp., male.

Fig. 4, photograph of adult of *Crasimorpha infuscata*, n. sp.

raised scales; the fore wings of *peragrata* are light brown with black scales between veins, and no raised scales are present (neither the type female nor the male is fresh). 2. The sclerotized portion of the eighth abdominal sternum of the female of *infuscata* is emarginate medially, that of *peragrata* is produced. 3. The valvae of *infuscata* are expanded distally; those of ?*peragrata* (Fig. 2, left half of vinculum omitted) are not. 4. One pair of lobes arises from the transtilla of *infuscata;* two arise from the transtilla of ?*peragrata*.

The illustrations of the genitalia were executed by A. Pizzini. Mr. J. Scott, Staff Photographer, Smithsonian Institution, made the photograph of the adult moth.

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HOST RELATIONSHIPS OF THE EUPHORINI

(HYMENOPTERA: BRACONIDAE)

All the members of the braconid tribe Euphorini seem to be internal parasites of the adults (or nymphs) of various insects. For some of the genera the host relations have been known a long time; for others they have remained unknown, but gradually these gaps in our knowledge of this interesting group are being closed. Each genus appears to be rather closely restricted with regard to type of host. Species of *Perilitus, Cryptoxilos* and *Microctonus* are parasites of the adults of certain Coleoptera, especially of the families Chrysomelidae, Coccinellidae and Curculionidae; the species of *Aridelus* develop in the nymphs and adults of Pentatomidae; those of *Euphorus* and *Euphoriana* in the nymphs, and occasionally the adults, of certain Miridae; and those of *Rhopalophorus* in the adults of bark beetles. In 1949 the new genus *Chrysopophthorus* was established by Goidanich for a European species of this tribe that parasitizes adults of *Chrysopa*. A similar species, not yet described and not yet associated with its host, is known to occur in the United States and Canada; in all likelihood it will eventually be found to be a *Chrysopa* parasite.

Specimens of the older genera *Euphoriella* and *Syntretus* have been rather common in collections but until recently nothing has been known concerning the hosts of either. In 1956, however, Kathryn Sommerman (Proc. Ent. Soc. Wash. 58:149-152) listed her rearings of a species of *Euphoriella* from nymphs and adults of 20 different species of Psocoptera; and in 1959 Cole (Ent. Mon. Mag. 95:18-21) recorded a new species of *Syntretus* from adults of the ichneumonid *Phaeogenes invisor* Thunb. *Wesmaelia pendula*, described by Foerster in 1862, has been widely collected in both Europe and North America but its host has remained unknown until now. Very recently I received for identification a specimen of this species which had been reared June 19, 1963, by D. W. Jones at Columbus, New Jersey, from a nymph of one of the damsel bugs belonging to the genus *Nabis*. Now we still lack authentic information on the hosts of *Myiocephalus* and *Streblocera*. Presumably the species of these genera, too, will be found to parasitize adults or nymphs of certain insects.

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TWO PUPAE OF THE PRIMITIVE SUBORDER ARCHOSTEMATA

(COLEOPTERA)

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Herein are described the pupae of *Micromalthus debilis* LeConte and *Cupes concolor* Westwood. *M. debilis*, with its complicated life history, is the sole representative of the family Micromalthidae. *C. concolor* belongs to the family Cupedidae consisting of several genera and a handful of species. These two families together comprise the present-day members of the suborder Archostemata, generally considered the most primitive of all groups of Coleoptera, as discussed by Böving and Craighead (1930-1931) and Atkins (1963). The pupae have not been treated taxonomically in detail heretofore, although Snyder (1913) pictured and briefly described the pupa of *C. concolor*, and Pringle (1938) and Scott (1938) did the same for *M. debilis*.

In a study of any group presumed to be ancient, it is always interesting to search for characters that might be primitive and that might therefore indicate relationships between taxa—in this case between orders. However, I cannot, with one possible exception, point out features of this sort with respect to these two species. In part this may be because we know so little about beetle pupae that primitive characteristics cannot be recognized. On the other hand, although the Archostemata separated from the other Coleoptera very early, they may have evolved both divergently from and in parallel with the others so that the pupae no longer exhibit primitive attributes.

The possible primitive feature is the sclerotized, sharp-edged mandibular teeth of *M. debilis*. This condition, though apparently not so well developed elsewhere in the Coleoptera, suggests a similar but more pronounced feature found in the Neuroptera, Megaloptera, and Trichoptera. In the latter groups the mandibles are movable and serve as a means of cutting the cocoons for emergence or of defense. The fact that the pupa of *M. debilis* possesses sensory-like setae on the labrum adds weight to the possibility that the mandibles of this species also are functional. Coleopterists finding live pupae should observe whether this is true.

The pupal mandibles of *C. concolor*, unlike those of *M. debilis*, do not have sclerotized, sharp-edged teeth though they are somewhat pigmented, and the labrum of the former is without setae. Other marked differences between the two pertain to the presence or absence of body setae and gin-traps and to such imago-reflecting characteristics as body size, elytral length and antennal length. The pupae agree in the elongate, exarate body shape, presence of a distinct pleural region on the abdomen and of a dorsal longitudinal median ridge on the abdomen, and absence of tubercles and urogomphi.

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The pupae of *C. concolor*, but not of *M. debilis*, exhibit modifications (fig. 7) resembling gin-traps (Hinton, 1946). These structures, formed by the anterior and posterior edges of the lateral parts of the terga, are similar in position to the gin-traps of the Tenebrionidae (Daggy, 1946, Hinton, 1946). However, instead of being heavily sclerotized, toothed, or otherwise ornamented as in the Tenebrionidae, the anterior and posterior edges seem rather soft. Although there is some question therefore whether these structures are true gin-traps, their gross appearance is highly suggestive; the anterior edge, on the posterior margin of a tergum, lies below the rest of the tergum and, when the abdomen is moved sideways, would seem to come in contact with the posterior edge formed by the anterior margin of the following tergum. Somewhat less well-defined structures located between some abdominal sterna may also be gin-traps. If so, this is the first time ventral ones have been observed for any beetle.

In describing the pupae, I have followed for the most part the format and points of comparison employed in my earlier papers on beetle pupae (Rozen, 1959, 1963). However, of necessity I have altered the style in some places to include new information that now seems pertinent to taxonomic studies on beetle pupae.

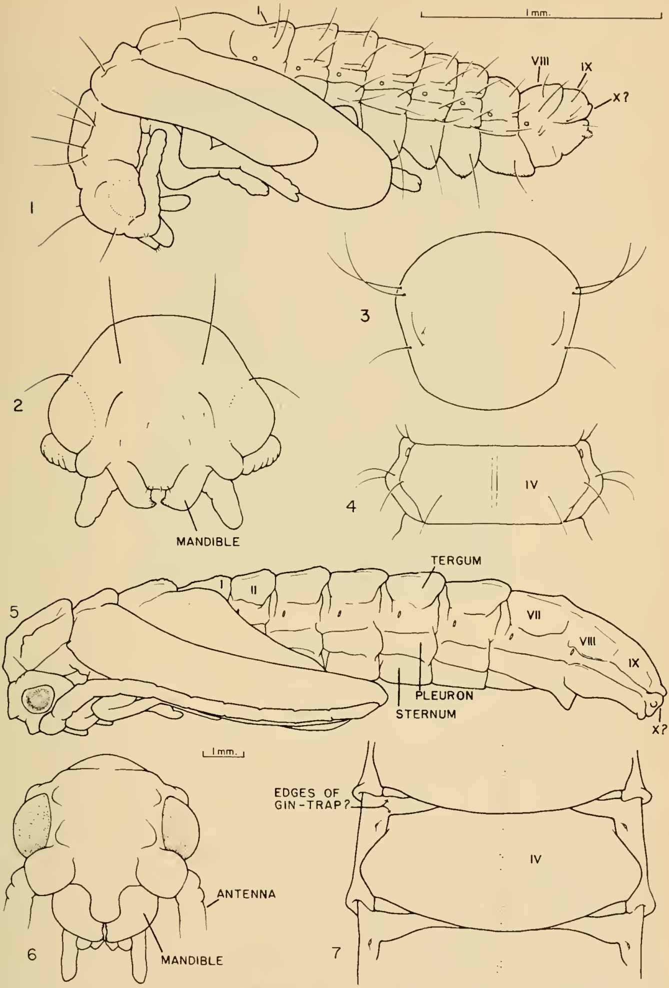
The specimens employed were kindly loaned through Dr. Donald M. Anderson by the United States National Museum, Washington, D. C.

Micromalthus debilis LeConte

(Figs. 1-4)

Total body length 2.0-2.3 mm.; body color whitish; shape (fig. 1) elongate, slender, somewhat laterally compressed, especially in region of basal abdonimal segments; body surface with widely scattered microscopic pubescence and with unpigmented, elongate, sharp-pointed setae (fig. 1), and without tubercles. Head (fig. 2) with several elongate setae; labrum with apical fine setae; mandibular teeth sharp-edged and sclerotized. Pronotum (fig. 3) with setae. Mesonotum (fig. 1) with pair of setae; each elytron without setae and short, not reaching femorotibial joint of hind leg. Metanotum (fig. 1) with pair of setae. All legs without setae. Abdomen (figs. 1, 4) without gin-traps but with unsclerotized, median, dorsal, longitudinal ridge; ventral surface microscopically asperate on median part of seventh sternum and perhaps (though to a lesser extent) on comparable parts of fifth and sixth sterna; paired, posteriorly directed prolongations of ninth sternum asperate. Fourth abdominal tergal sclerite (fig. 4) weakly sclerotized and not subdivided; tergum with pair of lateral marginal setae and with pair of discal setae; pleuron weakly sclerotized but represented as distinct lobe, bearing two elongate setae; sternum weakly sclerotized and bearing pair of elongate setae. Urogomphi absent.

Material: Six pupae, 13 larvae, Jackson Island, Maryland, July 16-17, 1913, larvae of all forms, paedogenetic form, and pupae *ex* "red-rotten" oak (H. S. Barber). One pupa, two larvae, near Plummers Island, Montgomery County, Maryland, June 28, 1913, in pine timber of old lock gate, lock 13, C. & O. Canal (E. A. Schwarz and H. S. Barber).



Figs. 1-4, female pupa of *Micromalthus debilis LeConte;* fig. 1, entire pupa, lateral view; fig. 2, face; fig. 3, dorsal surface of pronotum; fig. 4, fourth abdominal segment, dorsal view. Figs. 5-7, pupa of *Cupes concolor* Westwood; fig. 5, entire pupa, lateral view; fig. 6, face; fig. 7, fourth abdominal segment, dorsal view. Scales refer to figs. 1 and 5.

Cupes concolor Westwood

(Figs. 5-7)

Total body length approximately 16.0 mm.; body color whitish; shape (fig. 5) elongate, slender, cylindrical; body surface without microscopic pubescence, elongate setae, and tubercles, although with conical projection on face (fig. 6) corresponding to those of adult. Labrum without setae; mandibular teeth blunt and faintly pigmented though apparently not sclerotized. Each elytron long, extending well beyond (though obscuring) femorotibial joint of hind leg. Apparent, paired, dorsolateral gin-traps (figs. 5, 7) between metathorax and first abdominal tergum and between all abdominal terga except seven and eight and eight and nine; less well-defined ventrolateral gin-traps between sterna three and four, four and five, and (at least on some specimens) five and six; abdomen with unsclerotized, median, dorsal, longitudinal ridge; this ridge, as well as other projecting ridges on body microscopically asperate (asperities too small to be shown in figure 5) but asperities not found on median parts of abdominal sterna. Fourth abdominal tergal sclerite (fig. 7) distinct though not heavily sclerotized, and not subdivided; pleuron represented as distinct rectangular plate; sternum distinct though not heavily sclerotized. Urogomphi absent though paired, laterally projecting tubercles found on apparent tenth segment.

Material: Seven pupae, two larvae, one adult, Virginia shore below Plummers Island, Montgomery County, Maryland, June 7, 1913 (E. A. Schwarz and H. S. Barber). Three pupae, four larvae, same except larvae, pupae, and adults in decaying oak filled with fungus, *Daedalia quercina*. One pupa, six larvae, Connecticut, Hopk. U. S. 10081M; one pupa, Dead Run, Fairfax County, Virginia, opposite Plummers Island, Maryland, June 7, 1913, pupa in rotten log (put in alcohol June 12, 1913) (Pierce, E. A. Schwarz and H. S. Barber).

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HAROLD MORRISON

1890-1963

Harold Morrison, internationally known scale insect specialist, died at the Washington Hospital Center, Washington, D. C., on March 11, 1963. He had been in poor health for several years, and failed rapidly during the winter of 1962-63. He entered the hospital on February 19, and on February 22 suffered a severe stroke from which he did not recover.

Dr. Morrison was born on a farm in McCordsville, Indiana, May 24, 1890, the only child of Seymour and Harriet Morrison. When Harold was 9 years old his family moved to Indianapolis where he completed his elementary school education and entered Shortridge High School. There he came under the influence of Miss Rousseau McClelan, an outstanding teacher of science. Miss McClelan strengthened and gave direction to his interest in natural science, particularly entomology. Contacts with Dr. David Starr Jordan, president of Stanford University, and the reputation of Dr. Vernon Kellogg, professor of entomology there, led him to seek admission to that institution. After completing five terms at Stanford he transferred to Cornell University in order to profit from association with Professor

John Henry Comstock. He was awarded a B. A. degree by Cornell in 1914, and then returned to Stanford where he received an M. A. degree in 1915. He took additional post-graduate work at Harvard University and was granted the degree of Doctor of Science by that institution in 1927.

Dr. Morrison's first employment in entomology was in the office of the State Entomologist of Indiana from 1911 to 1915. During this period he prepared, with Harry F. Dietz as coauthor and Robert E. Snodgrass as illustrator, his first papers on scale insects. One of these, The Coccidae or Scale Insects of Indiana, was a comprehensive publication. In 1916 he entered the U. S. Department of Agriculture as a plant quarantine inspector in the Federal Horticultural Board, and in 1919 transferred to the Bureau of Entomology as an entomological explorer. In the latter capacity he visited the West Indies, collecting coccids and other insects. In 1920 he was appointed the Bureau's scale insect specialist and remained in that position until his retirement in May 1960. In addition to being a member of the taxonomic staff for 40 years, he was in charge of the taxonomic investigations of the Bureau from 1928 to 1935. After his retirement he was a collaborator in the Entomology Research Division, the successor organization to the Bureau of Entomology and Plant Quarantine, and continued to work on coccids. Subsequent to 1955, Dr. Morrison was helped immeasurably in bibliographic work by his wife, Emily, an accomplished scholar, and also a Cornell University graduate, who had been his assistant before they were married.

The eminence of Dr. Morrison as a coccidologist was recognized by coccid workers around the world. But persons unfamiliar with the early methods of study and the literature on this group of insects can scarcely appreciate the impact that his work had on the study and classification of these insects. He pioneered in the preparation of specimens for microscopic examination, and contributed to the improvement of mounting techniques of scale insects and other microscopic arthropods. He was the first person to devise a classification of a family of the Coccoidea based on all available stages and instars of the insects. A Classification of the Higher Groups and Genera of the Coccid Family Margarodidae, the thesis for his doctorate, which was published as a Technical Bulletin of the U. S. Department of Agriculture, was a masterful study.

Dr. Morrison authored or coauthored 37 papers; more than 30 of them dealt with the Coccoidea and 27 were detailed systematic studies. His last published contribution, A Selected Bibliography of the Coccoidea (U. S. Dept. Agr. Misc. Pub. 734, 222 pp., September 1957), compiled with the assistance of Miss Alice V. Renk, includes a complete list of his taxonomic coccid papers. A supplement to the bibliography, prepared by Dr. and Mrs. Morrison, was submitted for publication early in 1963. For some time prior to his death, Dr. Morrison devoted his time and energy to the preparation of an annotated generic check list of the Coccoidea and this work is being completed by Mrs. Morrison.

Because of his extensive and intimate familiarity with the coccids, the richness of the National Collection, and his interest in the studies of others, Dr. Morrison received numerous requests for the assistance that he willingly gave. The appreciation of coccidologists and their esteem for Dr. Morrison are well expressed by Dr. D. J. Williams, Commonwealth Institute of Entomology, London, who wrote, "I shall never forget his unstinted help on many matters. Nothing seemed to be too much trouble for him and any query was answered with meticulous care and understanding. It is saddening to know that such a store of knowledge is no longer with us and entomology has lost a great man."

From his early years as an entomologist, Dr. Morrison was a staunch supporter of scientific organizations. He became a member of the Entomological Society of Washington in 1916 and served as its 2nd vice president in 1931. He attended meetings regularly when his health permitted, and participated in the discussions and affairs of the Society. He was elected to membership in the Washington Academy of Sciences and was one of its vice presidents in 1931. His other affiliations included the American Association for the Advancement of Science, Indiana Academy of Science (fellow), Biological Society of Washington, Entomological Society of America (fellow), the Cambridge (Mass.) Entomological Club, the Canadian Entomological Club, Sigma Xi (honorary), La Real Sociedad Espanola de Historia Natural (honorary), and Nederlandsche Entomologische Vereenniging (Amsterdam) (honorary). He was a member of the Cosmos Club.

Dr. Morrison had interests beyond his professional ones. In his youth he was an athlete who held the high school high jump record for the state of Indiana; and in his college years, as a member of the track teams of both Stanford and Cornell, won numerous points for high jump and other track events in intercollegiate meets. He inherited a farm in Indiana and maintained a keen interest in it and in agricultural matters. He possessed more than an amateur's knowledge of mechanics and as a hobby collected many kinds of second hand machinery that he reconditioned and put to practical use. He had a prodigious memory, seeming to remember everything he learned. Temperamentally he was direct, critical, thorough, cautious and uncompromising. He enjoyed sociability to the full, and especially enjoyed entertaining visiting entomologists whom he and Mrs. Morrison frequently invited to dinner at their home or at the Cosmos Club.

Dr. Morrison is survived by his wife, Emily Reed Morrison of the home address, 1725 Lamont Street, N. W., Washington, D. C.; by two daughters, Mrs. Emily Waterman of Stamford, Connecticut, and Mrs. Harriet Christian of San Antonio, Texas; by one son, Professor Peter R. Morrison, University of Wisconsin, Madison (presently at the University of Alaska, College, Alaska); and by 11 grandchildren.

LOUISE M. RUSSELL

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

OFFICERS FOR 1964

MEETINGS

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PROCEEDINGS OF THE
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THE OFFICIAL SEAL OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

The story of the discovery of *Rheumatobates rileyi* Bergroth and its subsequent portrayal on the cover of our proceedings is an interesting one.

This small water strider was first mentioned in 1891 by Reverend J. L. Zabriskie (Jour. N. Y. Micro. Soc. 7: 128-129, 1 fig.) in an article entitled "A curious, unknown, aquatic, hemipterous larva." Then, in 1892, there appeared anonymously (Insect Life 4: 198) a complete description and excellent illustration of this bug, but it remained unnamed. On the basis of this description, Bergroth proposed the name *Rheumatobates rileyi,* new genus and species without further description (Insect Life 4: 321). All of the above references dealt with apterous forms.

Otto Heidemann, specialist in Hemiptera, with the old Bureau of Entomology, collected the first winged specimens near Glen Echo, Maryland in 1893. Mr. Heidemann, who, in addition to his other talents, was a gifted engraver, made a handsome woodcut of a fully winged male. This figure appeared for the first time on the cover of volume 3, number 1 of our Proceedings (issued March 8, 1894).

The cut appeared continuously through 1920. It is mentioned in Mr. Heidemann's obituary in 1916 (Proc. Ent. Soc. Wash. 18: 202) that the illustration had been adopted as the official seal of our society. However, I am unable to verify this from the minutes of these early meetings.

The seal was dropped from the cover in 1921, presumably because the woodblock needed replacing. Later a photograph of the seal was made and a new illustration appeared on the June 1937 issue and has appeared continuously since then. Because much detail in the original has been lost, I have redrawn the seal, based on specimens from Glen Echo, and had a new cut made. The results can be seen on the cover of this issue.

The seal is widely recognized as a symbol of our society. As an example, one of the late Professor H. B. Hungerford's favorite exam questions was, "Name the society whose official seal is *Rheumatobates rileyi?*"—EDITOR

NUMBERS OF OVARIOLES IN THE HETEROPTERA (INSECTA)

W. V. BALDUF, *University of Illinois, Urbana, Illinois*

The data on the numbers of ovarioles per ovary given below, were obtained by dissection of live material from Ohio, Illinois and northeastern Minnesota in the years 1940-1943. In the meantime, substantial additions to the knowledge of tubule numbers in the Heteroptera have been made by Woodward (1950), Carayon (1950), and Miyamoto (1957, 1959).

The system of supergeneric names employed is that of China and Miller (1955), except in the Miridae, where the subfamilial names follow Knight (1941).

Cydnidae

Corimelaena lateralis (Fabr.) (Corimelaeninae) has 5 tubes per ovary. In the Cydninae, *Pangaeus bilineatus* (Say) and *Sehirus cinctus* (P. B.) have 7.

Pentatomidae

Four species of Pentatominae have numbers of tubes varying from 4 to 6. These are *Neottiglossa sulcifrons* Stal 4, *Coenus delius* (Say) and *Mormidea lugens* (Fabr.) 5 and *Cosmopepla bimaculata* (Thom.) 6. All other Pentatomidae examined have 7 tubes per ovary. These are as follows. Asopinae: *Podisus maculiventris* (Say), *Stiretus fimbriatus* (Say). Pentatominae: *Chlorochroa uhleri* (Stal), *Hymenarcys aequalis* (Say), *Solubea pugnax* (Fabr.), *Trichopepla semivittata* (Say), *Peribalis limbolarius* Stal, *Thyanta custator* (Fabr.), *Acrosternum hilare* (Say), *Euschistus variolarius* (P. B.), *E. tristigmus* (Say), *E. euschistoides* (Voll.). Scutellerinae: *Homoemus aenifrons* (Say).

Coreidae

All coreids examined have 7 tubes per ovary. Material examined is as follows. Rhopalinae: *Leptocoris trivittatus* (Say), *Corizus lateralis* (Say), *Harmostes reflexulus* (Say). Alydinae: *Alydus conspersus* Mont., *A. pilosulus* H. S., *Protenor belfragei* Hagl., *Megalotomus 5-spinosus* (Say). Coreinae: *Catorhintha mendica* Stal, *Anasa tristis* (DeG.), *Chariesterus antennator* (Fabr.), *Acanthocephala terminalis* (Dall.), *Euthochtha galeator* (Fabr.)

Lygaeidae

Phlegyas abbreviatus (Uhl) of the subfamily Pachygronthinae has 6 tubes per ovary. All other subfamilies have 7. The material examined is as follows. Megalonotinae: *Ligyrocoris diffusus* (Uhl.), *Myodocha serripes* Oliv., *Uhleriola floralis* (Uhl.). Cyminae: *Kleidocerys resedae* (Panz.). Lygaeinae: *Ortholomus scolopax* (Say), *Lygaeus kalmii* (Stal), *Oncopeltus fasciatus* (Dall.).

Piesmidae

Piesma cinerea (Say) (Piesminae) has 6.

Berytidae

Jalysus spinosus (Say) of the Metacanthinae has 6.

Meziridae

Neuroctenus pseudomymus (Mezirinae) has 5.

Tingidae

Gargaphia tiliae (Walsh) of the Tinginae has 7.

Phymatidae

Phymata pennsylvanica americana Melin (Phymatinae) has 3.

Reduviidae

Sinea diadema (Fabr.) of the Harpactorinae has 8.

Nabidae

The three species of Nabinae examined all have 7 tubes. These were: *Nabis ferus* (Linn.), *N. roseipennis* Reut. and *N. subcoleoptratus* Kirby.

Cimicidae

Cimex lectularius (Linn.) of the Cimicinae has 7 (Davis 1956).

Miridae

Leptopterna dolabrata (Linn.) of the Mirinae and the following species of the Capsinae have 8 tubes per ovary: *Poecilocapsus lineolatus* (Fabr.), *Neurocolpus nubilus* (Say), *Stenotus binotatus* (Fabr.). All others examined have 7. Mirinae: *Collaria meilleurii* (Linn.), *Stenodema vicinum* (Prov.), *Trigonotylus ruficorne* (Geoffr.). Orthotylinae: *Lopidea davisi* Knight, *Melanotrichus altheae* Hussey, *Strongylocoris stygicus* (Say). Phylinae: *Reuteroscopus ornatus* (Reut.). Capsinae: *Lygus lineolaris* (P. B.), *Adelphocoris rapidus* (Say), *Horcias dislocatus nigritus* Reut.

Gerridae

Gerris remigis (Say) of the Gerrinae has 4.

Notonectidae

Notonecta undulata Say (Notonectinae) has 7.

Nepidae

Ranatra fusca P. B. has 5.

Belostomatidae

Belostoma flumineum Say of the subfamily Belostomatinae has 5.

Gelastocoridae

Gelastocoris oculatus (Fallen) of the Gelastocorinae has 6.

The records published here and by Woodward, Carayon an Miyamoto show a range of two to 17 ovarian tubes among the Heteroptera. However, there is reason to suspect that the number 17 reported by Miyamoto for four species of *Elasmucha* (Pentatomidae) represents a typographical error, since he reports seven in another *Elasmucha*, and the number seven prevails in that family.

Excepting this doubtful case, the range in the Heteroptera is two to eight. Hagan (1931) found two tubules per ovary in the Polyctenid, *Hesperoctenes fumarius* Westw., an ectoparasite on bats, and Balduf (1941) found the number three constant in more than 200 *Phymata* dissected. Eight tubules occur in several genera of harpactorine Reduviidae and in at least eight genera of Miridae, but rarely elsewhere in the order. The numbers four, five and six appear most often in the aquatic and subaquatic groups, but also in some genera of the Cydnidae, Pentatomidae and Lygaeidae, rarely in the Reduviidae and not at all in the Miridae. That seven tubules prevail in the order is clear, and is supported also by the data provided by the other investigators.

Heteropterists may find, in the tubule numbers, some characters of use for classification of the superspecific groups, and also in tracing the evolutionary development within the order. Pendergrast (1957) concluded that the male reproductive organs held more promise than the ovarian tubules in the classification of the Heteroptera.

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A KEY FOR PORTANUS WITH NEW RECORDS AND DESCRIPTIONS OF NEW SPECIES

(HOMOPTERA: CICADELLIDAE: XESTOCEPHALINAE)

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Portanus Ball, a genus of Neotropical leafhoppers, was redescribed and reported upon by Linnavuori (1959:45-51). At the time of his study the genus contained four species. Linnavuori added six new ones and keyed the ten known species. Since 1959, Kramer (1961) described three new species from Venezuela. This paper presents descriptions of six additional new species together with a revised key to all nineteen members of the genus. All of the material reported upon is in the collection of the United States National Museum.

Portanus and *Xestocephalus* are the only American members of the Xestocephalinae. *Portanus* may be separated from *Xestocephalus* on the basis of the long narrow body, the triangularly produced crown, and the developed submarginal vein of the hind wing. For a complete generic description, see Linnavuori (1959:45).

The following species were not seen during the course of this study: *pulchellus* Linnavuori, *hasemani* (Baker), *perlaticeps* Linnavuori, and *major* Linnavuori. For *youngi* Linnavuori and *corumba* Linnavuori, no additional data were available.

Portanus: KEY TO SPECIES

1. Veins of forewings banded with white 6
   Veins of forewings not banded with white 2
2. Ground color of crown bright orange 3
   Ground color of crown brown to pale yellow 4
3. Upper portion of clypeus with brown reticulated markings; pronotum with a pair of bright orange longitudinal elongated spots .... **elegans** Kramer
   Upper portion of clypeus without reticulated markings; pronotum without bright orange markings .... **facetus** Kramer
4. Claval suture ivory, rest of forewing unmarked .... **eburatus** n. sp.
   Claval suture not ivory, additional markings on forewings 5

5. Crown marked with a pair of small dark brown apical spots and a pair of large irregular pale orange spots........ **marthae** n. sp.
   Crown marked with a dark brown transverse apical stripe and a broad reddish brown band between the eyes........ **pulchellus** Linnavuori
6. Distal portion of aedeagus divided into two distinct shafts (Linnavuori 1959: Fig. 17*I*)........ **hasemani** (Baker)
   Distal portion of aedeagus undivided........ 7
7. Aedeagus with slender paired apical or preapical appendages........ 8
   Aedeagus simple or with short lamellate appendages placed variably........ 13
8. Two pairs of long appendages on distal portion of shaft (Figs. 1 and 2)........ **lex** n.sp.
   One pair of appendages on distal portion of shaft........ 9
9. Appendages distinctly preapical........ 10
   Appendages apical........ 12
10. Appendages short and bifurcated (Fig. 4)........ **stigmosus** (Uhler)
    Appendages long and entire........ 11
11. Distal portion of aedeagus irregularly serrated ventrally (Linnavuori 1959: Fig. 19*A*)........ **perlaticeps** Linnavuori
    Distal portion of aedeagus entire (Linnavuori 1959: Fig. 17*C*)........ **spiniloba** Linnavuori
12. Appendages uniformly slender (Linnavuori 1959: Fig. 17*G*)........ **major** Linnavuori
    Appendages widest mesally and finely serrated at margins (Figs. 9 and 10)........ **uhleri** n.sp.
13. Basal portion of aedeagus strongly recurved ventrally and usually with a mesal ventral rectangular projection (Fig. 11)........ 14
    Basal portion of aedeagus not recurved ventrally and never with a mesal ventral rectangular projection........ 16
14. Aedeagal apex trifid (Linnavuori 1959: Fig. 20*B*)........ **boliviensis** (Baker)
    Aedeagal apex not trifid........ 15
15. Aedeagal apex slender with a sharp projecting dorsal tooth (Fig. 11)........ **digitus** n.sp.
    Aedeagal apex broad and entire (Kramer 1961: Fig. 14)........ **linnavuorii** Kramer
16. Aedeagus short and comparatively simple (Fig. 5)........ **minor** n.sp.
    Aedeagus long and elaborated........ 17
17. Aedeagus with longitudinal lamellae on dorsal and ventral margins of shaft (Linnavuori 1959: Fig. 18*E*)........ **youngi** Linnavuori
    Aedeagus without such modifications........ 18
18. Side lobe of pygofer with a long falcate appendage (Linnavuori 1959: Fig. 18*D*); aedeagus sparsely elaborated (Linnavuori 1959: Fig. 18*B*)........ **longicornis** (Osborn)
    Side lobe of pygofer with a short tooth in posterior dorsal angle (Linnavuori 1959: Fig. 19*E*); aedeagus extensively elaborated (Linnavuori 1959: Fig. 18*A*)........ **corumba** Linnavuori

Portanus elegans Kramer

Portanus elegans Kramer 1961: 236.

The only species with which *elegans* might be confused is *facetus*. *P. elegans* is easily distinguished from *facetus* by the orange spots on the pronotum, the dark brown band on the crown between the anterior margins of the eyes, and the brown reticulated markings on the upper half of the clypeus. The male genitalia (Kramer 1961: Figs. 9-12) are distinctive but resemble those of *longicornis* (Osborn). Known only from Territory Amazonas, Venezuela.

Portanus facetus Kramer

Portanus facetus Kramer 1961: 236.

This species and *elegans* are the only members of the genus with bright orange markings. *P. facetus* is easily distinguished from *elegans* on the basis of markings. In *facetus* the pronotum lacks orange spots, the dark brown markings between the eyes consist of a pair of irregular triangles, and the clypeus lacks reticulated markings. The male genitalia (Kramer 1961: Figs. 5-8) are unique. Known only from Territory Amazonas, Venezuela.

Portanus eburatus, new species

(Figs. 6-8)

Length: Male 5.25 mm., Female 5.60 mm.

Coloration: Venter including legs and face stramineous to pale brown. Tibiae and tarsi of prothoracic legs darker. Crown with ground color of venter, marked with a pair of dark brown, minute, irregular spots on extreme apex, and a second pair of large irregular black spots directly behind first pair. Ocelli red. Pronotum brown with numerous minute pale circular areas. Scutellum with ground color of venter, margins of posterior angle yellowish. Forewings brown hyaline, claval area usually slightly darker than discal area, veins opaque brown, claval suture ivory.

Male Genitalia: Pygofer with a ventral process curved dorsally at apex (Fig. 8). Valve subovate and plates gradually constricted on distal half (Fig. 6). Style not distinctive. Aedeagus simple, recurved distally, and with a pair of sharp preapical ventral extensions (Fig. 7).

Female Genitalia: Seventh sternum indented on posterior margin with a slight suggestion of a tooth mesally.

Types: Holotype male (USNM Type No. 34861) Ft. Gulick, Panama, Canal Zone, August 22, 1952, F. S. Blanton. Allotype female, Mojinga Swamp, Panama, Canal Zone, November 11, 1951, F. S. Blanton. Three paratypes; one same data as allotype except date November 20, 1951 (abdomen missing); one female Loma Borracha, Panama, Canal Zone, July, 1952, F. S. Blanton; and one male Barinas, Venezuela, P. Anduze.

Portanus marthae, new species

Length: Male 5.10 mm., Female 6.25 mm.

Coloration: Venter including legs and face stramineous to pale brown. Tibiae and tarsi of prothoracic legs darker. Ground color of crown ivory, extreme apex with a pair of small dark brown spots and discal area with a pair of large irregular pale orange spots which may touch at coronal suture. Ocelli pale. Pronotal ground color same as crown with four longitudinal pale orange stripes. Scutellum ivory with basal angles paler. Forewings light brown hyaline with large patches of colorless areas in discal and claval regions producing a somewhat banded effect. Only apical veins distinctly opaque brown.

Male Genitalia: Unknown.

Female Genitalia: Seventh sternum with posterior margin nearly transverse but slightly produced at middle.

Types: Holotype female (USNM Type No. 34862) Costa Rica, Pablo Schild. Male paratype (abdomen missing) Fort Davis, Panama, Canal Zone, August 28, 1952, F. S. Blanton.

Portanus lex, new species

(Figs. 1-2)

Length: Male 4.25-4.50 mm., Female 5.00 mm.

Coloration: Venter including legs and face pale brown to stramineous, touched with darker areas on abdomen and legs. Crown, pronotum, and scutellum brown to pale brown with numerous minute pale round or oval areas. Ocelli reddish. Some specimens with a distinct red stripe mesally on pronotum and scutellum and laterally on pronotal margins and adjacent portions of forewings. Forewings brown to pale brown, veins variably banded with white spots, three more or less distinct pale areas on distal portion of costal margin.

Male Genitalia: Posterior margin of pygofer with a short, rather thick, upright appendage. Style not distinctive. Aedeagus with two pairs of appendages on distal portion (Figs. 1 and 2).

Female Genitalia: Seventh sternum as in *marthae*.

Types: Holotype male (USNM Type No. 34863) Arraijan, Panama, October 7, 1952, F. S. Blanton. Allotype female Rio Hato, Cocle Prov., Panama, November 9, 1952, F. S. Blanton. Sixteen paratypes; eleven with same data as allotype; one, Palm Beach nr. San Carlos, Panama, October 7, 1952, F. S. Blanton; one, Naranjal, Panama, October 1, 1952, F. S. Blanton; one, La Yeguada, Panama, October 21, 1952, F. S. Blanton; one, Rio Trinidad, Panama, March 18, 1912, A. Busck; and one, Tabogilla, Panama, February 15, 1912, A. Busck.

Portanus stigmosus (Uhler)

(Figs. 3-4)

Scaphoideus stigmosus Uhler 1895: 77.

Portanus stigmosus (Uhler); Ball 1932: 18.

This West Indian species, the type of the genus, was described from females only and until now was known only by the type series collected on St. Vincent Island. The male is reported upon below.

Male Genitalia: Side lobe of pygofer without appendages. Style as *boliviensis*. Aedeagus stout, narrowed basally, roundly enlarged distally, and with a pair of short bifurcated preapical ventral appendages (Figs. 3 and 4).

New Records: Six specimens Antrim, Dominica, British West Indies, March 11-20, 1956, J. F. G. Clarke. Three specimens Oyster Pond, Barbuda, British West Indies, April 6-20, 1956, J. F. G. Clarke. One specimen, English Harbor, Antigua, British West Indies, April 20, 1956, J. F. G. Clarke. One specimen, Quilesse, St. Lucia, British West Indies, February 22, 1941, R. G. Fennah.

Portanus spiniloba Linnavuori

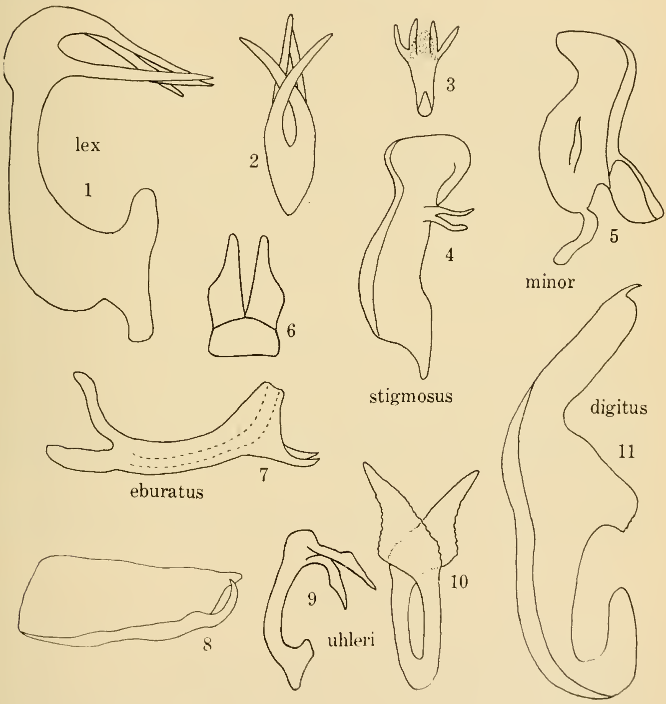
Portanus spiniloba Linnavuori 1959: 46.

One specimen representing a new locality record at hand with data: Loreto Missiones, Argentina, December 18, 1931, A. A. Ogloblin.

Portanus boliviensis (Baker)

Scaphoideus boliviensis Baker 1923: 36.

Portanus boliviensis (Baker); Linnavuori 1959: 50.



Portanus lex n. sp. Fig. 1, lateral view of aedeagus; Fig. 2, dorsal view of aedeagal apex. *P. stigmosus* (Uhler) Fig. 3, dorsal view of aedeagal apex; Fig. 4, lateral view of aedeagus. *P. minor* n. sp. Fig. 5, lateral view of aedeagus. *P. eburatus* n. sp. Fig. 6, ventral view of valve and plates (setae omitted); Fig. 7, lateral view of aedeagus; Fig. 8, lateral view of pygofer (setae omitted). *P. uhleri* n. sp. Fig. 9, lateral view of aedeagus; Fig. 10, dorsal view of aedeagal apex. *P. digitus* n. sp. Fig. 11, lateral view of aedeagus. Note: All aedeagi in lateral view arranged as in genital capsule. Drawings made at various magnifications.

Two specimens representing new locality records for Bolivia as follows: one, Rurrenabaque, Beni, November, 1921, Wm. Mann and the other, Huachi, Beni, Bolivia, September, 1921, Wm. Mann.

Portanus linnavuorii Kramer

Portanus linnavuorii Kramer 1961: 235.

Known only from a unique male collected in Territory Amazonas, Venezuela.

Portanus longicornis (Osborn)

Scaphoideus longicornis Osborn 1923: 37.

Portanus longicornis (Osborn); Linnavuori 1959: 49.

Two specimens representing new locality with data: Territory Amazonas, Puerto Ayacucho, Venezuela, June 15, 1950, J. Maldonado-Capriles. In these the spine on the side lobe of the pygofer is straight and not slightly curved as in Linnavuori's illustration (1959: 18*D*). The aedeagus also differs from his illustration (1959: 18*B*) in that the dorsal portion, which is weakly sclerotized, lacks a small hook and the extreme apex of the shaft is produced as if by a fusion of the short apical processes with the aedeagus proper. These differences are minor, however, and a new species description is not warranted, at least at this time.

Portanus uhleri, new species

(Figs. 9-10)

Length: Male 4.75 mm.

Coloration: Not distinguishable from that of *boliviensis*.

Male Genitalia: Posterior margin of pygofer with a short tooth. Style like *major*. Aedeagus with shaft slender and with a pair of large apical appendages widest mesally and finely serrated at margins (Figs. 9 and 10).

Female Genitalia: Female unknown.

Type: Holotype male (USNM Type No. 34864) Loreto Missiones, Argentina, December 18, 1931, A. A. Ogloblin.

Portanus digitus, new species

(Fig. 11)

Length: Male 4.50 mm., Female 5.20 mm.

Coloration: Not distinguishable from that of *boliviensis*.

Male Genitalia: Posterior margin of pygofer with an appendage similar to *lex*. Style like that of *major*. Aedeagus stout with basal portion strongly recurved and distal portion narrowed, terminating in a sharp slender dorsal tooth (Fig. 11).

Female Genitalia: Seventh sternum with posterior margin truncated.

Types: Holotype male (USNM Type No. 34865) San Esteban, Venezuela, November 22, 1939, Pablo Anduze. Allotype female and five paratypes with same data.

Portanus minor, new species

(Fig. 5)

Length: Male 4.00-4.40 mm., Female 4.60-5.00 mm.

Coloration: Ground color of venter including legs and face light brown to stramineous touched variably with darker areas on abdomen, legs, and face. Crown brown to dark brown, darkest anteriorly, four yellow spots on anterior margin, a pair at extreme apex and a single spot near each eye, two additional spots directly behind central pair (total six), discal region with yellow markings delimiting two highly variably subtriangular brown markings. Ocelli pale. Pronotum brown to dark brown marked with numerous minute pale round or oval areas. Scutellum brown with a few pale areas. Forewings as in *lex.*

Male Genitalia: Posterior margin of pygofer with an appendage similar to that of *lex.* Style like that of *major.* Aedeagus short, indented distally on dorsal margin and with a distinct basal area (Fig. 5).

Female Genitalia: Seventh sternum with posterior margin indented and a distinct blunt tooth at middle.

Types: Holotype male (USNM Type No. 34866) nr. Villa Real, Panama, August 22, 1952, F. S. Blanton. Allotype female Ft. Davis, Panama, Canal Zone, August 18, 1952. Forty-three paratypes, various localities and dates in Panama and the Canal Zone.

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A GENERIC HOMONYM IN THE MELOIDAE (COLEOPTERA)

Borchmann (Mitt. München Ent. Ges., vol. 32, p. 702; 1942) proposed a monotypic genus, *Ertlia*, for *E. fasciata,* a new species of Meloidae which he described (*ibid.*, p. 703) from material collected by Schulrat Ertl at Kigonsera, near Lake Nyassa, in Tanganyika. Unfortunately, the name *Ertlia* had been used previously by Aurivillius (Arkiv Zool., vol. 3, p. 124; 1907) for a genus of beetles in the family Cerambycidae. As a replacement name for *Ertlia* Borchmann, not Aurivillius, I propose *Ertliana,* new name.

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MUSCULATURE AND MECHANISM OF THE NYMPHAL SCENT-APPARATUS OF RIPTORTUS LINEARIS H.S. (HETEROPTERA: ALYDIDAE) WITH COMMENTS ON THE NUMBER, VARIATION AND HOMOLOGY OF THE ABDOMINAL SCENT GLANDS IN OTHER HETEROPTERA

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Abdominal scent-glands in the Heteroptera have been mentioned and described by many authors: Kunckel d'Herculais, 1866, 1895; Packard, 1895; Muir, 1907; Poisson, 1924, 1938; Brindley, 1929, 1930; Puri, 1924; Moody, 1930; Usinger, 1938; Drake and Slater, 1957; Carayon, 1948, 1958, 1962; Drake and Davis, 1958, 1960; Usinger and Matsuda, 1959 and Roth, 1961, to mention a few. The musculature of the scent-apparatus, however, has not been described in detail except perhaps Moody's account of the nymph of *Anasa tristis* (De Geer). During an investigation of the scent-apparatus in the Heteroptera, the writer found opportunity to study the musculature of the abdominal scent-apparatus of *Riptortus linearis* H. S., and the results of this study are presented in this paper.

Fifth instar nymphs of *Riptortus linearis* were collected in the Ayurvedic Gardens on the campus of Banaras Hindu University, India. Their musculature was studied in specimens preserved both in 70% alcohol and in Bouin's fluid. Freshly killed specimens were also used. Drawings were made with the aid of an ocular grid, and are not to the same scale.

THE GLANDS. The scent-glands are located under the tergites of the fourth and fifth abdominal segments. The Anterior gland, which is somewhat smaller than the Posterior one, opens externally between the fourth and fifth tergiters, while the Posterior one opens between the fifth and sixth tergiters (Fig. 1). The color of the glands is deep orange-red when fresh. Both the glands are roughly triangular in shape, the Anterior gland being constricted in the middle with two lateral pouch-like projections which provide attachment for the Lateral muscles (Fig. 2). The cephalic end of the Anterior gland is emarginate. Dorsally, each gland is attached by its neck to the posterior part of an ostiolar evagination. The posterior tip of the Anterior gland is in close apposition with the anterior face of the Posterior gland.

THE OSTIOLES (Fig. 4). The ostioles are located postero-laterally close to the margin of the ostiolar evagination. Each ostiole opens on each side into a trough-like depression, the peritreme, which is granular in appearance. The ostiolar evagination is dark in color and is beset with setae. No valves are present at the ostiolar opening.

THE MUSCULATURE. The muscles have been named according to their location with respect to the glands.

Muscles of the Anterior Gland. The Anterior gland is provided principally with five pairs of muscles, in addition to two pairs of Intermediate and two pairs of Interglandular muscles. The Postero-dorsal and Postero-ventral muscles are absent.

Anterior Muscles (AM 1, Fig. 2). These muscles are paired and have a common origin with the Anterior Laterals. They are attached anteriorly on the intersegmental membrane between the third and fourth tergites.

Antero-dorsal Muscles (ADM, Figs. 2, 3, 5). Arising from the neck of the Anterior gland, these paired muscles have a common attachment with the Anteroventrals on the intersegmental membrane between the third and fourh tergites.

Antero-ventral Muscles (AVM, Figs. 2, 5). These paired muscles are about half as long as the antero-dorsals and arise ventrally on the cephalic margin of the Anterior gland. They have a common insertion with the Antero-dorsals on the intersegmental membrane between the third and the fourth tergites.

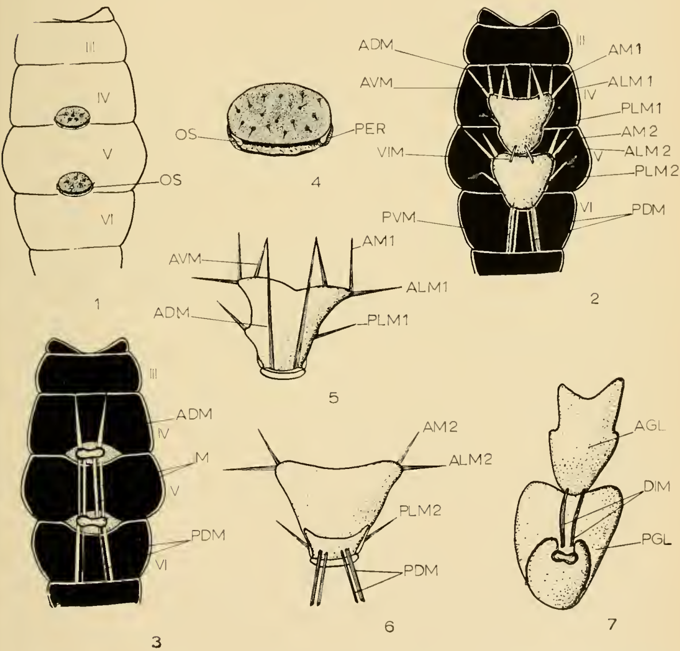

Fig. 1, Dorsal view of abdomen showing the location and external opening of the abdominal scent-glands; Fig. 2, Internal (ventral) view of the glands and associated muscles; Fig. 3, Internal (ventral) view of the muscles, after removal of glands; Fig. 4, Dorsal view of ostiolar evagination showing setae, ostiolar opening and peritreme; Fig. 5, Dorsal view of Anterior gland and associated muscles; Fig. 6, Dorsal view of Posterior gland and associated muscles; Fig. 7, dorsal view of Anterior and Posterior glands showing Dorsal interglandular muscles.

Lateral Muscles (Fig. 2)

Anterior Laterals (ALM 1). These paired muscles have common origin with the Anterior muscles on the lateral extremities on either side of the cephalic end of the gland, and are laterally attached on the tergum.

Posterior Laterals (PLM 1). These paired muscles arise laterally on the gland and are inserted on the tergum, their points of insertion being dark.

Muscles of the Posterior Gland. The Posterior gland is provided principally with six pairs of muscles, in addition to the two pairs of Intermediate and two pairs of Interglandular muscles. The Antero-dorsal and Antero-ventral muscles are absent.

Anterior Muscles (AM 2, Fig. 2). These paired muscles have common origin on the gland with the Anterior Laterals and are inserted on the intersegmental membrane between the fourth and fifth tergites.

Postero-dorsal Muscles (PDM, Figs. 2, 3, 6). These consist of two pairs of muscles. They arise on the neck of the Posterior gland and are inserted posteriorly on the intersegmental membrane between the sixth and seventh tergites. Each pair on each side consists of a thick outer and a narrow inner one.

Postero-Ventral Muscles (PVM, Fig. 2). These paired muscles arise from the blunt posterior end of the Posterior gland, and running ventrally along the outer thick muscle of the Postero-dorsal muscles on each side, are inserted with them on the intersegmental membrane between the sixth and seventh tergites.

Lateral Muscles

Anterior Laterals (ALM 2, Figs. 2, 6). Like the Anterior Laterals of the Anterior gland, these paired muscles also arise on the lateral extremities on either side of the cephalic end of the Posterior gland, but instead of being attached on the tergum laterally, are inserted on the intersegmental membrane between the fourth and fifth tergites.

Posterior Laterals (PLM 2, Figs. 2, 6). These muscles are paired and have almost the same origin and insertion as the Posterior Laterals of the Anterior gland.

Common Muscles of the Anterior and Posterior Glands. Both the Anterior and the Posterior glands have two pairs of Intermediate and two pairs of Interglandular muscles.

Intermediate Muscles (IM, Fig. 3). These two pairs of muscles run between the necks of the Anterior and Posterior glands. Each pair consists of an inner thick and an outer narrow muscle.

Interglandular Muscles

Dorsal Interglandulars (DIM, Fig. 7). These paired muscles run from the neck of the Posterior gland to the posterior part of the Anterior gland.

Ventral Interglandulars (VIM, Fig. 2). These are also paired and run from the posterior part of the Anterior gland to the anterior part of the Posterior gland.

MODE OF ACTION. The flattening of the glands is effected by the contraction of the Lateral, Anterior, Antero-ventral, Postero-ventral and the Ventral Interglandular muscles. The sudden contraction of these muscles perhaps provides the force necessary for the ejection of the fluid through the ostiolar openings. Normally, the walls of the necks of the two glands are in close apposition. The contraction of the Antero-dorsal, Intermediate, Postero-dorsal and partly the Interglandulars, pulls the walls of the neck apart, thus opening the passage from the glands to the exterior. It is likely that the common insertion of the Antero-dorsal and the Antero-ventral muscles plays some role in transmitting the wave of contraction from the muscles effecting the flattening of the glands to those which bring about the opening of the neck for the ejection of the fluid. However, simultaneous action of the two sets of muscles seems to be necessary for the ejection of the fluid.

That there is variation in the number and position of the abdominal scent-glands in various families, and even within various genera of the same family, has been mentioned by Kunckel d'Herculais (1895), Puri (1924), Brindley (1929) and Carayon (1955). The latter author also reported that the number and the position of these glands seem to be constant in a given species and probably also in all the species of a given genus. This constancy in number and position has been utilized in taxonomy by some authors (Usinger, 1938; Sweet & Slater, 1961), and very recently Carayon (1962) has discussed their taxonomic significance in the heteroptera. Table I shows the number and position of the abdominal scent-glands in certain families in the Heteroptera. While the presence of usually three pairs in many of them seems to be common, it is evident that reduction has occurred in others. This probably suggests that the primitive Heteroptera did possess a series of abdominal scent-glands, and that a reduction in their number has occurred. This progressive loss has been considered by Kirkaldy (1908), Brindley (1929) and China (1955) as indications of higher modification.

As far as is known, ventral abdominal scent-glands have not been reported in the Heteroptera. It seems unlikely that the metasternal scent-glands are the remnants of the primitive abdominal glands as is implied by Brindley (1930). However, it is probable that during the course of evolution, the function of the dorsal abdominal scent-glands may have been taken over by the metasternal glands. This seems to be reasonable in view of the fact that, with some known exceptions, the abdominal scent-glands become non-functional during the adult stage. This functional takeover by the metasternal glands from the abdominal glands may well have evolved for more efficient functioning of the glands, since the presence of wings in the adults would hamper the ejection and subsequent evaporation of the secretion of the glands if the latter were located dorsally on the abdomen of the adults. It has been suggested elsewhere (Gupta, 1961) that the function of the scent-glands is primarily defensive in the nymph and both defensive and sexual in the adults.

The homology of the nymphal and the imaginal scent-glands in the Heteroptera has not yet been established. As early as 1866 Kunckel d'Herculais reported that the nymphal and imaginal glands are morphologically similar. Kemper (1929) maintained that the two glands are different. He based his opinion on the evidence that metasternal glands are formed from two hypodermal buds, while the abdominal glands arise from a single invagination; also that they are different in their morphology and position. Brindley (1930) seemed to agree with Kemper. The present writer considers the abdominal and the

Table I

Families	Ostiolar openings	Segmental arrangement	Authorities
Pentatomidae	paired	3, 4, 5	Leston & Scudder (1956)
Cydnidae	paired & unpaired	3, 4, 5	Roth (1961)
Scutelleridae	paired	3, 4, 5	Leston & Scudder (1956)
Coreidae	paired	4, 5	Brindley (1929)
Pyrrhocoridae	paired	3, 4, 5	Brindley (1929)
Alydidae	paired	4, 5	Gupta (present study)
Lygaeidae	paired	3, 4 or 4, 5 or 3, 4, 5	Kunckel d'Herculais (1895); Brindley (1929); Leston & Scudder (1956)
Piesmatidae	paired	3, 4	Drake & Davis (1958); Carayon (1962)
Aradidae	paired	3, 4, 5	Usinger & Matsuda (1959)
Cimicidae	paired	3, 4, 5	Kunckel d'Herculais (1895); Brindley (1929)
Miridae	unpaired	3	Carayon (1958)
Anthocoridae	paired	3, 4, 5	Carayon (1958)
Thaumasto-coridae	paired	3, 4	Drake & Slater (1957)
Reduviidae	paired	4, 5	Brindley (1929)
Tingidae	unpaired	4, 5	Drake & Davis (1960)
Vianaididae	paired	4	Drake & Davis (1960); Carayon (1962)
Enicocephalidae	unpaired	4	Caryayon (1948)
Saldidae	paired	4	Brindley (1929); Gupta (1963)
Corixidae	paired	3, 4, 5	Kunckel d'Herculais (1895); Brindley (1929)

metasternal scent-glands as homologous structures. This is supported by the histological details and the mode of derivation of the two types of glands. The epidermal origin of the abdominal glands has been reported by Poisson (1924), Puri (1924), Moody (1930) and Carayon (1940), and the presence of the chitinous intima in the central collecting duct of the metasternal glands, indicating their epidermal origin, has been demonstrated by Puri (1924) and Johansson (1957).

List of Abbreviations

ADM, Antero-dorsal muscle of Anterior gland; **AGL**, Anterior gland; **ALM 1**, Anterior Lateral muscle of Anterior gland; **ALM 2**, Anterior Lateral Muscle of Posterior gland; **AM 1**, Anterior muscle of Anterior gland; **AM 2**, Anterior muscle of Posterior gland; **AVM**, Antero-ventral muscle of Anterior gland; **DIM**, Dorsal Interglandular muscle; **IM**, Intermediate muscle; **OS**, Ostiole; **PDM**, Postero-dorsal muscle of Posterior gland; **PER**, Peritreme; **PGL**, Posterior gland; **PLM 1**, Posterior Lateral muscle of Anterior gland; **PLM 2**, Posterior Lateral muscle of Posterior gland; **PVM**, Postero-ventral muscle of Posterior gland; **VIM**, Ventral Interglandular muscle.

Acknowledgement

I wish to express my gratefulness and sincere appreciation to Dr. W. F. Barr for reading the manuscript and to Dr. L. A. Kelton of Canada Department of Agriculture, Ottawa for determining the specimen.

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MISLABELED FIGURES IN SEYRIG'S GELINAE OF MADAGASCAR

(HYMENOPTERA: ICHNEUMONIDAE)

In 1952, there appeared part 4 of André Seyrig's "Les Ichneumonides de Madagascar" (Mém. Acad. Malgache, fasc. 19, 213 pp.), treating the subfamily Gelinae. This was published posthumously by his friend Lucien Berland, who took the unfinished manuscript, edited it for publication, and had drawings prepared. Seyrig had left an essentially complete manuscript of the tribes Brachycyrtini, Stilpnini, Hemitelini, and Phygadeuonini, but the manuscript for the Mesostenini was so incomplete that from it only a synopsis of the genera was published.

The figures prepared under Berland's direction help immensely, especially because of the many new genera. A few of the figures, however, are mislabeled. The existence of the errors was deduced by comparisons of the descriptions with the figures, and in 1958 it was possible to confirm these findings by study of Seyrig's collection in Paris. The mislabeled figures are as follows:

Figure 2, labeled *"Arearia paradoxa."* The figure is actually of *Tsirirella orbitalis.*

Figure 57, labeled *"Menaforia rufa."* The figure is of *Betsifia orbitalis.*

Figure 58, labeled *"Tsirambia acaulis."* The figure is of *Hemisphragia trianguliferus.*

Figure 59, labeled *"Hemisphragia trianguliferus."* The figure is of *Tsirambia acaulis.*

Figure 60, labeled *"Betsifia orbitalis."* The figure is of *Menaforia rufa.*

There is also a curious error in treating *Coccygodes*, *Odontocryptus*, and *Odontocryptus spiniculatus*, all previously described by Saussure, as new genera and a new species. This was doubtless due to a mix-up caused by the history of the manuscript.

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A NAME LIST OF WORLD CULICOIDES, 1956-1962
(Diptera, Ceratopogonidae)

Paul H. Arnaud, Jr.[1] and Willis W. Wirth[2]

In 1956, Arnaud published a name list of the genus *Culicoides* of the World as an appendix to his Revision of the *Culicoides* of Japan, Korea, and Ryukyu Islands (Arnaud, 1956, pp. 143-156). A total of 671 names was listed as published between 1758 and the beginnnig of 1956. The present paper gives the names of *Culicoides* proposed during the past 6-year period. The total of 245 new names (244) recent, 1 fossil) is listed below, which brings the grand total to 916 names now proposed within this single genus. This total does not, however, take into consideration synonymy and generic transfers, so we estimate that the total number of valid names of *Culicoides* would probably be in the order of 800.

As a possible index to the size of the *Culicoides* fauna of the world, it is interesting to compare the number of species of the genus *Culicoides* with the number of species of Culicidae in a rather thoroughly studied fauna. In Great Britain, in a temperate zone, Campbell and Pelham-Clinton (1960) listed 41 species of *Culicoides,* while in comparison in 1962 only 32 species of Culicidae (fide Paul Freeman, *in litt.*) occur in the same country. If this same ratio of approximately four *Culicoides* to three Culicidae were to hold in all faunal areas of the world, the number of actual species of *Culicoides* would be great indeed. Perhaps this ratio may not apply to tropical areas. It is interesting to note that Stone (1963) in Supplement II to the Synoptic Catalog of the Mosquitoes of the World, recorded 2,591 valid species in 118 valid genera and subgenera.

The method of presentation in the following list of *Culicoides* species is mostly self explanatory, and is as follows: Inasmuch as all names listed were proposed in the genus *Culicoides* the generic name is omitted from each citation. The names are arranged alphabetically, each with the name of the author and bibliographic citation. The type locality and type depository are given for each species when this information is known. Only the type locality, and not the general distribution is cited here. To save space, the names of the more important type depositories are abbreviated as follows:

A.S.U.S.S.R.—Zoological Institute, Academy of Sciences of the U.S.S.R., Leningrad.

B.M.N.H.—British Museum (Natural History), London.

B.P.B.M.—Bernice P. Bishop Museum, Honolulu.

C.N.H.M.—Chicago Natural History Museum, Chicago.

I.P.A.—Institute Pasteur d'Algérie, Algiers.

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[2]Entomology Research Division, A.R.S., U. S. Department of Agriculture, Washington 25, D. C.

P.D.H.—Division of Malaria, Philippine Department of Health, Manila.

U.S.N.M.—U. S. National Museum, Washington.

Z.S.I.—Zoological Survey of India, Calcutta.

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albertensis Wirth and Jones, 1957, U. S. Dept. Agr., Tech. Bull. No. 1170: 17 (Subsp. of *variipennis*). Alberta. (Canadian National Collection, Ottawa.)

albibasis Wirth and Hubert, 1959, Pacific Insects 1: 31. Malaya. (U.S.N.M.)

albopunctatus Clastrier, 1960, Arch. Inst. Pasteur d'Algérie 38: 84. République du Congo. (I.P.A.)

alexanderi Wirth and Hubert, 1962, Ann. Ent. Soc. Amer. 55: 190. Massachusetts. (U.S.N.M.)

alexandrae Dzhafarov, 1962, Ent. Obozrenie 41: 211. U.S.S.R., Azerbaidjan. (A.S.U.S.S.R.)

algeriensis Clastrier, 1957, Arch. Inst. Pasteur d'Algérie 35: 426. Algeria. (I.P.A.)

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ardleyi Tokunaga, 1962, Pacific Insects 4: 474. New Guinea. (B.P.B.M.)

arizonensis Wirth and Hubert, 1960, Ann. Ent. Soc. Amer. 53: 655. Arizona. (U.S.N.M.)

arnaudi Hubert and Wirth, 1961, Proc. Ent. Soc. Washington 63: 238. Ryukyu Islands, Okinawa. (U.S.N.M.)

assimilis Delfinado, 1961, Fieldiana: Zoology 33: 660. Philippine Islands. (P.D.H.)

australis Wirth and Jones, 1957, U. S. Dept. Agr., Tech. Bull. 1170: 15. (subsp. of *variipennis*). Louisiana. (U.S.N.M.)

autumnalis Sen and Das Gupta, 1959, Ann. Ent. Soc. Amer. 52: 628. India. (Z.S.I.)

azerbajdzhanicus Dzhafarov, 1962, Ent. Obozrenie 41: 211. U.S.S.R., Azerbaidjan. (A.S.U.S.S.R.)

azureus Wirth and Blanton, 1959, Proc. U. S. Natl. Mus. 109: 377. Panama. (U.S.N.M.)

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baghdadensis Khalaf, 1957, Bull. Soc. Ent. Egypte 41: 341 (subsp. of *similis*). Iraq. (B.M.N.H.)
baisasi Wirth and Hubert, 1959, Pacific Insects 1:12. Philippine Islands. (U.S.N.M.)
barbosai Wirth and Blanton, 1956, Florida Ent. 39: 161. Panama. (U.S.N.M.)
barnetti Wirth and Hubert, 1959, Pacific Insects 1: 32. Malaya. (U.S.N.M.)
begueti Clastrier, 1957, Arch. Inst. Pasteur d'Algérie 35: 432. Algeria. (I.P.A.)
bermudensis Williams, 1956, Jour. Parasit. 42: 298. Bermuda. (U.S.N.M.)
beybienkoi Dzafarov, 1962, Akad. Nauk Azerbaidzhan S.S.R. 1: 183. U.S.S.R., Azerbaidjan. (? A.S.U.S.S.R.)
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brevipalpis Delfinado, 1961, Fieldiana: Zoology 33: 654. Philippine Islands. (P.D.H.)
bubalus Delfinado, 1961, Fieldiana: Zoology 33: 658. Philippine Islands (P.D.H.)
bulbostylus Khalaf, 1961, Beitr. zur Ent. 11: 463. Iraq. (B.M.N.H.)
butleri Wirth and Hubert, 1960, Ann. Ent. Soc. Amer. 53: 650. Arizona. (U.S.N.M.)
cacticola Wirth and Hubert, 1960, Ann. Ent. Soc. Amer. 53: 653. California. (U.S.N.M.)
cameroni Campbell and Pelham-Clinton, 1960, Proc. Roy. Soc. Edinburgh, Sec. B. (Biol.) 67: 222. Scotland. (B.M.N.H.)
candidus Sen and Das Gupta, 1959, Ann. Ent. Soc. Amer. 52: 620. India. (Z.S.I.)
carjalaensis Gluchova, 1957, Ent. Obozrenie 36: 249. U.S.S.R., Karelia. (A.S.U.S.S.R.)
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THE PROPOSAL OF A NEW NAME

(Hemiptera: Hydrometridae)

In 1926 [Bull. Brooklyn Ent. Soc., 21: 129], Torre-Bueno wrote "Of all low things, I feel that 'debaptizing' some other man's insect has an undistinguished place all alone. Yet, under the rules of nomenclature as adopted there is nothing else to do. And the law compels me." Compelled by this same law, I too must correct a homonym.

Hydrometra insularis was described by Hungerford and Evans [1934, Annales Musei Nationalis Hungarici, 38: 76] for a new species found in Sumatra and Java. Unfortunately, this name is preoccupied by *Hydrometra insularis* Motschulsky [1866, Bull. Soc. Imperiale Naturalistes, 39: 188], which now belongs to the genus *Gerris* of the Gerridae, and the former species must be renamed. The following name, based upon the type locality, is here proposed:

Hydrometra sumatrana, n.n. = *Hydrometra insularis* Hungerford and Evans.—Florence A. Ruhoff, *U.S. National Museum, Washington, D. C.*

TYPES OF MICROLEPIDOPTERA DESCRIBED BY EDWARD MEYRICK[1] IN THE COLLECTION OF CORNELL UNIVERSITY

A. DIAKONOFF[2]

In the course of his long life Edward Meyrick described many exotic Microlepidoptera. By far the greater part of the types of his species was bequeathed, together with his collection, to the British Museum (Natural History) and is preserved there. A monumental monograph on these types by J. F. Gates Clarke is now in the course of publication.

Sometimes, however, Meyrick returned types to the institution or museum for which he made identifications. For this reason there are many of his types in collections scattered over the world. In fact, there are few collections of tropical Microlepidoptera in which no Meyrick types are present. Sometimes these "stray" types are not easily available; some have been overlooked. Since Meyrick never described the genital characters, an examination of these structures appears highly desirable.

A part of a small collection of Microlepidoptera, brought together by the Eichhorn brothers in 1918, from the Hydrographer Mountains of North Central New Guinea, was purchased by Dr. Wm. T. M. Forbes, and added to the collection of Lepidoptera of the Department of Entomology, Cornell University, Ithaca, New York. Much later, part of this collection was sent to Meyrick for identification. He described five new species in "Exotic Microlepidoptera" and returned the types to Cornell University where they are now. All of the types bear the same locality data as shown under *Sarisophora praecentrix.*

Recently I had the opportunity to study the five types. Photographs, a few notes, and descriptions and figures of the genitalia are presented in this paper.

My sincere thanks are due to the authorities of the Division of Entomology, Cornell University, in particular to Dr. J. G. Franclemont, for the permission to study and dissect the material, and to Mr. J. Scott, Smithsonian Institution, for making the photographs.

GELECHIIDAE

Sarisophora praecentrix Meyrick

(Fig. 1)

Sarisophora praecentrix Meyrick, 1931, Exotic Microlepidoptera 4: 78.

Holotype ♂, Cornell University type no. 1278-1, Hydrographer Mountains, British New Guinea, 2500 feet, February 1918 (Eichhorn brothers). Genitalia slide no. 5499 (Figs. 7, 8).

The following may be added to the original description. A clear fuscous median longitudinal streak over crown of head. Palpus with median segment dark fuscous except apex and lower edge. Antenna

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conspicuously dark fuscous, extreme tip yellowish, scape fuscous, dotted with yellow toward apex. Fore wing with apex subobtuse, termen gently but distinctly sinuate, oblique. Veins 7 and 8 stalked, but vein 9 distinctly separate. Dark transverse mark formed by a purple-fuscous suffusion, from $\frac{2}{3}$ of dorsum, clearly not reaching above base of vein 9 (not reaching costa!). Hind wing light ocherous-yellow, rather densely suffused with pale fuscous; cilia light ocherous-yellow.

Male genitalia (Figs. 7, 8). Uncus and vinculum of the shape characteristic for the genus *Lecithocera* H. S., of which *Sarisophora* Meyr., in my opinion, is only a synonym. Valva broad, rather curved upwards, with a small short-haired sacculus from well beyond base, and a broadly rounded cucullus. Harpe (armature of the disc of the valva) is represented by a moderately curved series of dense and strong spines of moderate length, situated well above the lower margin of the valva, where the end of sacculus forms an obtuse angle. Aedeagus large, dilated at base. Cornuti, a large and dense sheaf of spines.

Judging from the male genitalia the species may be nearest *Lecithocera lutescens* Diak., from the Snow Range.

Protolechia amphiplaca Meyrick

(Fig. 2)

Protolechia amphiplaca Meyrick, 1932, Exotic Microlepidoptera, 4: 352.

Holotype ♀, Cornell University type no. 1273-1. January-May 1918. Genitalia slide no. 1273-1 (Fig. 13).

Palpus strongly curved, ascending; tufts on vertex highly raised. Head and palpus and also anterior half of thorax purplish-brown. Fore wing with termen very oblique. All dark markings purplish-brown. Yellow basal patch on costa not reaching one-fifth. Cilia purplish-brown.

Female genitalia (Fig. 13) peculiar, suggesting a hyponomeutid; certainly not a *Protolechia*. Sterigma little developed, a pair of erect pear-shaped sclerites flanking the ostium which is not clearly developed. Ductus bursae with a colliculum represented by a small, slender sclerite fragment; ductus extremely long, tortuous, coiled. Corpus bursae large, ovoid. Signum, an ax-shaped denticulate plate with a slender stalk.

Scaeosophidae

Cyphothyris pyrrhophrys Meyrick

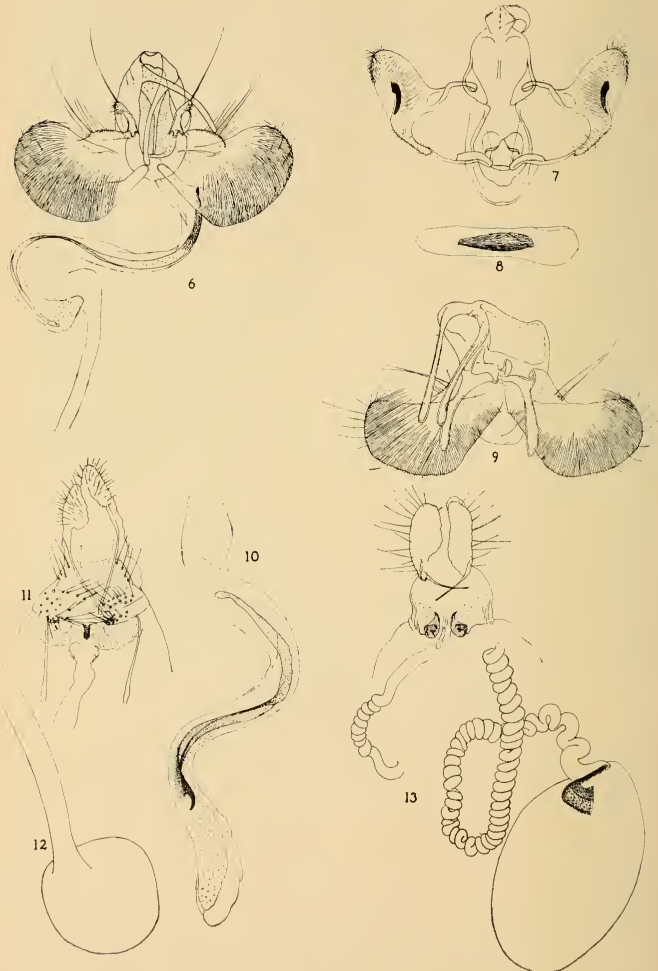
(Fig. 3)

Cyphothyris pyrrhophrys Meyrick, 1932, Exotic Microlepidoptera, 4: 332.

Holotype ♂, originally designated, Cornell University type no. 1271-1. January-February 1918. Genitalia slide no. 5498 (Figs. 9, 10).

Discal stigmata are dark, minute and raised, second double, one of these dots on upper, another, on lower angle of cell; the second oblique white line before apex not reaching costa. The specimen may have faded.

Male genitalia (Figs. 9, 10), similar to those of the following, but with vinculum broader and less defined, with valva more angulate, without a costal prominence. Tegumen and gnathos similar, but labides much longer, more gradually clavate and without the characteristic apical bristle. Aedeagus very similar (separated from mount).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Cyphothyris disphaerias Meyrick

(Fig. 4)

Cyphothyris disphaerias Meyrick, 1932, Exotic Microlepidoptera, 4: 333.

Holotype ♂, originally designated, Cornell University type no. 1272-1. January 1918. Genitalia slide no. 5497 (Fig. 6).

Palpus whitish, median segment infuscated, with a narrow subapical, incomplete fuscous ring; terminal segment with broad subbasal and supramedian rings. From the original description is also omitted any reference to a suffused fuscous irregular Y-shaped mark on the middle of dorsum, centered with white, its top connected by a line with the lower edge of the first circular spot.

Male genitalia (Fig. 6). Tegumen and uncus little sclerotized, the latter broad, semicircular. Uncus absent. Gnathos paired, arms long, simple, porrect. Valva broad, cucullus strongly dilated, rounded and semicircular, haired; sacculus weak, indicated at base only; costa forming a rounded separate prominence with a series of long bristles; labis, a slender clavate process, slightly dilated at base, distally short-haired with a single long bristle. Aedeagus peculiar (its apical portion punctulate in figure): extremely large, long, sinuous, containing a sinuous sclerotized band, ending in a strong hook; this band strongly resembles a female cestum!

OECOPHORIDAE

Syscalma pyroptera Meyrick

(Fig. 5)

Syscalma pyroptera Meyrick, 1933, Exotic Microlepidoptera 4: 367.

Holotype, ♀, Cornell University type no. 1276-1. March 1918. Genitalia slide no. 5495 (Figs. 11, 12).

Palpus pale ocherous; median segment long, strongly clavate, sprinkled with purple, tip with a broad ring; terminal segment orange-ocherous. Antenna (broken) purple, rough-scaled. Thorax purple. Forewing with dark parts deep purple. Cilia deep purple with two dark lines. Hind wing with dark markings and cilia deep purple-brown.

Female genitalia (Figs. 11, 12) with the eighth sternum moderately sclerotized, with two large fields of fine, articulating bristles flanking the ostium bursae. Sterigma little sclerotized, almost submembranous, formed by two transversely plicate moderate sclerites converging in middle, a small digitoid sclerite, darkly sclerotized, anterior to genital opening. Ductus and corpus bursae simple, the latter spherical, moderate.

A NOTE ON THE DISTRIBUTION AND RECOGNITION OF ZANCLOGNATHA ATRILINEELLA (GROTE)

(LEPIDOPTERA: NOCTUIDAE)

The name *Cleptomita atrilineella* Grote was proposed in 1873, Trans. Amer. Ent. Soc., 4: 301, for an unique male noctuid collected by G. W. Belfrage in Texas in the month of April. Smith, 1895, Bull. U. S. National Museum, No. 48, p. 27, synonymized *Cleptomita* Grt. under *Zanclognatha* Led., thus transfering *atrilineella* to that genus. The type is in the collection of the Philadelphia Academy of Natural Science. There is a photograph of the type in the collection of the U. S. National Museum.

Zanclognatha atrilineella (Grote), ♂

To my knowledge, no published records of other specimens of *Zanclognatha atrilineella* (Grote) exist. There is a penciled note, "Miss. (Benj. 1 ♀)," after this species in a manuscript catalog which came to the U. S. National Museum with the William Barnes collection of Lepidoptera. The specimen of *atrilineella* identified by Benjamin does not appear to be in the collection here. Perhaps it will be located in another collection, such as that at Mississippi State University, State College, Mississippi. In January 1962, Mrs. Joan Chapin, Baton Rouge, Louisiana sent a ♂ of this species to me for identification. It was collected at Prairieville, Ascension Parish, La., on July 8, 1961, by Glynn Lambert. In June 1963, a ♀ collected by M. and E. Roshore, Sept. 24, 1961, at Clinton, Hinds Co., Miss. was received from Bryant Mather, Jackson, Miss.

This species may be distinguished from other species of *Zanclognatha* of similar size (length of forewing: Male 10 mm., female 11 mm.) by the conspicuous, dark transverse lines and reniform spot of the forewing.

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A NEW ANOETUS MITE FROM PITCHER PLANTS

(ACARINA: ANOETIDAE)[1]

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The abliity of certain Arthropods to withstand the digestive action of the liquor in insectivorous pitcher plants is exemplified by the larvae of the mosquitoes, *Wyeomyia smithii* (Coquillett) and *W. haynei* Dodge, found only in the pitchers of *Sarracenia purpurea* L. (see e.g. Dodge, 1947; Price, 1958). Arthropoda that live exclusively in this unique habitat are rare, and a group which has received very little attention is the species of *Anoetus* (Anoetidae) mites found in the pitchers of some pitcher plants. Only two species of *Anoetus* mites have been reported from pitcher plants. Hirst (1928) described *Zwickia nepenthesiana* from the pitchers of *Nepenther ampullaris* from Singapore, and Nesbitt (1954) described *Zwickia gibsoni* from the pitchers of *Sarracenia purpurea* from Canada. Both of these species were later placed in the genus *Anoetus* by Hughes and Jackson (1958). The work reported here extends the range of *A. gibsoni* and describes a new *Anoetus* from the pitchers of *Sarracenia minor* and *flava.* Biological observations are reported for both mite species.

During the course of the present study, field collected pitchers of *Sarracenia purpurea* subspecies *venosa*, *S. minor*, *S. flava*, and *S. rubra* were brought into the laboratory and examined for anoetid mites. The plants were collected from Georgia and North Carolina.

All stages of *Anoetus gibsoni* were taken from *S. purpurea* pitchers collected in Rabun County, Georgia, and Wilmington, North Carolina, the only two localities from which this plant was collected. In a previous study *Anoetus gibsoni* was also collected from *S. purpurea* subspecies *gibbosa* from Itasca State Park in Minnesota (Price and Hunter, 1958, unpublished data). In all plants checked this was the only species of *Anoetus* found in the pitchers of *purpurea*, and conversely *A. gibsoni* was not found in the pitchers of any of the other species of pitcher plants listed above. These collections extend the range of *A. gibsoni* to Minnesota, Georgia, and North Carolina, and it seems likely this mite would be found in the pitchers of *purpurea* throughout the geographical range of the plant.

For the other pitcher plants checked, *Anoetus* mites were found in the pitchers of *S. minor* and *S. flava* only. The mite from *minor* is identical to the one found in *flava* pitchers but is morphologically distinct in all postembryonic stages from *A. gibsoni.* It appears that two distinct mite species are involved, *A. gibsoni* being restricted to *S. purpurea* and the new species described below limited to *S. minor* and *flava.* At Wilmington, North Carolina, *purpurea*, *minor* and

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flava pitcher plants were collected from the same bog area. Presumably, therefore, the mites would have had some opportunity to become established in all the pitcher plants of the area. The fact that *A. gibsoni* was found only in *purpurea* pitchers, and the new species was found only in *minor* and *flava* pitchers provides additional evidence of a species distinction for these mites.

All setal notation abbreviations in the following descriptions are those used by Hughes and Jackson (1958) in their review of the Anoetidae.

Anoetus hughesi n. sp.

In the non-hypopial stages this species has long body setae giving the mite a hairy appearance; palpal seta *pp*2 is long and directed laterally; propodosomal setae *dp*4 flagellumlike, several times the length of *dp*3; *dp*2 minute; tarsus II has heavy spinelike setae; legs II in the male are at least twice as thick as the other legs.

FEMALE. Idiosoma 490 μ long, 220 μ wide behind coxae II, greatest width of body 310 μ. *Dorsum*: Weak suture between propodosoma and hysterosoma; one granular plate on anterior of propodosoma, second plate on hysterosoma, exact shape of plates varies slightly from specimen to specimen. Propodosomal setae *dp*4 long whiplike, several times the length of *dp*3; *dp*2 very small, on edge of plate; *dp*1 not seen. Hysterosomal setae long, flagellumlike, position and relative lengths as shown; four pairs of pitlike structures as illustrated. *Venter*: Ventral setae fine, relative lengths and location as shown. A pair of small pitlike structures posteriolateral of setae *vm*1. Anal setae *vo*2 missing; *vo*1 small, at anterior end of anal opening; posterior of anus a pair of long setae which were interpreted as *vo*3, in which case setae *do*7 apparently missing (this setal pattern was constant in all female specimens checked). *Legs*: I and II heavier than III and IV; seta *f* on femurs I and II short, peglike, only about twice as long as diameter of setal base. Tarsal setae, in general, heavy; *ta*6 of tarsi I and II distinctly longer than *ta*5 or *ta*7. Leg I *ta*2 and *ta*3 2/3 to 3/4 length of *ta*1; *g*3 and *g*4 fine, slender setae. Leg II *g*3 and *ta*2 both flagellumlike; *ta*16 about twice length of claw. Claws curved. *Gnathosoma*: 100 μ long, 90 μ wide at base. Chelicerae long, slender; flagellum of chelicera not as long as serrated area. Palpal seta *pp*1 long, flagellumlike, over twice as long as *pp*2; *pp*2 directed laterally approximately twice length of palps, tapering to a point; *pp*3 about as long as *pp*2.

MALE. Idiosoma 420 μ long, 170 μ wide behind coxae II, 230 μ at greatest width of body. *Dorsum*: Propodosomal suture weak; propodosomal plate as in female; setae *dp*3 and *dp*4 slightly longer than in female; *dp*2 very small; *dp*1 not seen. Hysterosomal plate larger than in female; setae long, flagellumlike, those on posterior of body longer than in female, position and relative lengths as illustrated; four pairs of pitlike structures as shown. *Venter*: Ventral setae whiplike, of unequal lengths; *vm*1 setae anterior to ringlike structures *r*1. Anal setae *vo*2 present. Position and relative lengths of setae as shown. *Legs*: Legs II much heavier than other legs, genu and femur II twice diameter of genu and femur I. Legs I slightly heavier than either III or IV. Seta *f* on femur II short, spurlike, much heavier than seta *f* on femur I which is peglike as in female. Tarsus II setae heavy, *ta*7 much heavier than in female. Seta *ta*16 leg III only

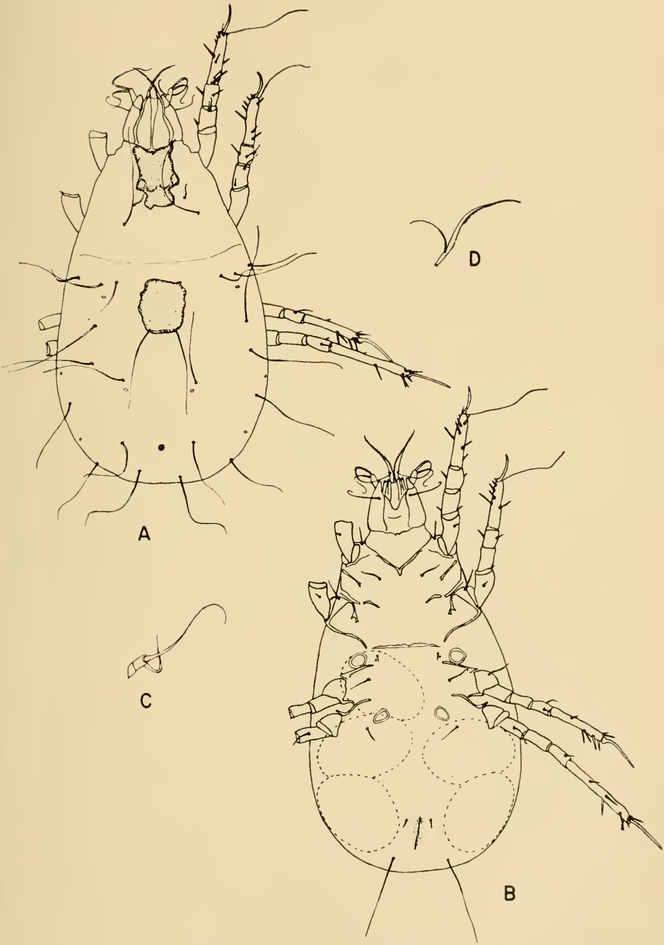

Fig. 1, *Anoetus hughesi* n. sp. Female, A, dorsal view; B, ventral view; C, palpus; D, chelicera.

slightly longer than claw; *ta*16 leg IV 1½ times length of claw. Claws III and IV longer than I and II; claw II heaviest. Claws curved. *Gnathosoma:* 60 μ long, 65 μ wide at base; chelicerae as in female. Palpal setae with same relative lengths as in female.

DEUTONYMPH. Oval, 250 μ long, 185 μ at greatest width. *Dorsum*: Smooth, without sculpturing; setae fine, minute, those of hysterosoma of equal length and slightly shorter than propodosomal setae. An eyelike structure on each side of hysterosoma between setae *dm*2 and *dm*3. *Venter*: Pedipalps about twice as long as wide; length of palpal seta *pp*1 about equal to combined lengths of genu and tibia I. Apodemata *a*2 extends well posterior of end of sternum *st*1, turns medial at posterior tip, almost reaching to *a*4; apodemata *a*4 connected by faint line to *a*5. Sternum *st*3 ending free, well posterior of level of setae on coxae II, coxae I and III with minute setae. Setae *vm*1 hairlike, longer than coxal setae I or III. Suctorial plate ellipsoid, suckers *su* of about the same size as central disc *pd*1; other structures on plate as illustrated. *Legs*: Legs I and II with internal sclerotization on some segments as shown. Seta *ta*16 of leg I cuplike on end (this seta tends to collapse or is poorly oriented on some mounts giving it a different appearance; in well-mounted specimens seta is as illustrated). Leg II seta *ta*16 lancet-shaped. Legs II and IV seta *ta*4 long flagellumlike; seta *ta*16 long and whiplike; *ta*16 on leg IV longer than tarsus. All tarsi with claws.

Type. This species was described from a series of 20 female, 20 male, and 20 hypopial specimens. Holotype and allotype with the following data: Evans Co., Georgia; June 15, 1961, from pitchers of *Sarracenia minor*. Paratypes from *Sarracenia minor* and *S. flava* pitchers collected from Evans, Bryant, Tift, and Wayne counties in Georgia. All collections were made by the authors. Holotype, allotype, and paratypes will be deposited with the U. S. National Museum, Washington, D. C.; paratypes with the Institute of Acarology, Wooster, Ohio; and with Dr. R. D. Hughes, Department of Biology and Genetics, Medical College of Virginia, Richmond, Virginia. Remaining paratypes will be retained in the Department of Entomology, University of Georgia, Athens, Georgia.

Remarks: This species is very similar to *A. gibsoni.* In the adult stage the species is easily separated from *gibsoni* by one or more of the following characters: *pp*2 is well developed and directed laterally, in *gibsoni* this seta is minute (or absent in the male?) and directed medially; dorsal setae considerably longer than in *gibsoni;* length of seta *f* of femur II only about twice diameter of setal base, this seta several times diameter of setal base in *gibsoni;* the chelicerae are long, slender and whiplike in the new species, in *gibsoni* they are heavier, shorter and curve medially. These characteristics will also separate the larval, proto- and tritonymphal stages of the two species. In the male leg II of *hughesi* is at least twice as thick as leg I, whereas in *gibsoni* these two legs are of about equal thickness.

The hypopi of the two species show a greater similarity than the other stages. The most distinctive differences found were as follows: pedipalps of new species shorter than in *gibsoni;* sternum *st*l ends well short of the posterior end of apodemata *a*2, these end on about the same level in *gibsoni; st*3 shorter in the new species; dorsal setae

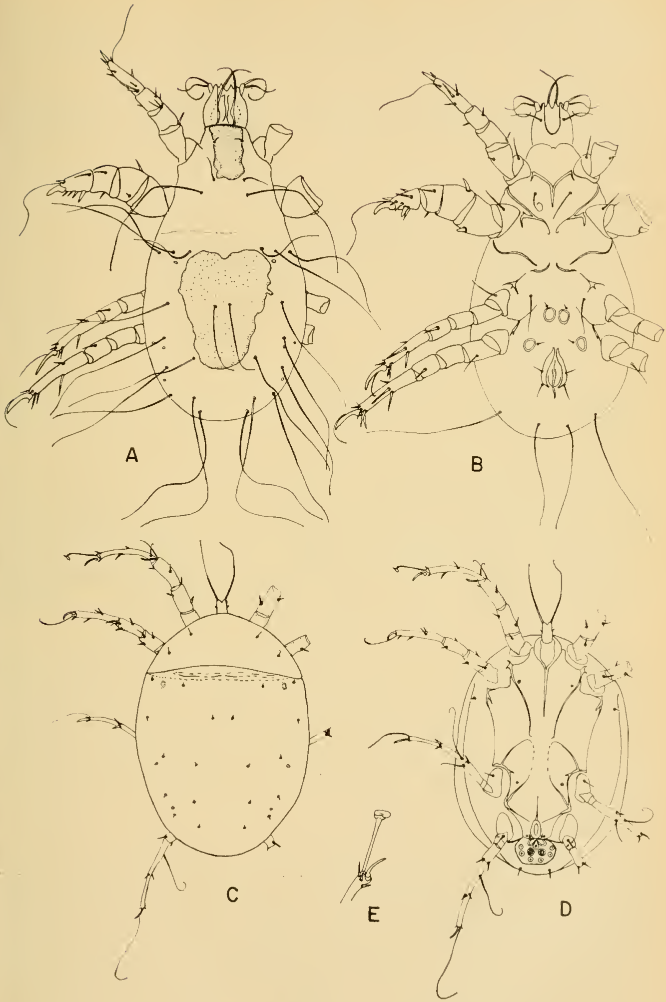

Fig. 2, *Anoetus hughesi* n. sp. Male, A, dorsal view; B, ventral view; Deutonymph, C, dorsal view; D, ventral view; E, tarsus I.

of unequal length, in *gibsoni* the dorsal setae are of about equal length. The eyelike spots on the dorsum of the new species are also present on *gibsoni* hypopi, although these were not mentioned in previous description of *gibsoni*.

In the key to the *Anoetus* given by Hughes and Jackson (1958) the adults of the new species would key to *bushlandi* and the hypopus to *gibsoni*. The following additions to the key will separate the new species.

Male

2. Pedipalpal seta *pp*1 long, flagellumlike, longer than tarsus I 2a
   Pedipalpal seta *pp*1 shorter than tarsus I 3

2a. Propodosomal setae *dp*3 and *dp*4 of about equal length, on the same level .... **bushlandi**
   Propodosomal setae *dp*4 much longer than *dp*3; *dp*4 setal base well posterior of *dp*3 .... **hughesi**

Female

The female of *hughesi* may be separated from *bushlandi* by the same characteristics given for the male.

Deutonymph

8. Apodemata *a*5 free, not meeting to form *st*2 9
   Apodemata *a*5 not free, meeting to form *st*2 .... **nepenthesiana**

9. Sternum *st*1 ending at level of or slightly short of posterior end of *a*2; pedipalps over twice as long as wide .... **gibsoni**
   Sternum *st*1 ending well short of posterior end of *a*2; pedipalps about twice as long as wide .... **hughesi**

Biology

During the course of this work some biological observations were made on both *gibsoni* and *hughesi*. *A. hughesi* was found in the green or partially green pitchers of *S. minor* and *S. flava* at all seasons of the year. In Georgia these plants are found in the southern or coastal areas where prolonged low temperatures would not normally occur, presumably reproduction of the mite would take place throughout the year.

Over 100 pitchers of *S. minor* and *flava* were collected during the year and examined in the laboratory for *Anoetus* mites. Live *A. hughesi* were found in 86% of the *flava* and 72% of the *minor* green or partially green, opened pitchers. In the pitchers examined in the laboratory, *Anoetus* mites were not found in any pitcher—such as small, newly opened—where insect remains were not present, and no live *Anoetus* mites were found in the completely dry, dead pitchers.

The largest populations of *A. hughesi* were found in pitchers having a large amount of partially dissolved insect remains. In general, the population size was correlated with the condition of the insect remains rather than the size of the pitcher; however, the larger pitchers often had more undissolved insects and therefore larger mite populations. Hypopi were most abundant in those pitchers where only the insect exoskeletons remained, and in some of these pitchers hypopi were the only live *Anoetus* found.

The various developmental stages of *hughesi* show a general vertical distribution within the pitchers. The hypopial stage was found on the wall of the pitchers above the insect remains, eggs were found attached to the pitcher wall at about the top level of the insect remains, the larvae and protonymphs below the eggs either on the wall of the pitcher or in the insect remains, and the tritonymphs and adults in the lower areas of the insect remains. In most of the pitchers examined, very little free liquid was found in the bottom of the pitchers, and the adult mites were usually found above this. It seems likely that these mites do not actually live in the free liquid of these pitchers.

The ecological habitat of *A. gibsoni* appears to be quite different from that of *hughesi*. Mature pitchers of *purpurea* contain a considerably larger volume of liquid than is found in *flava* or *minor* pitchers, and the origin of this liquid is apparently quite different. Hepburn (1927) found that unopened *purpurea* pitchers did not produce enough liquor to measure, and the liquor in opened pitchers came primarily from rain water; in contrast to this, unopened *flava* pitchers contain an average of 0.66 cc. of liquor and this volume rose to an average of only 1.50 cc. in opened plants. The chemical composition of the liquor is also different. Hepburn found that the protease of *purpurea* acts best in the presence of dilute alkali, and that of *flava* and *minor* acts best in the presence of dilute acid. These authors also reported differences in the chemical composition of the tissues of *purpurea* compared to *flava* and *minor*.

It was noted that the liquid from *purpurea* was usually teeming with microorganisms, but microorganisms were not usually seen in the liquid from *flava* or *minor*.

By cutting off the pitchers of *purpurea* just above the level of the liquid and examining the pitcher for mites, it was possible to determine the distribution of *gibsoni* in the pitchers. No mites were found on the sides of the pitcher above the surface of the liquid. All stages of the mite, including eggs and hypopi, were found below the surface of the liquid, indicating that the mite actually lives in the liquid of the pitcher.

Presumably the *Anoetus* mites in the pitcher plants feed on the decomposing insect remains or on microorganisms associated with the decomposition. In the laboratory *hughesi* has been reared in small jars or dishes containing a solution made by washing out the pitcher plant liquid with small amounts of water. The volume of liquid in the dishes and jars was always small enough that the center of the container extended above the water level. Crushed, freshly killed house flies were placed in the jars as a food source for the mites. *Anoetus* mites put into these solutions lived and some reproduction occurred, but because of heavy mold growth on the flies these cultures could not be maintained easily for long periods of time. In these cultures the mite eggs were always found above or at the edge of the water surface, and the larvae and nymphs were usually found on insect parts which extended above the surface of the water. Only the adults were commonly seen moving around below the water surface on the bottom of the container.

A. gibsoni has been reared in the laboratory for several months by putting the contents from several *purpurea* pitchers in finger bowls with distilled water added to make a liquid depth of at least one inch. Crushed, freshly killed house flies were added to the bowls at irregular intervals as a food source for the mites. The feeding stages of the mite tended to congregate around the crushed flies. Eggs of the mite were found scattered throughout the debris on the bottom of the dish. In these rearings hypopi were not observed on the sides of the dish above the water surface.

Under the rearing conditions used, large populations of *gibsoni* and *hughesi* did not develop, and over a long period of time the populations never much more than maintained their numbers.

The *Anoetus* mites probably move from pitcher plant to pitcher plant by the hypopi being carried to new plants on insects which visit the pitchers. In the case of *A. gibsoni* the *Wyeomyia* mosquitoes, although weak flyers, may serve as a transportation host. In this case since the hypopi apparently may live under water, they could attach to the mosquito pupae then move onto the adult mosquito when it emerges from the pupal case. No counterpart of *Wyeomyia* has been found in the pitchers of *minor* and *flava*. However, it would seem likely that some flying insects after entering these pitchers, are able to escape from the larger pitchers, and carry hypopi from one plant to another.

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SARCOPHAGID FLIES FROM THE REVILLAGIGEDO ISLANDS
(DIPTERA: SARCOPHAGIDAE)

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The author is indebted to Dr. John N. Belkin, University of California, Los Angeles and to Dr. Edward L. Kessel, California Academy of Sciences, for making available for study small but important collections of Sarcophagid flies from the isolated and peculiar Islas Revillagigedo, Mexico, which lie in the Pacific Ocean, several hundred miles off the coast of Mexico. The largest Island, Socorro, is latitude 19° N., longitude 111° W., approximately 300 miles West by South of the tip of Baja California. San Benedicto, the smallest inhabited island, lies about 50 miles North of Socorro, and Clarion Island is about 250 miles West of Socorro and 480 miles S.W. of San Jose del Cabo, Baja California.

Six species are recognized in this material, of which three are new. The types of the new species have been returned to their respective institutions, designated as (UCLA) and (CAS). Paratypes, where available, are deposited in the United States National Museum (USNM), the American Museum of Natural History (AMNH), the Instituto Oswaldo Cruz (IOC) and the author's collection at Washington State University (WSU).

The nomenclature of the species is in accordance with the views of Dr. William L. Downes, Jr. (unpublished theses, Ames, Iowa; arrangement of Sarcophaginae at United States National Musuem, 1957; "Sarcophagidae" of the forthcoming Catalog of North American Diptera), with one exception: *Chrysostomomyia* is elevated to subgeneric rank.

KEY TO THE GENERA AND SPECIES

1. Posterior dorsocentral bristles 3, strong, evenly spaced.......... 2
   Posterior dorsocentral bristles 4, or the anterior hairs of the row vestigial...... 4
2. Vein 1 setuled on basal half dorsally.......... **Helicobia marionella** (Ald.)
   Vein 1 bare 3
3. Propleuron pilose; median marginal pair of bristles on hind margin of 3rd apparent tergum .... **Blaesoxipha (Acridiophaga) angustifrons** (Ald.)
   Propleuron bare; no median marginals on 3rd tergum.......... **Blaesoxipha (Kellymyia) californica** (Parker)
4. Dorsocentral bristles 2:4.......... **Socorromyia blodgeti** new genus and species
   Dorsocentrals 0:1; only the prescutellar pair developed.......... 5
5. Genital segments entirely black or dark brown; median marginal bristles present on 3rd tergum.......... **Peckia (Chrysostomomyia) nigricauda** new species
   Genital segments wholly or in part red; median marginals usually absent on 3rd apparent tergum...... **Peckia (Chrysostomomyia) craigi** new species

Notes and Descriptions of the Species

Helicobia morionella (Aldrich)

Sarcophaga surrubea Aldrich, 1916:154, fig. 72 (not *surrubea* Wulp)
Sarcophaga morionella Aldrich, 1930:31.
Helicobia morionella, Lopes, 1939:508.

This is a widespread Neotropical species, ranging from California and Georgia to Puerto Rico and Brazil. It has also been recently collected in Hawaii, where it may have been accidentally introduced through commerce. One male, 3 females from Clarion and one male, Socorro Islands (UCLA, WSU).

Blaesoxipha (Acridiophaga) angustifrons (Aldrich)

Sarcophaga angustifrons Aldrich, 1916:142, fig. 63.
Sarcophaga caridei, Aldrich, 1927:588.
Servaisia (*Acridiophaga*) *angustifrons*, Roback, 1954:86, figs. 401-404.

This grasshopper parasite ranges widely in the United States and Canada, and was considered by Aldrich (1927) to be a synonym of *caridei* Brethès (Arg.); however, Roback (1954) restored it to specific rank. Four males, Clarion Island (UCLA, WSU), McDonald and Blodget collectors. These males agree very well with Aldrich's figure and description of *angustifrons*, except that the front is somewhat wider (0.11 to 0.13, average 0.12 of head width, compared with 0.084 to 0.12, average 0.098 for 6 males in the type series).

Blaesoxipha (Kellymyia) californica (Parker)

(Figs. 9-11)

Sarcophaga californica Parker, 1918:32.
Sarcophaga postilla Reinhard, 1947:111, fig. 17.
Kurtomyia postilla, Roback, 1954:84.

Male front 0.21 to 0.234 (average 0.224) of head width. A species very closely related to *cessator* Aldrich, with similar female genitalia. The female genitalia (figures 9-11) have broad genital sternites and the first genital tergum visible from above and lying in the same plane but inferior to the 4th apparent tergum. In these respects the female genitalia bear a resemblance to *Blaesoxipha plinthopyga* (Wd.) and *Socorromyia blodgeti*, new species.

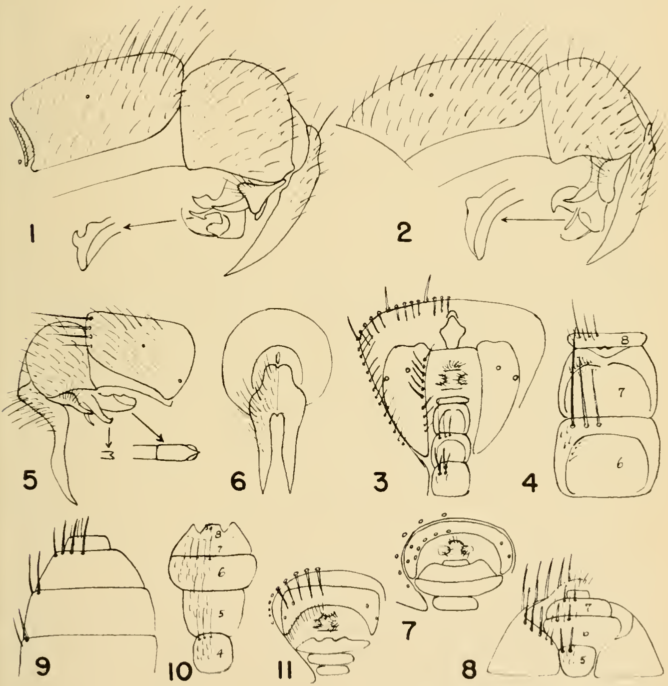
Female genital aperture posterior, transversely oval; genital segments red; 1st genital tergum whitish pollinose, not divided middorsally, visible from above, with marginal row of numerous (about 20) bristles; spiracle 6 on the tergum, near posterior margin; spiracle 7 at about middle of its length. Sternum 5 broader than 4; sternum 6 broadest, transverse; sternum 7 slightly narrower and shorter than 6; sternum 8 intimately fused with 7, trilobed on posterior margin, the middle lobe angular and setulose, the outer lobes triangular, glabrous, nude. Spermothecae 3, nearly globose, with 1 or 2 annuli.

Twelve males, 13 females, San Benedicto Island, April 30, 1955, McDonald and Blodget collectors (UCLA, WSU).

Socorromyia new genus

Male front narrow and without PFRO; outer vertical absent; arista long plumose on basal 0.60; acrostichals 0:0; dorocentrals 3:4; scutellum with 2 pairs of marginal bristles only; sternopleurals 2; prosternum and propleuron bare; mesosternum haired; postalar declivity with a few hairs.

This genus is based on *Socorromyia blodgeti* new species, known only from Socorro Island. The male genitalia, by conformation and particularly by the



Peckia (*Chrysostomomyia*) *nigricauda* new species. Fig. 1, profile of male genital composite with (arrow) enlarged ventral view of harpes. *Peckia* (*Chrysostomomyia*) *craigi* new species. Fig. 2, profile of genital composite, with (arrow) enlarged ventral view of harpes. Fig. 3, female genital orifice, posteroventral view. Fig. 4, female sternotheca (sterna 6-8). *Socorromyia blodgeti* new genus and species. Fig. 5, male genital composite, profile, with ventral view of penis and tip of anterior clasper. Fig. 6, forceps, posterior view. Fig. 7, tip of female abdomen, posterior view. Fig. 8, same, ventral view. *Blaesoxipha* (*Kellymyia*) *californica* (Parker). Fig. 9, tip of female abdomen, dorsal view. Fig. 10, sternotheca. Fig. 11, female genital orifice, posterior view.

small, unmodified penis, suggest an affinity with *Sarcophaga minutipenis* Hall but that species has the forceps vastly different. The female sternotheca is broad and the first genital tergum is undivided and visible from above.

The type species, S. blodgeti, n. sp.

Socorromyia blodgeti new species
(Figs. 5-8)

Length 7.5 to 10 mm. A medium sized species of the general *Sarcophaga* type but with distinctive male and female genitalia. Genital segments red; acrostichal, apical scutellar and median marginal bristles of 3rd tergum absent.

Male: Front at narrowest 0.155 to 0.180 (average 0.166 of four) of head width; outer vertical absent; inner vertical and reclinate frontoorbital bristles present; ocellar bristle moderately large; frontal rows of 9-10 pairs, widely divergent anteriorly; parafrontofacialia grey pollinose, with a row of small dark hairs. Antennae black, segment 3 3:1 and 2.5 as long as segment 2; arista long plumose on basal 0.60, dark, but with whitish band at middle of its length, basal 2 segments minute. Epistoma moderately warped forward; vibrissae slightly above oral margin; cheeks black-haired, metacephalon and occiput white-haired; 3 rows of black postocular bristles; palpi black, equal in length to haustellum, flattened basally, somewhat swollen apically.

Thorax black with grey pollen, forming the usual 3 black mesonotal stripes. Chaetotaxy: acrostichals 0:0; dorsocentrals 3:4; intraalars 1:1; supraalars 2:3; humerals 3; notopleurals 4; posterior callus 2; scutellars 2 marginal, 0 apical, 0 discal; sternopleurals 2; postalar declivity with few hairs; prosternum and propleuron bare; mesosternum haired; hind coxa setuled behind. *Legs* black, middle and hind tibia villous on apical half; mid femur without comb. *Wings* hyaline, slightly yellowed on basal half along costal margin; venation ordinary, vein 3 only setuled (basally); costal spine present, small; epaulet black; squamae white; halter dark brown, darker apically.

Abdomen rather slender, with usual grey checkering; lateral bristles only on segments 1-3; 4th segment with marginal row of 8 strong bristles; sterna 1-4 exposed, haired; sternum 5 deeply cleft, each arm with elongated finger-like posterior process; genital segment 1 black, pollinose apically, with marginal row of 8 bristles; genital segment 2 red, shining. Forceps long, acute, moderately separated, slightly angulated at middle of free portion, reddish basally becoming black apically, the tips acute; accessory plate brown, slender, subtriangular; claspers black, about equal length, posterior clasper straight, acute, and without bristle, anterior clasper moderately stout, with tip hooked and bifid; penis small, brown, 2-segmented, the apical segment quite simple. Male genitalia figures 5-6.

Female: Similar to male except for usual sexual differences (front about 0.33 of head width, with 2 strong PFRO; outer vertical present; legs without ventral villosity on tibiae; fore and middle femora with huge red modified areas posteriorly). Tergum 4 with marginal row of about 14 strong, erect bristles interspersed with a few smaller, recumbent bristles; sterna 3-5 completely concealed by the overlapping margins of the terga; sterna 2-5 with posterior marginal bristles; sterna 6-8 (sternotheca) fused, broadened, red, 6 larger than 7 plus 8; genital aperture posterior, rounded, genital tergum 1 visible from above, not divided dorsally, with marginal row of 12 very stout bristles, spiracles 6 and 7 both on the tergum; sternum 8 small, rectangular, intimately fused with 7; spermothecae 3, oval, with few annuli. Genital segments figures 7-8.

Holotype male and *allotype* female: Socorro Island, May 1-5, 1955, McDonald and Blodget (UCLA). *Paratypes:* 3 males, 5 females, same data as holotype (UCLA, IOC, WSU); 1 female, Socorro Island, T. Craig (CAS).

This species is dedicated to Mr. D. Claude Blodget, one of its collectors. It is identical with *Prosthetocirca cana* (Tns.) from the Galapagos Islands in one interesting feature—females of both species have terga 2-4 overlapping and completely concealing sterna 3-5, whereas in the male these sterna are completely exposed. *P. cana* females lack the modified fore femur as described for *blodgeti*, and the two genera are not otherwise closely related, though both are endemic to restricted Pacific islands.

Peckia (Robineau-Desvoidy)

Peckia (*sensu* Downes manuscript) is a large, diverse group of Neotropical species, whose members are divisible into at least 9 described and a number of undescribed subgenera. *Peckia* (*sensu stricto*) consists of *Musca praeceps* Fab. and allied species with abdomen shining black, non pollinose; squamae black. With *praeceps* Downes combines *Chrysostomomyia* and other species as subgenus *Peckia*.

Chrysostomomyia Townsend, as a subgenus of *Peckia*, is a compact group of species with very similar male genitalia. It would seem advantageous to recognize this species group as a subgenus, rather than to obscure relationships by lumping it with *Peckia* (*s.s.*) and *Paraphrissopoda* as subgenus *Peckia.* Two new species of this group are represented in the material from the Revillagigedos Islands. Both are very similar to the type species, *Sarcophaga chrysostoma* Wied., but differ obviously in the coloration of the male genitalia, and both possess only one (not 2) dorsocentral bristle. Further differences between them and the continental species are equally obvious: the head is grey or yellowish grey pollinose (not bright yellow), the sternopleural bristles are usually 2 (not 3), and the "harpes" of the male penis bears a lobe or tooth on the outer margin.

Peckia (Chrysostomomyia) nigricauda new species

(Figure 1)

Length: 12-19 mm:; a large, black-tailed species with discal thoracic bristles wanting and male middle and hind tibiae densely villous.

Male: Front at narrowest (slightly before ocelli) 0.200 to 0.231 (average 0.218 of six) of head width; outer vertical and ocellar bristles vestigial; PFRO absent; frontal rows of about 10 pairs, moderately divergent anteriorly; parafaciofrontalia yellowish grey pollinose, with a row of small black hairs becoming about 3 rows towards the vertex; cheeks, metacephalon and occiput yellowish grey pollinose, with whitish hairs except for 2 postocular rows of black hairs, continued as a few dark hairs below the eye. Vibrissae distinctly above the oral margin, with the usual adjacent black bristles continued as a row along the buccal margin and along nearly half the length of the facial ridge. Antenna 3 about 4:1, black, reddish brown basally; arista long plumose 0.75 from base, the second segment nearly as long as its diameter. Palpi black, slender, as long as haustellum.

Thorax greyish pollinose, with the usual 3 black stripes; chaetotaxy: acrostichals 0:0; dorsocentrals 0:1; intraalars 0:1; supraalars 1:3; scutellars 2 marginal, 1 apical (large, cruciate), 0 discal; humerals 2; notopleurals 4; posterior callus 2; postalar declivity setuled; propleuron bare; prosternum setuled; sternopleuron with 2 (rarely a small 3rd) bristles near dorsal border and extremely densely bristled ventrally; hind coxae setuled behind. *Legs* black, middle and hind tibiae densely villous, fore tibia slightly so; all femora villous ventrally and coxae densely bristled apically; hind femur slightly bowed, anterodorsally with a row of about 12 bristles; middle femur without comb. *Wings* hyaline, costal spine absent; vein 3 setuled at base, others bare; epaulet black; squamae white, with a large discal brownish cloud on the lower lobe.

Abdomen black, grey pollinose in the usual checkered pattern; terga 1-2 with a lateral bristle only; tergum 3 with 2 lateral and a median marginal pair; tergum 4 with marginal row of numerous bristles; sterna 1-4 without bristles but uniformly clad with hairs which become shortest on sternum 4; sternum 5 large, V-shaped, each arm thickened and densely clad with short bristles near base, thin and sparsely haired along the sides, and with some longer hairs apically. Genital segments black or dark brown, shining, the first 1.5 longer than wide, with a triangular pollinose patch posterodorsally and uniformly haired, the hairs somewhat longer posteriorly but without a marginal row of bristles. Forceps black, slightly curved and tapering to a point in profile, the apical portions well separated in posterior view and setuled, becoming bare apically; accessory plate triangular, thickly clad with long bristly hairs except at the apex, which is bare, thin and incurved; claspers black, the posterior pair shorter, anterior pair rather simple, tapering to a curved point apically; penis very similar to *chrysostoma,* with a pair of long, *smooth,* slender filaments from near apex, which is bluntly produced; harpes of ventralia with an acute recurved hook at the middle of its outer margin (fig. 1, arrow). A similar, simple triangular process is also present in the following species, thus distinguishing both species from *chrysostoma,* which has none. Genitalia figure 1.

Female: Unknown.

Holotype male (UCLA) and 2 *paratypes* (IOC, WSU): Clarion Island, May 7-8, 1955, McDonald and Blodget; 2 paratypes, Clarion Island, T. Craig coll., Feb. 27, 1928 (CAS) and March 22, 1932 (WSU).

Peckia (Chrysostomomyia) craigi new species

(Figures 2, 3, 4)

Length 9-18 mm., genital segments partly red (male) or entirely red (female); frontal vitta broadening to lunule.

Male: Front at narrowest 0.17 to 0.210 (average 0.182 of seven) of head width; ocellar and outer vertical bristles vestigial; frontal vitta velvety black, narrowest at RFRO and broadening to lunule; frontal rows of about 11 pair, hair-like above, moderately divergent below; parafaciofrontalia brownish yellow pollinose, with 3 rows of black setules above, becoming 1 row below; parafacials broad, 0.80 of width of facial plate; vibrissae well above oral margin, index (distance above/distance between) 0.40 or greater; cheeks broad, 0.375 of head height, greyish pollinose, white haired; occiput grey, white-haired, with 1-2 rows of black postocular bristles. Antennae black, segment 3 4:1; arista long plumose on basal 0.70. Palpi slender, blackish; haustellum black, as long as antennae.

Thorax greyish pollinose (*brownish* grey in some individuals), with 3 black stripes. Chaetotaxy: acrostichals 0:0 (or prescutellar extremely weak); dorsocentrals 0:1; intraalars 0:1; supraalars 1:3; humerals 2; notopleurals 4; posterior callus 2; postalar declivity setuled; scutellars 2 marginal, 1 apical (strong), 0 discal; sternopleurals 2 (a weak 3rd sometimes in line with the others); prosternum setuled; propleuron bare; hind coxae setuled behind. *Legs* black; hind and mid tibiae villous (extremely so in large individuals); hind femur slightly bowed; mid femur without comb. *Wings* hyaline, veins brown, vein 3 setuled at base above and below; epaulet black; basicosta white; squamae whitish, lower lobe with a cloud or in large part translucent.

Abdomen black, grey or brownish grey pollinose with usual checkered pattern; terga 1-3 with lateral bristles only; sterna 1-4 strongly narrowing, black-haired, overlapping the terga, without bristles; sternum 5 broadly V-shaped, with brushes of black spines at the base of each arm. Genital segment 1 blackish, shining, with triangular yellowish pollinose patch posteriorly, without marginal row of bristles but with larger, erect hairs on the pollinose patch; genital segment 2 red, setose, slightly pollinose on back, glabrous on sides. Forceps elongate, slightly bowed in lateral view, somewhat inflated in the smallest males, more slender in the large males; penis and claspers much like *nigricauda* but the penis with larger ventralia, apex more rectangular and "harpes" with an isosceles triangular projection on its outer margin.

Female: Much as the male, but front broad, 0.28 of head width, with 2 PFRO; outer vertical 0.67 of inner; frontal vitta broadening to lunule as in male. Tibiae non-villous; coxae and venter of thorax not so densely bristled; abdomen broad; sterna 2-6 with strong bristles (very stout on 3-5) on posterior margin, sternum 6 with 3 pair, the inner pair smallest, sterna 3-6 overlapped by the margins of the terga, 3-8 of uniform width. Genital orifice (fig. 3) large, subtriangular, entirely concealed from above, the dorsal margin slightly rounded and with numerous bristles, of which only 3 pair are erect; genital segments fully exposed, yellowish red; genital tergite divided into two rather pentagonal, flat lateral pieces, their inner margins parallel, each with a marginal row of about 10 bristles, of which 5-6 are stout; spiracle 6 at margin, 7 at middle of width of the tergum; a middorsal pentagonal sclerotization in the dorsal membrane connecting the two halves of the tergum. Sternotheca (fig. 4) not broader than the preceding sterna; sterna 6-7 subrounded, with concave, glabrous disc, 6 bristled, 7 not so, 8 short and tranverse. Spermathecae 3, small, globular, with smooth walls.

Holotype male and *allotype* female (CAS): Socorro Island, Mexico, March 1, 1928, T. Craig. *Paratypes:* 3 males, 4 females, same data as holotype (CAS. AMNH, WSU); 22 males, 8 females, Socorro Island, May 1-5, 1955, McDonald and Blodget (UCLA, AMNH, USNM, IOC, WSU).

Variations in chaetotaxy and male forceps: This species varies quite clearly from one to two complete rows of black postocular hairs. The sterno-pleurals are often 3 in a straight line, the middle one weak, but in two small females and many males it is entirely lacking and one male has but a single sternopleural on one side. Median marginal bristles of third tergum are lacking in all males and all but two females of the (UCLA) series. The villosity of the male mid and hind tibiae is usually dense and long, but the smallest male has sparse villosity only slightly longer than the diameter of the tibia. This male also has the forceps perceptibly inflated, as compared with the other specimens.

This species is dedicated to Mr. T. Craig, who first collected it. It is known only from Socorro Island. A further distinction between it and *nigricauda* is of special interest—the frontal vitta is broadened to the lunule in *craigi* but sub parallel its entire length in *nigricauda*.

It would be interesting to learn if either of these two *Chrysostomomyias* occur on San Benedicto Island, or if perhaps a third endemic species remains to be discovered.

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A TRIBE OF CECIDOMYIIDAE (DIPTERA) NEW TO NORTH AMERICA

A single male specimen, received for identification from J. P. Hungate, collected at Ogotoruk Creek, Cape Thompson, Alaska (lat. 68° N., long. 166° W.), August 29, 1960 (J. J. Davis), agrees so well with Edwards' redescription of the type that I must consider it the following species.

Family Cecidomyiidae, Subfamily Lestremiinae, Tribe Strobliellini, *Strobliella intermedia* Kieffer 1898, Bull. Soc. Hist. Nat. Metz (2) 8: 51; Edwards 1938, Proc. Roy. Ent. Soc. London (B) 7(5): 107; Pritchard 1951, Univ. Calif. Publ. Ent. 8(6): 239.

The type was from Austria, and Edwards recorded a specimen each from Scotland and England. The species is the only representative of its tribe.

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SOME INSECT COLLECTIONS IN SOUTH AMERICA

Doris H. Blake, *Smithsonian Institution, Washington, D. C.*

From early in December 1962 until the end of February 1963 I was traveling in South America on a grant from the National Science Foundation and in part my project was to examine entomological collections. The purpose of this paper is to give to North American entomologists some general idea of what these collections consist. Although I did not have the opportunity to see all the collections there by any means, this is an account of the many that I did examine.

The first collection was at the Museu Nacional at Quinta da Boa Vista, Rio de Janeiro, Brazil. This is the largest museum in Brazil. Located in an old part of the city in a lovely park of several acres, it was formerly the palace of the old rulers, the last of whom, Dom Pedro II, abdicated in 1889. He was much interested in natural science and left a scientific library which was the basis of the present one and is said to be the largest in South America. The first and second floors of this old pink masonry palace are now mainly exhibition halls. On the third floor the entomological collection is housed. It is especially strong in Lepidoptera, Hemiptera and Odonata. The building is made up of long halls, and one of the largest of these halls is taken up by the Lepidoptera collection. Dr. José Oiticica and Alfredo Rei de Rego Barros are working on this collection. There is no one working on Coleoptera, although there is a sizable collection occupying part of a hall. There are many named specimens as well as a section in which the material is sorted but not determined. There are many Hispidae and Curculionidae. Joaquim Pereira Machado is working on the Orthoptera. Dr. José Carvalho and Johann Becker work on Hemiptera. Dr. Carvalho told me the Hemiptera collection, which numbered 13,000 in 1953, has now nearly doubled. Dr. Newton Dias dos Santos works on Odonata. The entomological exhibition on the second floor is beautifully and interestingly arranged and fills a small hall. Not only is there a representative collection of insects arranged systematically in the centre of the hall, but about the sides are various aspects of entomology both as a science and as an economic factor.

The Instituto Oswaldo Cruz is primarily for medical research. It has a good entomological collection, a good library, and several entomologists working there. The building is located not far from the Museu Nacional on Avenida Brasil and formerly was directly on the harbor, but now that the marshes have been filled in, there is a small airport opposite. The main building, a Moorish-Spanish style, very ornate, three-story building, stands out prominently on a hilltop in a beautiful park of flowers and tropical trees. There are several other buildings including two hospitals, a chemistry and a pathology building. The main building houses the entomological collection on its second floor. The J. F. Zikán collection of about 160,000 specimens, chiefly Coleoptera, Lepidoptera and Hymenoptera, was bought by the

Instituto. In R. L. Araujo's paper describing this collection (Rev. Brasil Ent., vol. 1, March 1954) the figures are given for the different orders. There are also other collections, among them that of Adolpho Lutz. Prof. Angelo Moreira da Costa Lima was there when I visited the place, but was suffering from eye trouble. Prof. Hugo de Souza Lopes, chief of the section of Entomology, works on Diptera, especially on Sarcophagidae of which he has a fine collection. Dr. Sebastico José de Oliveira also works on Diptera. Dr. Davis Mendes works on Coleoptera and Lepidoptera.

A third important collection in Rio de Janeiro is in the Servico de Defesa Sanitaria Vegetal (Plant Protection Service), Ministerio da Agricultura. At present it is housed in a century-old building on Rua Santa Luzia, but I was told that it will be removed sometime in the future to Brasilia with the rest of the government offices. Dr. Cincinato Gonçalves, who also teaches at the Universidad Rural at some little distance from Rio de Janeiro, has charge of the collection, and works as an economic entomologist. As an example of his vigilance, he showed me a twig of one of the great old gnarly Ficus trees that line the city street by the office, which was overrun with a species of thrips that had been imported from either Central America or the West Indies. The old office is crowded with cases of insects. It is epecially strong in Orthoptera, three-fourths of which are Brazilian. In the coleoptera collection are many Tenebrionidae, a considerable number of Scarabaeidae, and a few drawers of Chrysomelidae. Dr. Goncalves himself is interested in Leaf-cutting Ants, of which he has studied the life-histories and described new species. He had 16 drawers of these. Aristoteles G. d'Araujo e Silva is another entomologist working there, chiefly on cataloging and the bibliography of injurious insects.

Besides these large collections in institutions, there are two large private collections in Rio de Janeiro. One, that of Moacir Alvarenga of Rua Eduardo Guinow, apt. 307. Botafogo, who has a collection of Erotylidae, the other the large collection of Dr. Carlos Alberto Seabra, of Praia do Flamengo 340. I was not able to see either of these collections.

The Departmento de Zoologia, Avenida Nazare 481, Caixa Postal 7172, São Paulo, contains a sizable entomological collection and a good library. In the past three years under the directorship of Dr. P. E. Vanzolini, the Department has taken on new life, the collections increased and many new and mostly young workers have come in. The collection of Coleoptera is extensive. There are about 50 drawers of Carabidae, 50 of Buprestidae, 50 of Cerambycidae, 50 of Tenebrionidae, 7 cases of Chrysomelidae, about 3 cases (nearly 100 drawers) of Scarabaeidae, and nearly 100 drawers of Curculionidae. They have a rather unusual way of turning all specimens mounted on points on the side, they say, in order to show the ventral as well as dorsal surface. U. R. Martins works on Cerambycidae, Languiriinae, and Barini, Padre Pereira on Scarabaeidae, Hans Rauscher on Bostrichidae. In Diptera Nelson Papaveron is working on the Asilidae, Karol Lenko on Hymenoptera, especially on ants. Lauro Travassos Filho works on Heterocera in general. R. L. Araujo, who divides his time between São Paulo and Rio de Janeiro, works on Termites. Henrique M. Canter works on Lygaeidae.

Besides this large and growing collection at the Department of Zoology, there are several private collections in São Paulo. Bruno Pohl, Rua Pelotas 247, one of the older entomologists, has sold most of his collection to Richard von Diringshofen, Rua Maestro Cardim 987, Caixa Postal 2131, but still retains many of the Chrysomelidae. Mr. Diringshofen, a well-to-do business man, has been collecting insects since boyhood, and his 22-room house is in large part filled with his collections, all beautifully mounted and in large series. He tries to have at least a dozen of each species. He told me his drawers of Erotylidae contain 105 types, all South American. He would like to exchange in this group. He has a large collection of Cassids, well identified, and about 50 drawers of Carabidae. His collection of Lepidoptera is large and he has many Orthoptera. Down in his basement are stacked from floor to ceiling boxes of insects still in papers that are not yet mounted. He has collectors all over South America, and particularly in Amazonas, collecting for him all the time.

Werner Bokermann, Rua Anita Garibaldi 45, São Paulo, has a large collection of *Chlamisus* of about 3000 specimens, mostly from South America, a few from North America and Africa. There are about 200 identified species in it.

In the Department of Zoology at the Universidad do Paraná at Curitibá, is the largest collection of bees in Brazil, of about 120,000 specimens representing 4,000 species, of which more than 2,000 have been compared with the types. The man behind this entomological study is Prof. Padre J. S. Moure who has been working since 1938 on bees. He published his first paper in 1940 and since then 82 more papers. Moreover after 20 years' work he has nearly completed a catalogue of the bees of Latin America from Mexico and the West Indies southwards. The university building which houses the Zoological Department is new and modern and Padre Moure has installed new cases and laboratory equipment and is now working on enlarging the library. Besides the bee collection is a small general collection of insects, the foundation for which is a collection of 50,000 insects that the University bought of Felipe Justus Junior of Ponte Grossa. In it are many butterflies from all over the world. Dr. Jayme Loyala e Silva is Padre Moure's assistant and there are two other men, Dr. Bernadette Luis de Oliveira and Lic. Danuncia Urban, who are working on bees.

Besides this collection at the University, there is a small general collection of insects at the Natural History Museum in Curitiba, occupying 3 cabinets consisting of 50 drawers each. The collection is well cared for but with few determined specimens, and is largely from Paraná. Dr. Rudolf Lange, who is also a teacher there, has collected most of the insects and spends half his day working at the museum.

At the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Avenida Angel Gallardo 470, Buenos Aires, the entomological collection contains roughly about 2,000,000 mounted specimens, besides very many unmounted ones that have not been counted. Dr. M. J. Viana is at present the only entomologist at the museum, as there has been very little appropriation for the past five years. He has worked on the Chrysomelidae, and in particular the Cassid beetles, and is anxious to build up this collection by an exchange of specimens. In all, the entomological collection contains approximately 6,000 types. There are some very old historical collections such as those of Col. Antigua de Burmeister and C. Berg.

The largest and best determined group is the Coleoptera. The Bruch collection, which is a representative one, contains 80% of all named species of Coleoptera from Argentina, and also many Bruch types. The Curculionidae amount to 110 boxes, the Chrysomelidae to about 100 boxes, the Cerambycidae to 120 boxes. These are the three largest families. The next largest group is Lepidoptera, which are from all over South America and are well determined and in good condition. Bruch's collection is also here as well as other collections that the Museum has bought. The third largest group is Hemiptera, also from all over South America. Prof. De Carlo, now retired, classified these, working chiefly with the aquatic bugs, but the rest of the Hemiptera are well represented although not studied. The fourth largest group is the Orthoptera; these are mostly from Argentina and were determined by Dr. José Liebermann. The Hymenoptera are best represented by the ant collection. All the Argentine species are here and there are types of Forel, Sanchis, Bruch, and Gallado Borning. There are a fair number of Diptera but not so well determined, but what is named has been compared with types in the British Museum. At São Paulo I also met Antonio Martinez, who has some connection with this museum, whose address is Husares, San Isidro Peira, Buenos Aires. He works on Scarabaeidae.

Besides the entomological collection here, two women have been working for the past thirty years on spiders and have built up a very good and well determined collection, representing all the Argentine species and 47 families. These women are Rita Delia Schiapelli and Berta Gerschman de Pickelin.

The entomological collection and its history has been written up in more detail by Emilio V. Gemignani. Published at the Seventh International Congress for Entomology in Berlin, August 1958, this account gives the data as of that year.

Although I visited the Museum at La Plata, I was unable to see any of the entomological collection there since the ones in charge were away on their summer vacation. January is the month for the regular closing of the museums in Argentina. Dr. Viana told me that the insect collection at the La Plata Museum was an excellent one. One other large collection in Argentina that I did not see is at Tucumán, at the Institute of Miguel Lillo.

The Museo de Historia Natural "Javier Prado" at Lima, Peru, contains an entomological collection which is largely the work of the entomologist there, Dr. Fortunato Blancas, during the past decade. There are two wooden cases, one of 40 drawers of Lepidoptera, the collection of Paul Martin, the other of 30 drawers of a general collection, two of which are the Raimondi collection. Besides these are 4 cases filled with boxes of specimens in which are many determined specimens as well as some that are unnamed. This latter represents almost entirely Dr. Blancas' material. His especial interest is the fly genus *Phlebotomus,* but the Diptera in general are well determined. There are 8 boxes of Diptera, most of which are named, 4 boxes of Hemiptera, 5 of Homoptera, 18 of Hymenoptera, 25 of Orthoptera, and 1 of Odonata. There are scattered determinations throughout these groups. The only other entomologist working here at present is a student, Elizabeth Gambino, who is interested in Lepidoptera, particularly the Pieridae.

At the Universidad del Valle, Facultad de Medicina, Cali, Colombia, Dr. C. J. Marinkelle v. Charlois has a small collection of insects that he is studying in his work on Parasitology, and some boxes of insects that he collected while in San Salvador. At the Palmira Facultad de Agronomica, Colombia, is another insect collection of about 70 drawers, chiefly Lepidoptera and Coleoptera, with a few drawers of Homoptera and 2 drawers of Neuroptera. These were collected by the professor of entomology there, Dr. A. Figueroa, and his students.

At the Universidad Nacional de Colombia, Facultad de Agronomica, at Medellin, Colombia, is an insect collection built up since 1932 by Dr. F. Luis Gallego, the professor of entomology, and his students. The insects are neatly mounted and arranged in systematic order and in modern drawers with small cardboard trays, as at the U. S. National Museum. The Coleoptera are the best represented, having 2 drawers of Carabidae, 2 drawers of Coccinellidae, 2 of Elateridae, 11 of Scarabaeidae, 7 of Cerambycidae, 8 of Chrysomelidae, and 8 of Curculioniadae. Of Lepidoptera there are 4 cases with twelve drawers in each. The Diptera are rather poorly represented and Hymenoptera a little better. Besides this systematically arranged collection, Dr. Gallego has thirty-six drawers of insects arranged as to their economical significance, as parasites, predators, insects injurious to vegetables, etc., this being used in his teaching.

There is another insect collection in Colombia that I did not examine at the Estacion Agricultura Experimental de Tibaitata not far from Bogota. The entomologist and curator of this collection is Miss Isabel Sanabria.

In all my travels in South America, which were made in company with Dr. Doris Cochran, herpetologist at the United States National Museum, we met with the greatest courtesy and friendliness on the part of the biologists there. Their collections were opened up to us, and in nearly every city we were taken on collecting trips in the surrounding area. In short, our whole expedition was made very happy everywhere by the efforts of these hospitable hosts.

TWO SPECIES OF LIMNEPHILIDAE NEW TO NORTH AMERICA

(TRICHOPTERA)

Many species of Limnephilidae are known to occur in both the Palearctic and Nearctic Regions, some being found over the entire Holarctic Region, others occupying more restricted ranges in Alaska, Siberia, or elsewhere. Though present knowledge indicates that the two species recorded here are widely distributed in the Old World, no previous New World records have come to my attention. The specimens are in the collection of the U. S. National Museum.

Grammotaulius signatipennis McLachlan: 2 ♂, Mekoryuk, Nunivak Island, Alaska, Aug. 16, 1960, and Aug. 26, 1959, R. H. Washburn. This species was recorded from Sweden to Kamchatka by Schmid, 1950 (Rev. Suisse Zool. 57: 344), who also provided good figures of its structures. It is a close relative of *G. betteni* Griffin, which is known from China and the Pacific Northwest.

Limnephilus stigma Curtis: 1 ♂ 1 ♀, Mekoryuk, Nunivak Island, Alaska, Aug. 16, 1960, R. H. Washburn. This species is known from the northern and middle parts of the Palearctic Region and is closely related to the Nearctic *L. indivisus* Walker. Betten and Mosely, 1940 (Francis Walker Types of Trichoptera, p. 131) give good figures showing the differences between the two species.

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A METHOD OF PRESERVING THE COLORS OF THE CASSIDINAE

(COLEOPTERA: CHRYSOMELIDAE)

During the course of some work on the Cassidinae, I have developed the following method for preservation of the golden colors of these insects.

The preservative is a fluid which is prepared in the following proportions:

¾ pint water (distilled)
2 teaspoons iodized table salt
½ teaspoon boric acid (household grade)
1 or more teaspoons 70% isopropyl alcohol (aqueous solution)

The amount of isopropyl alcohol may be varied at the preparator's desire, but very large amounts tend to darken the colors.

I found it best to use the fluid also as a killing agent. When dropped into the fluid, the insect will alter its color to a dull orange or pearly color. Punctures must be made in the specimens soon after death or they will not return to their normal brilliance. These punctures are best made between the procoxae and on the mid-line of the metasternum. After about forty-eight hours the fluid usually becomes milky and must be changed, but after that time it seems to remain clear indefinitely.

I preserved large numbers of specimens in this fluid early in August 1962. Half of this material, which consisted mostly of *Deloyala guttata* (Oliv.) and *Metriona bicolor* (F.), was preserved with the aforementioned punctures and half was not. Those with the punctures regained their complete normal coloration and have retained it, without noticeable change, to the time of writing. Those preserved without these punctures have not regained their normal coloration.

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A NEW SYNONYM IN THE GENUS EUROSTA

(DIPTERA: TEPHRITIDAE)

In November 1963, during a visit to the British Museum (Natural History), I examined the holotype of *Trypeta donysa* Walker (1849, List. Spec. Dipt. Ins. British Mus. 4: 1007). This specimen, a male, proves to be conspecific with *Eurosta nicholsoni* Benjamin (1934, U. S. Dept. Agric. Tech. Bull. 401: 27; fig. 19), and since *donysa* is a prior name, the species is to be known as *Eurosta donysa* (Walker) **(new synonymy)**. The type locality of *donysa* was not stated by Walker, but it is almost certainly Florida, since *nicholsoni* is known only from specimens collected in several localities in Brevard Co. in that State. The underside of the label attached to the type reads "*T. dionysa.*"

Benjamin's descriptions and wing figures correspond very well to the characters exhibited by the type and an accompanying male. In the British Museum specimens, the hyaline spot at the distal center of cell 2nd M_2 is more extensive, and the hyaline spot at the center of cell Cu_1 is triangular and attains the posterior wing margin. The rounded appearance of each abdominal tergum typical of tephritids is destroyed in this distinctive species by a longitudinal (anterior to posterior) channel situated about 0.3 mm. from each lateral border, causing the integument to fold somewhat dorsally along the lateral edges of the abdomen instead of curving downward to meet the lateral membrane.

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SOCIETY MEETINGS

717th Regular Meeting, May 2, 1963

The 717th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on May 2, 1963, at 8 p.m. in the Nursing Auditorium of Catholic University. Twenty-eight members and twenty-four guests were in attendance. Minutes of the previous meeting were accepted as read.

The Picnic Committee announced that the annual picnic had been set for June 15 at the Log Lodge in Beltsville.

Two candidates were accepted to membership: *Harold Robinson* and *John S. Buckett.* Three candidates for membership were announced: *Roger D. Price, Richard W. Fields,* and *A. Thomas Olive.*

A. B. Gurney showed a recent publication by Jacques R. Helfer titled *How to Know the Grasshoppers, Cockroaches and their Allies.* He commented on the good illustrations, all done by the author, and the general quality of the work.

W. H. Anderson reported the death of Harold Morrison on March 11, 1963 in his 72nd year.

Two area science fair projects were displayed and discussed. Kyra Krombein explained the nesting behavior of *Osmia lignaria,* and Robert Brown told of his work on the chromatography of *Drosophila.*

Dr. Donald MacCreary of the University of Delaware presented the evenings talk "Observations on Allergies Caused by Insects." He discussed the various types of allergies using examples drawn from his experience.

The meeting was adjourned after the introduction of visitors in time for those present to tour the Entomological facilities at Catholic University.

OLIVER S. FLINT., JR., *Recording Secretary*

718th Meeting, June 15, 1963

The annual picnic was held jointly with the Insecticide Society of Washington at the Log Lodge, Agricultural Research Center, Beltsville, Maryland, on June 15, 1963.

OLIVER S. FLINT, JR., *Recording Secretary*

719th Regular Meeting, October 3, 1963

The 719th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on October 3, 1963, at 8 p.m. in room 43 of the U. S. National Museum. Thirty-eight members and sixteen guests were in attendance. Minutes of the previous meeting were accepted as read.

President Bickley announced the appointment of Dr. Philip Luginbill, Jr. as chairman of the Program Committee for the remainder of the year. The death of *Price G. Piquett* was announced and John Fales was appointed chairman of the obituary committee. The composition of the nominating committee was announced: R. A. St. George, Chairman, A. B. Gurney, and R. H. Nelson.

F. L. Campbell announced that the Washington Academy of Sciences will include the entire membership of the Society in their directory of scientists.

Three candidates were accepted to membership: *Roger D. Price, Richard W. Fields,* and *A. Thomas Olive.* One candidate to membership was announced: *R. B. Eads.*

T. L. Bissell showed adults and young of a stinkbug, *Edessa florida* Barber, found on a bindweed on the shore of the Chesapeake Bay in Southern Maryland.

A. B. Gurney noted a 10-day field trip which he made in southwestern Texas in July 1963, during which time he spent 4 days in the Big Bend National Park. He observed the biology and distribution of grasshoppers and collected specimens of mites and other insects. Colored photographs of Cat-tail Falls, Pulliam Bluff and other points of interest in and near the park were shown.

F. L. Campbell announced that the National Academy of Sciences is celebrating its centennial this month, and that a special stamp will be issued in its honor on October 14th.

W. A. Bickley showed a semipopular book, "To know a fly" by Vincent G. Dethier.

E. A. Taylor gave the first portion of the evening's program on "Eradication of fruit flies on Pacific islands with male annihilation and sterile male release techniques," a most interesting illustrated talk about the eradication of the Oriental Fruit Fly and the Melon Fly in Rota. For the second part of the program, L. D. Christensen showed and made comment on the film "Mass rearing of Fruit Flies."

After the introduction of visitors, the meeting was adjourned at 10 p.m.

OLIVER S. FLINT, JR., *Recording Secretary*

PUBLICATION DATE

The date of publication of Vol. 65, No. 4 was December 12, 1963. The date of publication of Vol. 66, No. 1, will be found in Vol. 66, No. 2.

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PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

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U. S. NATIONAL MUSEUM
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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884

MEETINGS

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

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

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THE ANT LARVAE OF THE SUBFAMILY CERAPACHYINAE: SUPPLEMENT

George C. Wheeler *and* Jeanette Wheeler, *Department of Biology University of North Dakota, Grand Forks*

This article has been prepared as a supplement to "Ant Larvae of the Subfamily Cerapachyinae" by G. C. Wheeler (1950). It includes (1) earlier references in the literature which had been overlooked, (2) subsequent references in the literature, (3) revised descriptions, (4) descriptions of species not previously described and (5) a key.

Subfamily Cerapachyinae Forel

Revised Description—Elongate, slender, subcylindrical and curved ventrally. Segmentation distinct. Spiracles small. Leg vestiges present or absent. Head small; at the anterior end. Mouth parts large and prominent; bearing few or no spinules. Head hairs few or none; short and nearly always simple. Antennae moderately large, with two or three sensilla. Labrum a thick flap, usually small. Mandibles rather feebly sclerotized; typically long and slender; base moderately stout; distal two-thirds narrow and thin; tapering to an apex which is slightly curved backward and medially; medial border with denticles. Maxillae lobose; mostly rather long and round-pointed; palp small, a cluster of three to six sensilla or a low elevation bearing sensilla or a short obtuse projection bearing sensilla; galea a slender conical projection bearing two apical sensilla. Labium large and prominent; palp a cluster of three to five sensilla, sometimes slightly elevated. Opening of sericteries a transverse slit.

Generalized Drawings—Fig. 1*b* shows a generalized (or synthetic) profile of a cerapachyine larva. In our study of the body shapes of ant larvae we have used only profiles (i.e., outlines in side view), since dorsal and ventral views rarely show anything distinctive. To facilitate comparison of profiles we decided that all drawings would need to be of the same size. This, however, presented a problem in flexible larvae, because such larvae are preserved with various amounts of curving and contraction. Hence it was necessary to establish a standard measurement to be the same for the profiles of all genera. We chose the distance (on the drawing) from the anus to the first abdominal spiracle, for two reasons: (1) the abdomen is relatively inflexible and scarcely extensible; (2) these are two easily located points (in contrast, for example, to the posterior end, which would have to be designated arbitrarily on a curve).

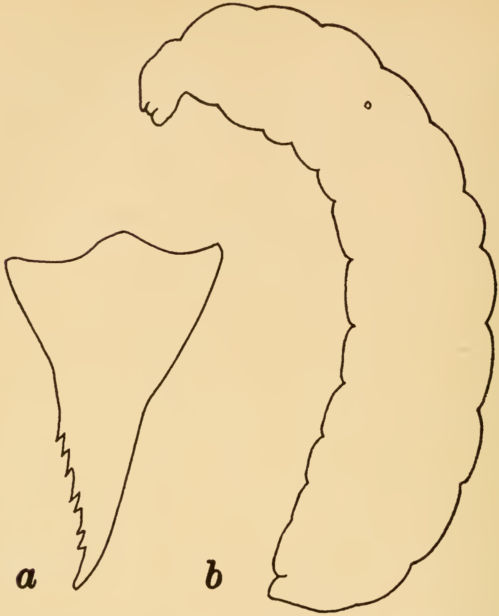

Fig. 1: *a*, generalized mandible (anterior view) for the subfamily Cerapachyinae; *b*, generalized body profile for the subfamily Cerapachyinae.

Our actual procedure (see Wheeler and Wheeler, 1960, for further details) was this:—(a) The drawing of a side view of a larva of *Lioponera* was placed on a Vertical Sketchmaster and the instrument was adjusted until the distance (on the projected image) from anus to first abdominal spiracle was 8 cm (not a significant measurement, merely convenient). (b) The images of the profile and of the first abdominal spiracle were traced on paper. (c) The first drawing was removed and replaced by a side-view drawing of *Eusphinctus;* the instrument was adjusted until the images of anus and first abdominal spiracle were superimposed on corresponding parts of the first drawing; then the image of the second profile was traced on the same paper. (d) Sideview drawings of *Cerapachys* and *Phyracaces* were processed in the same manner as the second. (e) The generalized profile (Fig. 1*b*) for the subfamily was obtained by a sort of averaging of the four generic profiles.

Fig. 1*a* shows a generalized (or synthetic) outline of a cerapachyine mandible in anterior view, derived by the same technique (see above), using the apex and the anterior condyle as the points of reference.

References to the Subfamily

Bernard, 1951:—"Larves eucéphales, carnivores; se nourrissant seules" (p. 1041). "Les larves sont du type Dorylide" (p. 1046).

Creighton, 1950, p. 56:—"This blending of ponerine and doryline traits had been recognized many years earlier by Emery and Forel but [W. M.] Wheeler was able to augment their observations by additional information concerning the structure of the larvae and the activities of the workers. . . . The larvae of the Cerapachyinae are, so far as is known, very similar to those of the Dorylinae."

Emery (1899, p. 9) thought that the Ponerinae and Cerapachyinae were the most primitive ants: "i caratteri delle loro larve accennano a loro volta ad una forma più semplice, meno perfezionata della cura della prole e della sua alimentazione."

Emery (1904, p. 114-115) used larval characters to support his thesis that *Cerapachys* and related genera belong in the Dorylinae rather than in the Ponerinae. Referring to the larva (p. 115) of *Cerapachys augustae*, he said: "A mio avviso, essa serba completamente il tipo dorilino per la sua forma sottile, quasi cilindrica, che contrasta vivamente con la forma tozza e panciuta delle larve di Ponerinae. La conoscenza di questa larva viene dunque in appoggio alla mia tesi."

Kusnezov, 1962, p. 134: A translation into Spanish of G. C. Wheeler's (1950, p. 102) characterization of the larvae of the Cerapachyinae.

Key to Mature Larvae of **Cerapachyinae**
(in our collection)

1a. With a row of long single-hooked hairs around each somite .... **Lioponera**
1b. Without such hairs 2
2a. Body hairs simple or lacking .... **Cerapachys**
2b. Body hairs bifid 3
3a. Branches of bifid body hairs simple .... **Eusphinctus**
3b. Branches of bifid body hairs multifid .... **Phyracaces**

Genus **Cerapachys** F. Smith

Revised Description—Leg vestiges present. Body hairs simple or lacking. Head hairs short or lacking. Labrum small, not covering bases or tips of mandibles; broader than long; numerous sensilla; posterior surface sparsely spinulose. Maxillary palp a cluster of 4-6 sensilla, which are more or less fused into a low elevation; galea an elongate projection.

Subgenus **Cerapachys** F. Smith

Moderately stout; crescentic in profile. Body hairs few and simple. Cranium subhexangonal in anterior view. Head hairs simple or lacking. Maxillae with few or no spinules.

Cerapachys opacus Emery
(Fig. 2)

Length (through spiracles) 3.4 mm. Crescentic in profile; diameter greatest at the fourth abdominal somite, tapering gradually to the anterior end and more

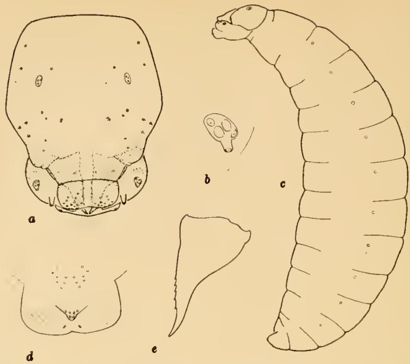

Fig. 2: *Cerapachys opacus.* *a*, head in anterior view, ×90; *b*, palp of left maxilla in anterior view, ×278; *c*, larva in side view, ×22; *d*, labrum in posterior view, ×139; *e*, left mandible in anterior view, ×174.

rapidly to the posterior end, which is round-pointed. Anus ventral. Leg, wing and gonopod vestiges present. Thirteen feebly differentiated somites. First abdominal spiracle slightly larger than the others. Body naked. Integument without spinules, but with a few sensilla, each of which bears a minute (0.006 mm long) spinule. Head moderately large, cranium subhexagonal in anterior view; widest near the middle. Head naked; integument with about 22 sensilla, each of which bears a minute (0.004 mm long) spinule. Antennae small, each with three sensilla, each of which bears a minute spinule. Labrum small, feebly bilobed, twice as broad as long; anterior surface with 13 sensilla on each half; ventral border with two sensilla near the middle; posterior surface sparsely spinulose, the spinules rather coarse and arranged in oblique rows; posterior surface with two isolated sensilla near the ventral border, a sclerotized cluster of six sensilla near the center and 14 dorsally. Mandibles moderately sclerotized; subtriangular in anterior view; apical tooth long, slender and curved medially; medial border with about five minute denticles. Maxillae with the apex conoidal and directed medioventrally; palp represented by a sclerotized cluster of five sensilla, one of which is elevated; galea peg-like with two apical sensilla. Labium with a few short transverse rows of minute spinules; palp represented by a cluster of five sensilla. (Material studied: three larvae from New Guinea, courtesy of Dr. E. O. Wilson.)

Subgenus **Parasyscia** Emery

Cerapachys (Parasyscia) augustae Wheeler

Emery, 1904, p. 115:—See above. After Wheeler, 1903.

Subgenus **Syscia** Roger

Slender and subcylindrical; curved ventrally. Body hairs lacking. Head subpyriform in anterior view. Head hairs simple. Maxillae with the distal half spinulose. Labium with spinules on the middle of the anterior surface.

Cerapachys (Syscia) australis Forel

VERY YOUNG LARVA—Length (through spiracles) about 1.6 mm. Crescentic; diameter (including that of head) nearly uniform throughout. First abdominal spiracle slightly larger than the others. Body hairs moderately numerous, short. Of two types: (1) the more numerous, generally distributed, simple, 0.012-0.036 mm long; (2) more scattered, some on each somite, bifid (at least at the tip), 0.018-0.03 mm long. Integument with transverse rows of minute spinules on thoracic and first three abdominal somites and on the dorsal surface of the last abdominal somite. Head and mouthparts generally similar to *C. (S.) crypta*. (Material studied: two larvae from Queensland, courtesy of Dr. E. O. Wilson.)

Genus Phyracaces Emery

Anterior end curved ventrally. Body hairs moderately numerous, short, bifid, with the branches simple to multifid. Cranium transversely subelliptical; head hairs few, short, simple. Labrum small; breadth twice the length; numerous sensilla near ventral border; no spinules. Maxillae with a few minute spinules; palp a cluster of five sensilla; galea a low cone. Labium with a few minute spinules; palp a cluster of five sensilla. Hypopharynx spinulose dorsally.

Phyracaces larvatus Wheeler
(Fig. 3)

MATURE LARVA—Length (through spiracles) 5.7 mm. Arcuate, with the diameter nearly uniform and the anterior end curved ventrally. Leg and wing vestiges present. Thirteen feebly differentiated somites. Spiracles small, nearly uniform in diameter. Body hairs moderately numerous and generally distributed, short (0.054-0.102 mm), more or less deeply bifid, with the branches simple to

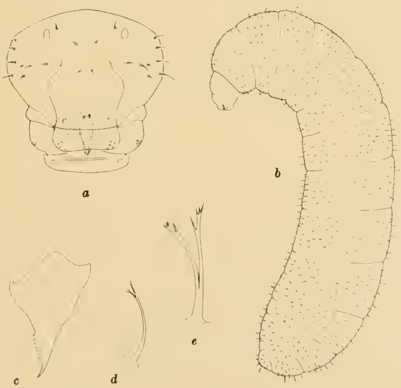

Fig. 3: *Phyracaces larvatus*. *a*, head in anterior view, ×85; *b*, larva in side view, ×14; *c*, left mandible in anterior view, ×176; *d* and *e*, two body hairs, ×278.

multifid. Integument beset with short transverse ridges, each of which may bear several minute spinules; the spinules most numerous on the ventral surface of the thorax and abdominal somites I-III and also on the dorsal surface of abdominal somites VIII-X. Head small; cranium broader than long, transversely subelliptical. Head hairs few (about 22), short (0.012-0.048 mm long), simple and slightly curved. Each antenna mounted on a rounded elevation and bearing three sensilla, each with a minute spinule. Labrum short and broad, with the ventral border slightly concave; about seven sensilla on and near the ventral surface of each half. Mandibles subtriangular in anterior view; feebly sclerotized; the apical tooth small, acute and slightly curved medially; the medial border with about ten minute denticles. Maxillae rather large and swollen; the apex conoidal and directed medioventrally, with a few minute spinules in short rows on the medial surface; palp represented by a cluster of five sensilla; galea a low cone with two apical sensilla. Labium short, with a few minute spinules in short transverse rows; palp represented by a cluster of five sensilla; opening of sericteries a transverse slit with slightly protruding lips. Hypopharynx with two lateral sensilla on the ventral portion of each half; numerous spinules in short transverse rows on the dorsal portion.

YOUNG LARVA—Body hairs of two types: (1) simple, 0.018-0.188 mm long, longer hairs with flexible tips, generally distributed; (2) 0.024-0.108 mm long, with bifid tip, a few on each somite. Otherwise similar to the mature larva.

Material studied: Three larvae from Victoria, Australia, courtesy of Dr. W. L. Brown.

Phyracaces senescens Wheeler

YOUNG LARVA—Length (through spiracles) 3.2 mm. Generally similar to *Ph. larvatus*, except in the following details: Body hairs shorter (0.012-0.042 mm), simple. Head hairs moderately numerous (about 50). Mandibles with about five denticles.

VERY YOUNG LARVA—Length (through spiracles) about 1.5 mm. Body straight and of uniform diameter. Hairs mostly simple (a few with the tip bifid), 0.012-0.144 mm long, the longest with long flexible tip. Head hairs few (about 30). Otherwise generally similar to young larva.

Material studied: several larvae from Victoria, Australia, courtesy of Dr. W. L. Brown.

Genus **Acanthostichus** Mayr

Emery, 1901, p. 430:—"Le larve di *Dorylus* hanno la medesima forma cilindroide delle larve di *Eciton* e *Acanthostichus* che differisce molto dal tipo a collo sottile e addome rigonfiato delle larve di Ponerine."

Kusnezov (1962, p. 134) quotes G. C. Wheeler's (1950, p. 110) English translation of Emery's (1899) description.

Acanthostichus ramosmexiae Bruch

Bruch, 1925, p. 113-114: Worker larva about 6 mm long. Subcylindrical, somewhat compressed dorsally, considerably attenuated anteriorly to a third of the maximum diameter; sides more parallel, less compressed. Thorax somewhat longer than the three following somites, truncated anteriorly. Posterior end rounded. Abdominal somites IV-VII longer and wider. Entire surface thinly covered with pale erect hairs, which are somewhat longer than the distances between them. Head inclined ventrally more or less at a right angle to the body. Mouth parts feebly chitinized and pale yellowish. Mandibles subtriangular, very long and sharp-pointed, with the apex slightly curved. Maxillae with a lateral conical papilla, which is rather large and slightly curved. Differing somewhat from the common ponerine type and showing a certain resemblance to the doryline *Eciton*. (Freely translated from the Spanish.) Figure of mouth parts and photographs of larva in side and ventral views, p. 114.

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NOTES AND TWO NEW GENERA

(Lepidoptera: Noctuidae)

John G. Franclemont, *Department of Entomology, Cornell University, Ithaca, New York*

The following notes and the new genera described here are extracted from manuscripts and published to make them available for use by other workers.

AMPHIPYRINAE

Iodopepla Genus Novum

Type: *Ceramica u-album* Guenée, 1852, = *Iodopepla u-album* (Guenée).

The species upon which this genus is based has had a rather checkered taxonomic existence. It was described three times by different workers, each time in a different genus; in addition it has been placed in *Mamestra*, *Hydroecia*, and *Gortyna*. In 1908 Hampson

(Catalogue of the Lepidoptera Phalaenae in the British Musuem, vol. 7, p. 597) placed it in the genus *Phuphena* Walker, 1858, where it remained until Forbes in 1954 (Cornell Univ. Agr. Exp. Sta. Mem. **239:** 210), following a suggestion of mine that it might be related to *Oligia*, placed it questionably in that genus. A critical study of the type of *Phuphena* and related species revealed little in common between these species and *u-album*. The moth is of uncertain position, but it may be an outlier of the genera centering around *Oligia;* if this is so, then Grote's placement of the species in *Apamea* Ochsenheimer, 1816, when he described it under the name *purpuripennis* would be close to the true position. Smith's placement in *Hydroecia* Guenée, 1841 (1893, Bull. U. S. Natl. Mus., **44:** 177; and 1899, Trans. Amer. Ent. Soc., **25:** 15) merely reflects a change in name, the use of *Hydroecia* for *Apamea*. Grote later (1895, Abhandlungen des naturwissenschaftlichen Vereins zu Bremen **14:** 43) used *Gortyna* Ochsenheimer, 1816, for the complex called *Hydroecia* by Smith.

Description: Head with front clothed with erect scales, vertex with erect scales, scales at level of antennae shorter than those of front and vertex, which appear tufted; palpi upcurved, appressed to front, reachnig to upper ¾ of eye, first and second segments clothed with scales and fringed outwardly with short narrow scales, third segment clothed with scales; proboscis well developed; antennae in male with the segments well marked ventrally (subserrate), pubescent and ciliate, in female simple and pubescent with cilia reduced. Thorax clothed with scales and a few intermixed hair-like scales; neither patagia nor tegulae set off; a low, spreading, median tuft behind patagia, and another on caudal third. Forewing with outer margin of membrane crenulate; R_2 from outer fourth of accessory cell, R_{3+4} stalked for one-fifth their length from apex of accessory cell, R_5 from apex of accessory cell, connate at base with stalk of R_{3+4}; M_2, M_3, and Cu_1 arising equidistant from one another. Hindwing with outer margin crenulate, moderately broadly and deeply excavated between M_1 and M_3; R_S and M_1 from apex of discal cell; M_3 and Cu_1 from lower angle of discal cell. Forelegs of male with a tuft of long narrow scales from base of tibia, absent in female; hind femora in both sexes fringed above with long hair-like scales; tarsi with three rows of spines beneath. Abdomen clothed with scales, with some long hair-like scales on basal three segments.

Male genitalia with tegumen and vinculum moderate; uncus small; juxta with lateral apical angles prolonged into long, scobenate arms; valves about three times as long as broad, produced into an extended flap below cucullus; cucullus well set off, produced into a point at outer angle bearing a heavy spine, and with numerous long setae; clasper broad, produced into a short, rounded process dorsally; editum raised, prominent, with numerous setae; sacculus simple. Aedeagus short, with a scobinate patch near apex and a scobinate projection at apex opposite patch; vesica armed with two bulbous based cornuti and a broad, ribbed and rugose, sclerotized band for almost entire length.

Female genitalia with ovipositor valves membraneous; both pairs of apophyses stout; bursa with four heavy, longitudinal signa of about equal length; last abdominal sternite deeply cleft at ostium, the margins of cleft rugose.

For the time being the genus may be placed near *Oligia*, but it differs in several fundamental features of the genitalia of both sexes.

The articulation between the tegumen and vinculum is simple, and the valves of the female genitalia are membraneous, not heavily sclerotized as in *Oligia.*

I had thought that it might be possible to place this genus in its true position when we knew more about the East Asian fauna, but the discovery of another species, apparently endemic to Cuba, has caused me to be less positive. It may still, however, be one of the group of relict forms which is represented in Eastern North America by one or two species and in East Asia by a like number.

PLUSIINAE

In his revision of the North American Plusiinae (Mem. So. California Acad. Sci., **2:** 216), McDunnough uses the generic name *Agrapha* Hübner, [1821], (Verzeichniss bekannter Schmettlinge [sic], p. 250) for *aerea* Hübner, crediting Dyar (1902, Jour. New York Ent. Soc., **10:** 81) with citing this species as type. He overlooked a short note by Grote in the Entomologist's Record of 1896 (**8:** 303) entitled, "Generic Types in Plusia," in which Grote designates *Phal[aena] Noct[ua] glauca* Cramer as the type of *Agrapha.*

The original proposal of *Agrapha* included two species, *aerea* Hübner and *ahenea* Hübner with *glauca* Cramer 311 G cited as a synonym. *Phalaena glauca* Cramer, 1780 (Papillons Exotiques, vol. 4, p. 45, pl. 311, fig. G) is a homonym of *Phalaena glauca* Cramer, 1777 (Papillons Exotic, vol. 2, p. 17, pl. 107, fig. E). The figure of *glauca* (pl. 311, fig. G is only fair, but it is a Plusiine, and there seems to be no question but that it is the species described by Druce in 1889. (Biologia Centrali-Americana, Lipidoptera Heterocera, vol. 1, p. 332, pl. 30, fig. 17) as *Plusia longicornis.* Hübner's name *ahenea* should be used for this species in the future.

The two species *aerea* and *ahenea* are not congeneric, thus McDunnough's usage of *Agrapha* for *aerea* cannot stand. Kostrowicki in 1961 (Acta Zoologica Cracoviensia, **6:** 396) treats *Agrapha* in the sense of Dyar and McDunnough, and as a synonym of *Plusia* Ochsenheimer, 1816. I think that McDonnough was correct in regarding *aerea* as representing a genus distinct from *Plusia.* The genitalia of both sexes are more like those of the species which Kostrowicki included in his genus *Macdunnoughia* in 1961 than like any of the species included in *Plusia.* The development and sclerotization of the sacculus is like the species of *Macdunnoughia* and unlike any species of *Plusia;* the clasper and armature of the vesica of the aedoeagus differ from both genera. The female genitalia have a short, thick ductus bursae, agreeing with *Macdunnoughia* and not *Plusia;* the bursa lacks the signum of *Macdunnoughia;* and the ostial plates differ from both genera. For *Agrapha* McDunnough, 1944 (Mem. So. California Acad. Sci. **2:** 216) the name **ALLAGRAPHA genus novum** is proposed with *Noctua aerea* (Hübner), [1800/03], = *Allagrapha aerea* (Hübner) as type and only included species.

BOOK REVIEW

Advances in Insect Physiology, Volume 1. Edited by J. W. L. Beament, J. E. Treherne, and V. B. Wigglesworth. 1963. 512 pp., Academic Press, London and New York, $14.80.

Volume 1 contains seven reviews:

"The physiological significance of acetylcholine in insects and observations upon other pharmacologically active substances" by E. H. Colhoun is a classic in toxicology. Almost every page presents enticing ideas for further research. This selective, but penetrating, review succinctly stresses limitations of techniques on which data are based and emphasizes the chemistry within the insect rather than the chemical applied to it.

"Feeding behavior and nutrition in grasshoppers and locusts" by R. H. Dadd is more biochemical than is suggested by the title. Outstanding insights on the idiosyncracies of nutrition and on the roles of ascorbic acid and carotene are presented. The appraisals of other subjects is less discriminating. Following custom, diets with agar or casein are called "synthetic." The discussion on steroids is already obsolete.

"The biochemistry of the insect fat body" by B. A. Kilby covers too much for a short review. To discuss the biochemistry of an organ requires extensive referral to the biochemistry of the whole insect.

"The properties of insect axons" by Toshio Narahashi promotes the advantages of microelectrode techniques. This interesting and speculative discourse emphasizes the physical chemistry of inorganic solutions on isolated nerve cords. Fortunately, this compliments the emphasis on organic molecules in Colhoun's review. Variables in techniques are accentuated, but problems and artifacts of instrumentation are not covered.

"The chitin/protein complexes of insect cuticles" by K. M. Rudall effectively compiles biophysical data from x-ray analyses, infrared absorption, polarization optics, and electron microscopy from Insecta and other Classes.

"Osmotic and ionic regulation in insects" by J. Shaw and R. H. Stobbart is less precisely stated than the other discussions. This results from sufficient data on this subject to discourage general statements on fauna so varied as insects.

"Functional aspects of the organization of the insect nervous system" by D. S. Smith and J. E. Treherne emphasizes structural organization rather than function. This review extols electron microscopy and is profusely and impressively illustrated.

The book has an eleven-page author index and an inadequate fifteen-page subject index. References for each review contain both authors and titles.

Since this volume is designed to stimulate and catalyze further advances, success will make it rapidly become obsolete. All entomologists cognizant of insect behavior and functions should read this book; biologists and chemists in toxicology and physiology should study it.

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A NEW SPECIES OF IODOPEPLA FRANCLEMONT FROM CUBA

(Lepidoptera, Noctuidae)

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In the preceding paper (p. 71) J. G. Franclemont has established a new genus, *Iodopepla,* for *Ceramica u-album* Guenée. The purpose of the present paper is to describe and name a second species of the genus and thus make its name available for a proposed list of the Noctuidae of Cuba.

Key to the Species of **Iodopepla**

1. Oribicular spot of the forewing a minute point or absent; a dark shading of reddish-brown scales extending from reniform spot to beyond post-medial line; upper surface of hindwing without an indication of a post-medial line; cucullus of valve of male genitalia wider than long, greatly produced ventrally, terminating in a single anal spine; vesica of aedeagus bearing a broad, rugose, sclerotized band and two bulbous cornuti .... *I. u-album* (Guenée), Figs. 2 and 4.

Orbicular spot of forewing well developed; dark shading about reniform spot not extending beyond postmedial line; upper surface of hindwing with a broken postmedial line; cucullus as long as wide, ventral projection terminating in two short coronal setae; vesica of aedeagus bearing a broad, rugose, sclerotized band and one bulbous cornutus .... *I. alayoi,* n. sp., Figs. 1 and 3.

Iodopepla alayoi, n. sp.

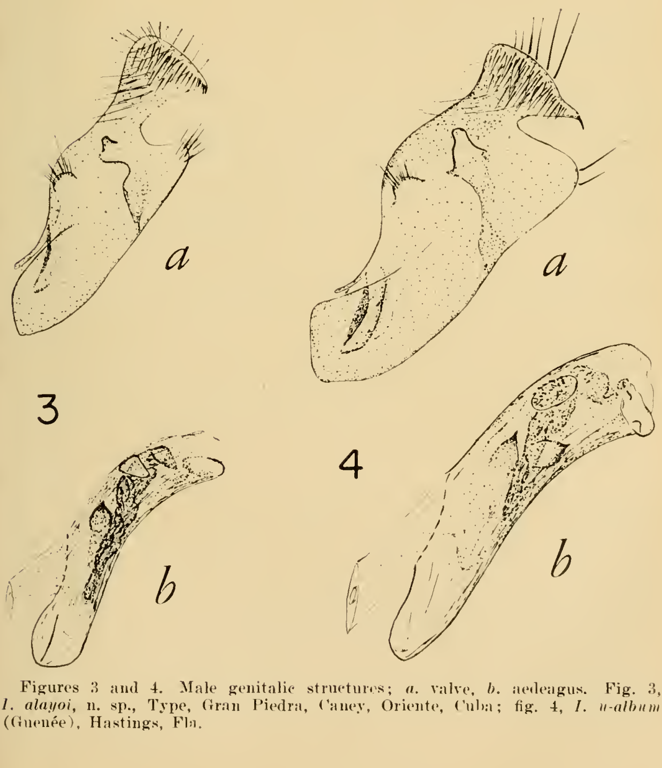
Male.—Head with proboscis moderately well developed, smaller than in *u-album;* labial palpi upcurved, reaching about to middle of frons, third segment shortest (approx. 0.25 mm.), rounded apically, nearly porrect, clothed with appressed brown scales except a few white scales at apex, first and second segments longer (approx. 0.50 and 1.10 mm.), clothed laterally with mixed dark-brown and reddish-brown appressed scales, clothed ventrally with a loose fringe of long, narrow ,dark-brown and reddish-brown scales and hairs; frons flat, smooth, scarcely exceeding anterior margin of eyes, clothed with semi-erect scales, those at level of antennae shorter and light gray in color, the others dark brown except pale gray at extreme apex; vertex of head with a tuft of erect, reddish-brown scales; eyes large, width approximately equal to width of frons, naked, hemispherical; ocelli present, small, adnate to dorsal margin of eye caudad of base of antenna; antenna slightly serrate ventrally, ciliate. Vestiture of patagium, tegula, and thorax mainly of loose, semi-erect, brown, pale-tipped scales. Pectus clothed with reddish-brown hairlike scales concealing appressed, rounded, shiny white scales. Legs moderate, clothed with mixed brown and reddish-brown scales; femora of middle and hind legs with a ventral fringe of long, pale, reddish, hairlike scales; tibiae of all legs with a semi-appressed dorsal mass of elongate scales. Forewing triangular, 14 mm. in length; basal third of costa slightly convex; termen slightly angled at Cu_1, anterior two-thirds straight, tornus rounded; inner margin straight; R_2 from outer third of small, elliptical, accessory cell; R_3 stalked with R_4 for about one-fifth their length from apex of accessory cell; R_5 from apex of accessory cell, connate at base with stalk of R_{3+4}; M_1 from basal third of accessory cell; M_2 and M_3 from shortly above lower angle of discal cell, M_3 equidistant from M_2 and Cu_1; Cu_1 from lower

Figures 1 and 2. Adult males. Fig. 1, *I. alayoi*, n. sp., Type, Gran Piedra, Caney, Oriente, Cuba; fig. 2, *I. u-album* (Guenée), Winchendon, Mass.

angle of discal cell. Hindwing rather oval except excavated between M_1 and M_3; R_S and M_1 shortly stalked, length of stalking about one-half width of discal cell; M_3 and Cu_1 connate from lower angle of discal cell.

Pattern of maculation as illustrated (Fig. 1). Ground color of upper side of forewing gray, suffused with reddish brown, suffusion heaviest distad and caudad of reniform spot; transverse lines and terminal area brown; reniform and orbicular spots gray, ringed with white. Upper surface of hindwing smoke brown; postmedial line dark brown; fringe pink. Lower surfaces of wings shiny smoke brown, suffused with light reddish brown; postmedial line of both wings and fine terminal line of hindwing dark brown.

Male genitalia (Fig. 3) rather small, vertical distance (base of uncus to ventral end of vinculum) 2.2 mm., length of valve 2.0 mm. Valves symmetrical; cucullus well developed, about as wide as long, produced ventrally; corona diffuse, not dense, coronal setae mostly slender, curved, two on apex of ventral projection of



Figures 3 and 4. Male genitalic structures; *a*. valve, *b*. aedeagus. Fig. 3, *I. alayoi*, n. sp., Type, Gran Piedra, Caney, Oriente, Cuba; fig. 4, *I. u-album* (Guenée), Hastings, Fla.

cucullus shorter and stouter; ventral margin of valve roundly produced below cucullus; clasper a short, rounded projection, as wide as long; editum raised, rounded, prominent, clothed with numerous setae; sacculus simple. Uncus small, short, about as wide as long, clothed dorsally with long setae. Juxta well developed, laterodorsal angles produced into long, slightly curved, scobinate arms.

Type male, Gran Piedra, Caney, Oriente, Cuba, September 1960, P. Alayo, ♂ genitalia slide No. 1313, ELT, in the personal collection of Mr. Alayo, Habana, Cuba. One male paratype, same locality, June 1952, F. de Zayas, in the United States National Museum, Washington, D. C.

In addition to the characters indicated in the key, *alayoi* differs from *u-album* in the following ways. In *alayoi* veins R_s and M_1 of the hindwing are stalked, but they are connate in *u-album*. The male genitalia (Figs. 3 & 4) are smaller in *alayoi* (length of valve 2.0 mm) than in *u-album* (length of valve 2.5 mm). The clasper is smaller than the editum in *alayoi*, but it is larger than the editum in *u-album*. In *alayoi* the ventral margin of the valve is not so broadly produced as in *u-album*.

The shape of the antemedial line is extremely variable in *u-album*. Therefore, the apparent difference in the shape of the antemedial line of the forewing between the specimen of *u-album* illustrated (Fig. 2) and the type of *alayoi* (Fig. 1) is not considered of importance. The extension of the gray ground color into the apex of the forewing in *alayoi* may or may not be useful in separation of this species and *u-album*. Some specimens of *u-album* exhibit a faint indication of this coloration, and only two specimens of *alayoi* are known.

Iodopepla u-album (Guenée)

Ceramica u-album Guenée, 1852, Histoire Naturelle des Insectes, Spécies Général des Lépidoptères, v. 5 (Noctuélites I), p. 345.

Ceramica v-album Guen. [sic], Walker, 1856, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, pt. 10, p. 418.

Ceramica w-album Guen. [sic], Grote, 1874, Bull. Buffalo Soc. Nat. Sci., 2: 22.

Mamestra w-album (Guen.) [sic], Grote, 1875, Check List of the Noctuidae of America, North of Mexico, pt. 1, p. 8; 1882, New Check List of North American Moths, p. 26; 1890, Revised Check List of the North American Noctuidae, p. 12.

Mamestra u-album (Guen.), Smith, 1891, List of the Lepidoptera of Boreal America, p. 41, no. 1909; 1891, U.S. National Museum Proc., 24: 231.

Hydroecia u-album (Guen.), Smith, 1893, Bull. U.S. National Museum, No. 44, p. 174; 1899, Trans. Amer. Ent. Soc., 26: 15; 1900, Insects of New Jersey, p. 415.

Gortyna u-album (Guen.), Grote, 1895, Abhandl,. naturw. Ver. Bremen, 14(1): 43.—Dyar, 1903, Bull. U.S. National Museum, No. 52, p. 174, no. 2160.—Grossbeck, 1917, Bull. American Museum Nat. Hist., 37(1): 61.

Phuphena u-alba (Guen.) [sic], Hampson, 1908, Catalogue of the Lepidoptera Phalaenae in the British Museum, v. 7, p. 597, pl. 121, fig. 24.

Phuphena u-album (Guen.), Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America, p. 64, no. 2397.—Draudt *in* Seitz, 1926, Die

Gross-schmetterlinge der Erde, v. 7, p. 242, pl. 35(f).—McDunnough, 1938, Mem. So. California Acad. Sci., 1: 92, no. 2544.

Fagitana u-album (Guen.), Smith, 1909, Insects of New Jersey, p. 462.

Oligia ? u-album (Guen.), Forbes, 1954, Mem. Cornell U. Agric. Expt. Sta., No. 329, p. 210.

Iodopepla u-album (Guen.), Franclemont, 1964, Proc. Ent. Soc: Washington, 66 (2): 71.

Apamea purpuripennis Grote, 1874, Proc. Acad. Nat. Sci. Philadelphia, p. 206; 1875, Canadian Ent., 7: 58; 1882, New Check List of North American Moths, p. 29; 1883, Proc. Amer. Philos. Soc., 21: 147—Smith, 1893, Bull. U.S. National Museum, No. 44, p. 174 (as synonym of *u-album*).

Gortyna purpuripennis (Grt.), Grote, 1875, Check List of the Noctuidae of America, North of Mexico, pt. 1, p. 11; 1875, Bull. Buffalo Soc. Nat. Sci., 2: 309; 1890, Revised Check List of the North American Noctuidae, p. 20.

Orthosia baliola Morrison, 1874, Proc. Boston Soc. Nat. Hist., 17: 148.—Grote, 1875, Canadian Ent., 7: 58 (as synonym of *purpuripennis*).

Types.—The types of *u-album* and *purpuripennis* are in the British Museum (Natural History), London, England. The type of *baliola* may be in the Michigan State University collection, East Lansing, Michigan.

Distribution.—This species occurs mainly in the States of the Atlantic Coast, but its has been reported in the literature from Minnesota and there is a specimen from Baton Rouge, La., in the collection of the U.S. National Museum. Specimens from the following localities have been examined. Massachusetts (Winchendon), New Jersey (Lakewood and Lakehurst), Georgia (Thomasville), Florida (Hastings, St. Petersburg, and Key West), and Louisiana (Baton Rouge). The specimen from Lakewood, New Jersey, was reared from a pupa found in the soil of a cranberry bog. The food plant of the genus is unknown. Specimens from Florida were collected in March and April; but those from Massachusetts, New Jersey, and Louisiana were captured in August.

A NEW SUPERFICIALLY CRYPTIC SPECIES OF TROGODERMA FROM THE SOUTHWESTERN UNITED STATES[1]

(COLEOPTERA: DERMESTIDAE)

R. S. BEAL, JR., *Arizona State College, Flagstaff*

Trogoderma grassmani Beal (1954) is a moderately abundant species of dermestid beetle that occurs throughout the southwestern United States in old wasp, bee and sheltered bird nests, and frequently as a minor pest in various stored food products. The original description of the species included a series of twenty-three vaguely different specimens that were taken in a granary in Salina, Utah. Close study of their external features failed to reveal the consistent presence of any single character by which these specimens might be distinguished from *T. grassmani*.

[1]Work on this paper was carried out under National Science Foundation Grant No. G-13280.

The pupae of *T. grassmani* are unique among members of the genus in that they lack dorsal gin-traps. All other *Trogoderma* species for which the pupae are known possess three sets of these movable, toothed, jaw-like structures (Hinton, 1946; Beal, 1954).

I collected a series of *Trogoderma* larvae in 1960 in the nest of an unidentified rodent in an old barn in Northern Arizona. Superficially they appeared to be *T. sternale plagifer* Casey. Upon rearing them to maturity I was surprised to find them identical with the Utah form of "*grassmani*." My surprise was compounded when I examined the pupae and found each with three, well-formed, dorsal gin-traps, completely unlike typical *T. grassmani*.

Still not satisfied that the two forms of "*grassmani*" represented completely distinct species, I carried out a series of crossbreeding experiments between them. A culture of *T. grassmani* was obtained from Komatke, Maricopa County, Arizona. These were isolated as pupae and placed on dried dog food in petri dishes in various combinations with similarly isolated specimens of the other form, all of which were progeny of the series collected at Wild Bill Tank in Coconino County, Arizona. The number of tests carried out was limited by the difficulty of obtaining adults of each form at the same time. However, I believe that enough tests were conducted to lead to reliable conclusions. In some tests, as can be seen from the following schedule, more than a single specimen of one sex was included in the hope of increasing the opportunity for crossbreeding. In *no* test were progeny produced.

No. of tests	Wild Bill Tank specimens	Komatke specimens
3	1 female	1 male
1	2 females	1 male
1	3 males	3 females
1	1 male	1 female
1	1 male	2 females
1	2 males	1 female

Several dishes with two specimens of the opposite sex of each form were kept under identical conditions as a control. These all produced progeny except for one pair of "Komatke" specimens.

Dissection of the male genitalia of the forms shows noticeable dissimilarities in the length of the aedeagus relative to the length of the lateral lobes. This difference in the genitalia, the presence of pupal gin-traps, and the evident reproductive barrier seem to indicate beyond question that this form is specifically distinct from *T. grassmani*.

I submit therefore the following description of the new species and take pleasure in dedicating it to Mr. George Okumura of Sacramento, California, a student of the genus to whom I am indebted for much information on the group.

Trogoderma okumurai, new species

(Figs. 2, 3, 4, 5)

Adult male.—Color of dorsal and ventral surfaces black with elytral maculae reddish; antenna with first segment brownish and apical segments black; femora brownish black with extremities of legs brownish. Pubescence of dorsal surfaces moderately coarse, suberect, consisting of blackish, light golden-brown, and white hairs; pubescence of undersurfaces moderately coarse, recumbent, golden-brown.

Head with punctures of frons shallow, two or three times as wide as facet of eye, separated by about one-fourth diameter but becoming confluent toward epistoma and smaller and more sparse on vertex; pubescence of intermingled black, golden-brown and white hairs. Antenna 11-segmented, extending in repose nearly to hind angle of prothorax; segment three minute, half as wide as segments two or four; segments four to nine strongly eccentric; segment ten sub-

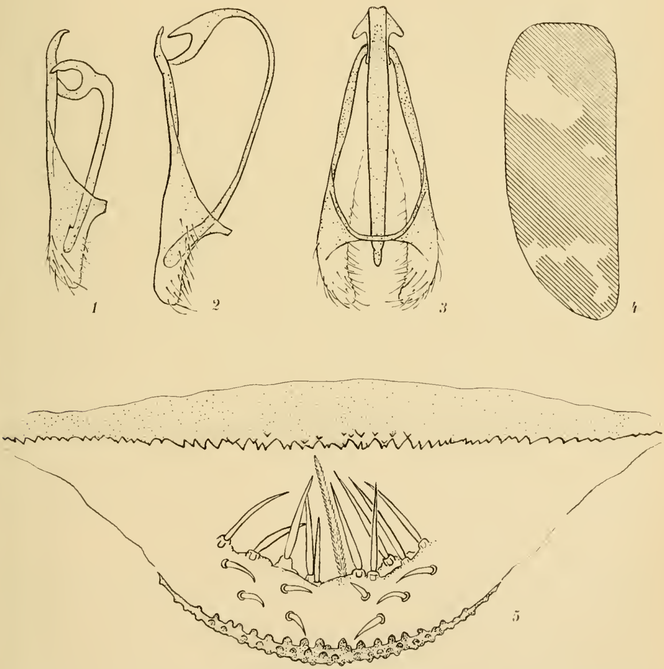


Fig. 1, Lateral view of male genitalia of *Trogoderma grassmani;* fig. 2, lateral view of male genitalia of *T. okumurai;* fig. 3, same in ventral view; fig. 4, pattern of elytral maculation in typical specimen of *T. okumurai;* fig. 5, middle gin-trap of pupa of *T. okumurai.*

eccentric; segment eleven subequal in length to length of segments nine and ten combined. Eyes with medial margins straight.

Pronotum immaculate; punctures of disc simple, subequal in diameter to facet of eye, separated by one to four diameters, becoming coarser and denser toward sides. Pubescence black on disc with intermingled white and golden-brown hairs on sides and patch of white hairs on basal lobe.

Elytra with punctures of disc two or three times as large as punctures of pronotum, separated by one or two diameters of one puncture. Maculation as figured. Light colored pubescence mostly limited to areas of light maculation and consisting mostly of white hairs with a few scattered golden-brown hairs. Epipleuron ending at about level of hind margin of metasternum; transversely shallowly concave on anterior half. Hind wings with very short pigmented proximal spur on stigma; vein 1A reduced to very short spur distally to point of divergence from vein $2A_2$.

Antennal fossa extending to base of pronotum, about one-third as wide as long, deeply excavated; anterolateral wall concave; posterior diagonal margin raised and knife-like, extending to lateral apex of fossa; floor of fossa minutely granulate-rugose throughout. Mesosternal disc with raised part on either side of sulcus trapezoidal, a little longer than wide. Ratio of width between procoxae and mesocoxae 1:3.2. Mestasternum without oblique discal striae; median anterior process broad, subtruncate, with wide, interrupted margin. Abdomen without oblique striae on first sternite. Tergite of first periphallic segment rounding, set with several series of short setae along apical margin. Phallus as illustrated. Length (of pronotum and elytra): 2.5 mm.; width (across humeri): 1.4 mm.

Adult female.—Antenna brownish, extending in repose to about anterior third of lateral margin of pronotum; segments three to seven subequal in length and becoming very little but progressively wider and eccentric; club four-segmented with segments slightly eccentric; segment eleven about one and one-half times as long as segment ten. Antennal fossa with floor minutely granulate-rugose on medio-anterior two-thirds becoming finely punctate on latero-posterior third. Length (of pronotum and elytra): 3.0 mm.; width (across humeri): 1.7 mm.

Range of observed variations: Pubescence of pronotum almost entirely black with few scattered white hairs laterally to black on disc with white and golden-brown and few scattered black hairs on sides. Elytral pattern consisting of narrow subbasal and subapical light maculate bands covered with light colored pubescence and few light colored submedian hairs to broad subbasal and subapical light maculate bands with submedian light maculate area as figured. Length of males varying from 2.2 mm. to 2.8 mm. Length of females varying from 2.4 mm. to 3.1 mm. Ratio of width to length of males and females varying from 1:1.72 to 1:1.92.

Type data.—Male holotype, female allotype, numerous spermotypes (specimens bred from holotype and allotype) and numerous paratypes (in cultures from original collection): Wild Bill Tank (6 miles north of Bellemont), Coconino County, Arizona, original collection of larvae made August 25, 1960, R. S. Beal; 23 paratypes: Salina, Utah, July 2, 1943, C. J. Sorenson. Holotype and allotype deposited in the collection of the California Academy of Sciences.

Adults of this species will key to *T. grassmani* in the keys of Okumura and Blanc (1955) and Beal (1956). Differences in the male genitalia provide positive separation of the two species. Larvae key to *T. grassmani* using the key of Okumura and Blanc but to *T. sternale plagifer* using the key published by Beal in 1960.

I have been unable to find any single character that may be used consistently to separate larvae of *T. okumurai*, *T. grassmani*, and *T. sternale*. Color variations of *T. okumurai* may produce specimens resembling variations of either of the other species. *T. okumurai* is never quite as dark as most specimens of *T. grassmani*, but some have the terga and pronotum as dark as the lighter variants of *T. grassmani*. Other specimens are creamy-yellow like *T. sternale plagifer*, and others may have moderately dark mesonotum, metanotum and terga, and a light colored pronotum like *T. sternale maderae*. The large spicisetae of the abdominal terga are quite sparse on the middle half of each tergum of *T. okumurai*, and the small spicisetae of the terga are dense, giving the larvae a silky appearance similar to *T. sternale plagifer*. Larvae of *T. grassmani* usually have a much denser transverse row of large spicisetae across the middle of each tergite and finer, less conspicuous setae inserted on the acrotergite. However, occasional larvae of *T. grassmani* also have a fairly sparse transverse row of large spicisetae.

The combination of characters that I find most helpful in separating larvae of *T. okumurai* from other closely related forms in the same general geographic area are the following:

T. grassmani: Most of the large spicisetae that form a transverse row across the abdominal tergites are located behind the middle. In *T. okumurai* most of the large spicisetae are inserted at the middle or before the middle. In *T. grassmani* there are in addition usually two or three setae inserted on the dorsal side of the second segment of the maxillary palpi but usually only one in *T. okumurai*.

T. sternale plagifer: Most specimens of *T. okumurai* have darker pigmentation on the terga than is found in this species. Usually specimens are taken in a series. A series consisting of all light-colored specimens keying out to *T. sternale maderae* would in all probability correctly be assigned to it. A series in which most specimens showed darkly pigmented terga should probably be assigned to *T. okumurai*.

T. sternale maderae: Mature specimens almost invariably have one or two setae inserted on the second antennal segment. This is true of no specimens of *T. okumurai* that I have seen.

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ACINIA PICTURATA (SNOW), A RESURRECTED SYNONYM

(DIPTERA: TEPHRITIDAE)

The genus *Acinia* Robineau-Desvoidy (1830, Essai sur les Myodaires, p. 775) is represented by two species in the Palearctic (Hendel, 1927, Flieg. Palaearkt. Reg., p. 136), by one species in the Nearctic, and by eight species in the Neotropical Region. The single Nearctic species has been cited as *fucata* (F.) ever since Loew (1862, Smithsonian Misc. Collect. 6(1): 95) first associated North American specimens with that name in one of the earliest revisions of North American Tephritidae. Benjamin (1934, U.S. Dept. Agric. Tech. Bull 401, p. 46) suggested that the North American specimens did not, in his opinion, seem to fit the "Fabrician descriptions" and tentatively stated that *Acinia picturata* (Snow), described as *Tephritis picturata* (Snow, 1894, Kansas Univ. Quart. 2: 173; type locality, Florida) might be the name properly applicable to them.

In his revision of New World *Acinia*, Aczél (1958, Rev. Brasileira Ent. 8: 75) makes abundantly clear that *picturata* and *fucata* are indeed distinct and easily recognizable, and that the latter has its population center in northern South America. The revision by Aczél should be consulted for means of separating the two species.

Acinia picturata (Snow) (= *Acinia fucata* (F.) of North American authors) is found from New Jersey south to Florida and in all of the southern States west to and including California. It is also known to occur in Baja California, in Mexico at least as far south as the State of Veracruz, and in Jamaica, Puerto Rico, and on the island of Antigua. *A. picturata* has been reared from inflorescences of *Pluchea foetida*, *P. imbricata*, *P. purpurascens*, and *P. sericea*, and larvae of *fucata* have been found in the stems of *Tessaria absinthoides* and *T. integrifolia*, lending further credence to the distinction between the two species.

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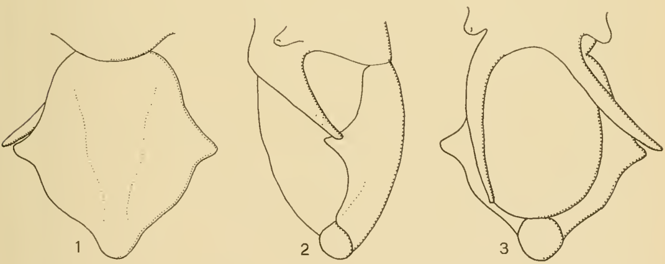
A NEW SPECIES OF HALOBATES FROM THE BAY OF BENGAL
(HEMIPTERA: GERRIDAE)

JON L. HERRING, *Entomology Research Division, A.R.S., U. S. Department of Agriculture*

Recently, Mr. William H. Gladfelter, Department of the Navy, Suitland, Maryland, sent to the U.S. National Museum some insect specimens that were collected with fishes and miscellaneous invertebrates during a trip through the Strait of Malacca. The marine water striders that he collected represent three species: *Halobates micans* Eschscholtz, *H. germanus* White, and the following new species.

Halobates trynae, n. sp.
(Figs. 1-3)

A rather short, oval, steel-gray species with apical 3 antennal segments in proportion 12: 9: 13[1] in ♂ and 13: 9: 13 in ♀. Basal segment of anterior tarsus shorter than apical segment, 11: 14 in ♂ and 12: 15 in ♀. Middle and hind femora not noticeably stout. No black bristles on mesometanotum of either sex. Left styliform process of ♂ short, curved outward, reaching middle of tergum 9; right process elongate, curved inward (Fig. 3). Venter of ♂ and ♀ with distinct yellow markings.



Male. *Head.* Antenna over one-half as long as body, 69: 123; proportion of segments I-IV, 35: 12: 9: 13. Head wider across eyes than length, disc rather abruptly swollen, depressed laterally. Eyes small, interocular width only slightly over 4 times width of an eye. *Thorax.* Pronotum with sides subrounded and diverging posteriorly, shorter than head on median line, 10: 20; anterior and posterior margins rather deeply concavely arcuate. Meso-metanotum abruptly roundly angled anteriorly, width just behind anterior angles equal to width of head including eyes, 42: 42, abruptly increasing in width posteriorly, greatest width anterior to bases of middle and high acetabula, 42: 55; sides distinctly rounded. No black bristles present on thorax or acetabula. *Legs.* Anterior femur incrassate; length (excluding trochanter) about one-third longer than tibia, 50: 33. Anterior tarsus

[1] 27.5 units = 1 millimeter.

with basal segment distinctly shorter than apical segment, 11: 14. First segment of intermediate tarsus 3 times as long as second 40: 14. Hind tarsus 1-segmented. Intermediate femur much longer than posterior femur, 145: 105. Intermediate tibia longer than posterior tibia, 80: 52. *Abdomen.* Styliform processes (Fig. 3) asymmetrical, clothed with long pubescence; left process short, curved outward, attaining apex of median flange of tergum 9, visible from above. Right process long, curved inward, extending beyond level of lateral flanges of tergum 9. Tergum 9 symmetrical, about as broad as long (Fig. 1). *Coloration.* Uniformly steel gray with very fine pubescence. Rostrum, antennae, legs and tergum 9, glistening black. Pale markings on head not extensive, extending forward to middle of eyes. Venter much the same as dorsum except abdominal segments medially, and middle acetabula, yellowish; lateral margins of abdominal segments and styliform processes, brown. *Size.* Length 4.5 mm; greatest width 2.0 mm.

Female. Very similar to ♂ but more oval in form, i.e., shorter and broader. Antenna proportionately longer than in ♂, over one-half as long as body, 67: 116; proportion of segments I-IV, 32: 13: 9: 13. First anterior tarsal segment shorter than second, 12: 15. Intermediate femur to posterior femur, 140: 94. Intermediate tibia to posterior tibia, 77: 52. Coloration as in male. Length 4.3 mm.; greatest width 2.2 mm.

Holotype ♂ (USNM Type No. 67324), Bay of Bengal, 6° 19′ N, 92° E, Nov.-Dec. 1961, W. Gladfelter. Allotype ♀, 8° 10′ N, 92° E, same date and collector. Paratypes, 1 ♀, same data as holotype; 2 ♀♀, same data as allotype; 2 ♂♂, 1 ♀, 6° 29′ N, 94° 49′ E, same date and collector. All material in the U.S. National Museum.

Although these specimens bear labels reading "St. of Malacca", the latitude and longitude readings place the locality northwest of the Strait in the region of the Nicobar Islands.

Diagnosis. This species belongs to the open-ocean group and runs to *eschscholtzi* Herring in my key (1961). The males of that species are unknown, but females of the two species exhibit striking differences. *H. trynae* may be distinguished from *eschscholtzi* by the shorter anterior tarsal segment I, the lack of a keel or fold across the posterior margin of the head, the more concave anterior and posterior pronotal margins, the relatively longer intermediate femur (as compared with the posterior femur) and its shorter body. Tergum 9 of the male most closely resembles that of *micans*, but the left styliform process is quite different (Figs. 1-3).

Reference

Herring, Jon L. 1961. The genus *Halobates* (Hemiptera: Gerridae). Pacific Insects 3 (2-3): 223-305.

ANNOUNCEMENT

At a recent meeting of our Executive Committee, Dr. Thomas E. Snyder was elected Honorary President of the Society.

NOTES ON THE BIOLOGY OF THE EURYTOMA RHOIS COMPLEX

(HYMENOPTERA: EURYTOMIDAE)[1]

H. H. NEUNZIG[2]

Bugbee in 1939 made an investigation of the chalcids which infest the seeds of several species of the genus *Rhus*. On the basis of morphological studies and host records he concluded that a single species, *Eurytoma rhois* Crosby, is associated with *Rhus hirta* (L.), *Rhus copallina* L., and *Rhus glabra* L. However, although no clear-cut correlation of morphological features with host was found, he admitted that some basis for isolating various populations existed, and that additional information might at a later date necessitate the splitting of the complex.

During the past few years, seeds of *R. copallina*, *R. glabra*, and *R. hirta* have been collected principally in North Carolina, and to a lesser extent at other locations in the eastern United States. Each sample consisted of approximately one pint of seed obtained during the period January to April.

Approximately one-half of the samples yielded seed chalcids. Many were reared from *R. copallina* seed collected in the coastal plain, piedmont, and mountain regions of North Carolina. Also, numerous seed chalcids were reared from *R. hirta* seed collected in several states just north of North Carolina. However, no seed chalcids were obtained from a total of 24 samples of *R. glabra* seed which were mostly collected in the coastal plain and piedmont areas of North Carolina.

The lack of seed chalcids in seeds of *R. glabra* appears significant. Particularly since *R. glabra* is a common plant in North Carolina, and it, at times, can be found growing in close proximity to *R. copallina*.

After initial rearings showed a lack of seed chalcids in the *R. glabra* samples, and an abundance of chalcids in the *R. copallina* seed, a special effort was made in succeeding years to locate mixed stands of *R. glabra* and *R. copallina* and to obtain samples from these areas. These subsequent samples continued to support earlier data suggesting that the chalcids associated with the seed of *R. copallina* do not infest the seeds of *R. glabra*.

Notes taken on the phenology of *R. copallina* and *R. glabra* also show a marked difference in seasonal development for the two species of plants. *R. glabra* breaks dormancy and produces leaves earlier in the spring than *R. copallina*. Also, *R. glabra* flowers and produces fully developed fruits prior to the time *R. copallina* flowers. Seeds of the two species in the early stage of development which could be utilized by seed chalcids for oviposition are therefore available at two distinct periods during the growing season.

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[1] Contribution from the Entomology Department, North Carolina Agricultural Experiment Station, Raleigh. Published with the approval of the Director of Research as Paper No. 1592 of the Journal Series.

[2] Thanks are due B. D. Burks, U. S. National Museum, who identified the parasite associated with seed chalcids reared from *R. copallina* seed.

A parasitic chalcid, *Idiomacromerus* sp., was also reared from a few of the sumac seeds. Only seed chalcids associated with *R. copallina* were found to be hosts of this torymid. No previous record of parasitism of seed chalcids reared from *R. copallina*, *R. hirta*, or *R. glabra* seed has been reported in the literature. Bugbee (1941) has found *Eurytoma seminis* Bugbee, which feeds within seeds of *Rhus trilobata*, parasitized by *Idiomacromerus bimaculipennis* Crawford.

The above findings concerned with the biology of seed chalcids associated with *Rhus* spp., together with the fact that some morphological differences, although of a somewhat elusive nature, do exist among populations of chalcids reared from *R. copallina*, *R. glabra*, and *R. hirta*, make it appear that more than one species of seed chalcid infests the seeds of these sumacs.

Literature Cited

Bugbee, Robert E. 1939. A discussion of the *Eurytoma rhois* complex with a description of a new species (Eurytomidae). Ann. Ent. Soc. Amer. 32: 415-427.

————. 1941. A new species of the *Eurytoma rhois* complex from the seeds of *Schmaltzia* (*Rhus*) *trilobata* (Eurytomidae). Jour. Kans. Ent. Soc. 14: 98-102.

IDENTITY OF THE GENUS MIOCOLUS FOERSTER

(Hymenoptera: Braconidae)

Miocolus Foerster, 1862 (Verh. naturh. Ver. preuss. Rheinlande 19: 237), type, *M. pallipes* Foerster, was placed by the author in the cyclostomine section of the Braconidae, and there in the subfamily Hecabolinae. It remained unrecognized until three American species were assigned to it in Hymenoptera of America North of Mexico, Synoptic Catalog (1951, U. S. Dept. Agr., Agr. Monogr. 2, p. 182). I have not been satisfied with that treatment, however; and I find now, after studying the types, that all three species belong elsewhere: The types of *Anisopelma minima* Cresson and *A. utilis* Cresson, which are in the Academy of Natural Sciences in Philadelphia, are very small specimens of *Monolexis fuscicornis* Foerester; and the type of *Acrisis americanus* Brues (recently very kindly lent to me by Dr. Kenneth MacArthur, of the Milwaukee Public Museum) is a dwarf specimen of *Allorhogas* which has lost the second intercubitus.

Now, through the kindness of Dr. E. Königsmann, of the Humboldt University Museum in Berlin, I have had the privilege of studying the type of *Miocolus pallipes* Foerster. It is not a cyclostomine at all but belongs in the Blacinae and is clearly congeneric with *Blacus humilis* (Nees), the type of *Blacus* Nees. *Miocolus* Foerster, 1862, therefore, falls as a synonym of *Blacus* Nees, 1818.—C. F. W. Muesebeck, *U. S. National Museum*

STUDIES ON IDIOCERINAE LEAFHOPPERS: II. THE INDIAN AND PHILIPPINE SPECIES OF IDIOCERUS AND THE GENUS IDIOSCOPUS

(Homoptera: Cicadellidae)

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Thanks to the courtesy of Dr. W. E. China, British Museum (Natural History), I was able to study specimens of most of the species of *Idiocerus* Lewis included by Distant (1908) in his work on the Cicadellidae of India. To Dr. J. P. Kramer, Entomology Research Division, U. S. Department of Agriculture, I am grateful for the loan of Baker's material of Philippine leafhoppers.

Distant's work includes: *Idiocerus nivcosparsus* Lethierry, *I. fasciolatus* Distant, *I. atkinsoni* Lethierry, *I. clypealis* Lethierry, *I. scutellatus* Distant, *I. unimaculatus* Melichar, *I. subopacus* Motschulsky, and *I. astutus* Melichar. In the Annals and Magazine of Natural History (1912) he described *I. maculatus* also from India. Baker (1924) found this name preoccupied and changed it to *I. incertus*. Baker (1915) in his studies in Philippine Jassoidea, on page 338, established the genus *Idioscopus* and included in it *Idiocerus clypealis* and the two new species *Idioscopus tagalicus* and *I. palawensis*. He separated *Idioscopus* from *Idiocerus* on external morphological characters. The present study proves the correctness of placing *Idiocerus clypealis* in a separate genus. However, examination of the male genitalia of Baker's material shows that the other two species properly belong in a new genus herein described. I was not able to see specimens of *Idiocerus unimaculatus* and *I. subopacus*. All but one of the other Indian species of *Idiocerus* are herein transferred to *Idioscopus*. *Idiocerus astutus* is a species of *Balocha*.

Balocha astuta (Melichar) n. comb.

Idiocerus astutus Melichar, 1903, Hom. Fauna Ceylon, p. 150.

Idocerus astutus Melichar. Distant, 1908, Fauna British India, Rhynchota Vol. IV, Homoptera, p. 189.

Although I was able to see but one female specimen it is evident that this species is a *Balocha*. The forewing venation (fig. 2) is typical of this genus. This species seems closer to *Balocha pallida* Maldonado-Capriles described from West Pakistan. Melichar's description as quoted by Distant is quite complete and satisfactory so is quoted verbatim: "A small species; perfectly unicolorous, greenish-yellow, locally more pale green or yellow to rusty yellowish; eyes brown; face paler yellow, not marked; ocelli small vitreous; tegmina hyaline, slightly brownish-yellow with a weak golden shining lustre, veins delicate, not prominent, somewhat darker than the ground-colour, at tip of clavus a brown spot and the apical tip of tegmina with a piceous longitudinal spot; wings hyaline, vitreous; body beneath and legs pale yellow or greenish-yellow." Pedunculate cell as long as its peduncle.

Female genitalia: seventh sternum with posterior margin convex and slightly notched medianly, longer than remaining sterna together (fig. 1). Specimen from Nilgiri Hills, South India, T. V. Campbell collector, BM 1926-171.

Can be distinguished from the other five species so far included in *Balocha* by not having smoky forewing with broadly blackened median longitudinal vein, not being conspicuously banded with orange red or red, not having a round spot inside the pedunculate cell, being uniformly colored except for the brownish apical tinge of the forewing.

Idioscopus Baker, 1915

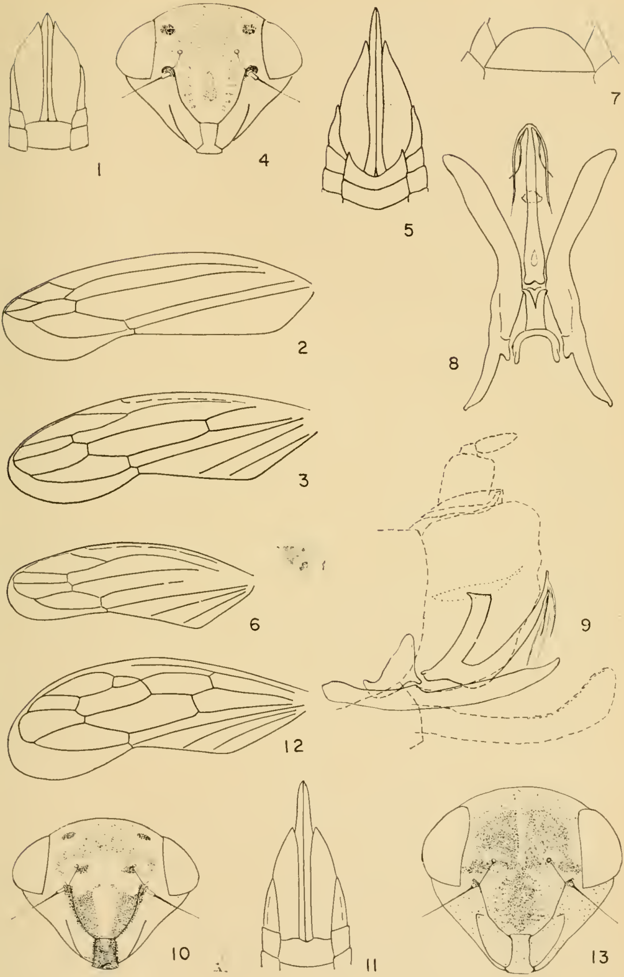
Idioscopus Baker, 1915, Philippine Jour. Sci. 10(6): 338.

Redescription of the genus: Relatively small species, up to 5 mm. in length. Vertex short, about one third as long as pronotum, finely or very finely transversely rugose or shagreened, anterior margin convexly round and parallel to posterior. Eyes close to hind margin of head. Head definitely wider than pronotum. Filament of antenna short, hair-like or slightly enlarged apically. Ocelli low on face, closer to eyes than to each other. Upper extremities of clypeus well developed in most species, reaching ocelli or just mesad of them. Clypellus longer than wide, sides slightly concave, usually wider apically than basally. Pronotum with anterior margin convexly round, sides short, shorter than scutellum. Scutellum triangular, wider or narrower than long, not swollen, medianly longer than head and pronotum together. Legs of moderate length; hind tibia strongly spinulose on posterior edges, other two edges setose. Forewing longer than abdomen in both sexes (venation as in figures 6 and 12) with four apical cells and one or no anteapical cell, usually no discal cell; costal margin of forewing convex, broad in some species; appendix relatively broad, reaching to second apical cell in most species.

External female genitalia: seventh sternum longer than sixth, slightly produced and concave medianly; valves as long or longer than abdominal sterna together, glabrous; ovipositor longer or slightly longer than valves, narrow, straight, glabrous.

Male genitalia: valves spatulate, upcurved on lateral aspect, at rest held almost vertical to long axis of body; upper margin on apical half with long hairs, hairs over one and one-half times depth of valve. Aedeagus with basal projection (apodeme) well developed, projecting upward, expanded laterally or not at apex; aedeagus elongate, curved, with four (two long and two short) apical filaments; gonopore opening subapically. Styles with anterior end flattened laterally, shorter than posterior end. Connective flattened laterally except at base and apically; slightly widened apically and broadly basally, inverted T-shaped on frontal aspect. Tenth tergum or base of anal tube detached, narrow, horse-shoe shaped, slightly expanded at tips. Pygofer short and deep, apically recurved mesad like a cupped hand, caudal margin wavy; a longitudinal unchitinized area near upper margin (see dotted outline on figure 20), apically with many very short setae.

Balocha astuta (Melichar), female. 1, seventh sternum and apex of abdomen, ventral; 2, forewing venation. *Idioscopus atkinsoni* (Lethierry), female. 3, forewing venation; 4, face, frontal view; 5, female tip of abdomen, ventral. *Idioscopus clypealis* (Lethierry). 6, male, forewing venation; 7, female, seventh sternum; 8, male, internal genitalia, caudal view; 9, male, concealed and external genitalia, lateral view. *Idioscopus fasciolatus* (Distant) female. 10, face, frontal view; 11, tip of abdomen, ventral. *Idioscopus incertus* (Baker), male. 12, forewing venation; 13, face, frontal view.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Type of genus: *Idiocerus clypealis* (Lethierry), established by Baker in 1915. Geographic distribution: Oriental.

The genus can be separated from other Idiocerinae genera as follows: scutellum and clypeus not swollen; upper extremities of clypeus well defined and reaching ocelli; four apical and usually one anteapical cells; aedeagus long, upcurved, with four apical filaments, with basal apodeme well developed. Closer to *Paraidioscopus* gen. nov. than to any other idiocerine genus.

Idioscopus atkinsoni (Lethierry) n. comb.

Idiocerus atkinsoni Lethierry, 1889, Jour. Asiatic Soc. Bengal 58, p. 252.

Idiocerus quinquepunctatus Melichar, 1903, Homoptera Faun. Ceylon, p. 146.

Female: Vertex relatively long, slightly less than one-half as long as pronotum, about one-fourth as long as wide: shagreened. Eyes extending well beyond lateral margins of pronotum. Upper lateral margins of clypeus well defined, reaching to ocelli; lateral margin of clypeus curved to clypellus. Clypellus, twice as long as wide, with a preapical transverse depression. Pronotum one-half as long as wide, posterior margin concave. Scutellum nearly twice as wide as long. Forewing venation as in figure 3; tip of ovipositor reaching to apex of second apical cell. Vertex infuscate except along posterior and lateral margins and medianly, with a basal median elongate small spot and two circular spots surrounded by yellow on anterior margin. Face (fig. 4) infuscate on both sides of median yellowish line; the two circular spots on vertex visible. Clypeus yellow with a small median black longitudinal line and with minute lateral fuscous striae. Pronotum yellow with fuscous disc, a narrow median brownish longitudinal line and two black spots near anterior margin. Scutellum with a triangular black spot near each basal angle and with a central narrow fuscous streak dilated anteriorly and posteriorly, a small fuscous spot on each side of its apical end. Forewing pale ochraceous, subhyaline; veins fuscous, well defined, costal margin yellowish; brownish areas at tip of clavus, at end of yellow costal margin, and apically. Legs and sterna yellow; ovipositor brown, pygofer brownish on lateral margins.

Female genitalia: seventh abdominal sternum deeply concave, caudal angles sharp; pygofer with inner margins wavy, a shallow depression midway near inner margin, as in figure 5. Drawings and description from specimens collected at Lyallpur, Punjab, West Pakistan, BM(NH) collection.

Idioscopus clypealis (Lethierry)

Idiocerus clypealis Lethierry, 1889, Indian Mus. Notes 1(1):5.

Idiocerus nigroclypeatus Melichar, 1903, Homopt. Fauna Ceylon V(1).

Idiocerus clypealis Lethierry, Distant, 1908, Fauna British India, Vol. IV:187.

Idioscopus clypealis (Lethierry). Baker, 1915, Philippine Jour. Sci. 10(6):339.

Male: vertex short, about one-third as long as pronotum; finely transversely corrugated. Eyes extending well beyond lateral margin of pronotum. Face from crown to near ocelli very finely transversely corrugated, remaining portion of face shagreened. Upper extremities of clypeus directed to a point close and mesad to the ocellus on their respective sides, not to the opposite ocellus as in the species of some other genera in Idiocerinae; lateral margin of clypeus angularly bent near middle. Antennal flagellum as in some species of *Idiocerus,* slightly enlarged at tip. Lora reaching to about middle of lateral margins of clypeus, slightly elevated. Head across eyes slightly wider than from crown to apex of clypeus. Pronotum almost three times as wide as long, hind margin broadly and shallowly concave. Scutellum slightly wider than long. Forewing without preapical cells, as in figure 6.

Head and pronotum flavescent; vertex with two black spots on anterior margin in most specimens (Baker points out that this is a male sexual character but in specimens from Lahore, West Pakistan, these are present in both sexes), face immaculate or with two small black spots at base of clypeus. Clypellus flavescent, black in the males from the Philippine Islands. Scutellum yellowish with a triangular blackish spot near each lateral angle. Forewing very pale ochraceous, translucent; veins inconspicuous, concolorous, except brownish apically; costal area yellowish to about middle. Body beneath and legs yellowish; a somewhat large black spot on each propleura; abdomen dorsally sooty-blackish; pygofer brownish medianly.

Male genitalia as in figures 8 and 9. Drawn from specimens collected by the author in Lahore, West Pakistan.

Female: coloration and dimensions as in the male except for the spots near ocelli that are missing in the females and the variable color of the clypellus. Seventh abdominal sternum brownish, shaped as in figure 7; ovipositor dark brown apically and light brown basally.

This species was seen by the author, in many Districts of West Pakistan, attacking mango trees in huge numbers. The Pakistani specimens at hand differ from others from Chikkahallapura in South India in having the clypellus pale instead of blackish as in the latter.

Idioscopus fasciolatus (Distant) n. comb.

Idiocerus fasciolatus Distant, 1908, Fauna of British India, Vol. IV: p. 186.

Distant's description is very clear so is quoted verbatim: "Vertex and pronotum grayish; vertex with two oblique central testaceous stripes and two black spots at anterior margin; pronotum with two curved discal testaceous stripes and four black spots, one near each lateral angle and two on anterior margin; scutellum suffused with pale testaceous, a black spot near each basal angle and two piceous spots on disk; head (figure 10) beneath pale ochraceous, a transverse testaceous fascia, which is deflected on each side, between eyes and beneath this fascia two black spots with pale centres, posterior margins of face and the clypeus black; body beneath and legs pale ochraceous; tegmina pale bronzy subhyaline, the veins fuscous, costal margin to near middle and a basal transverse fascia stramineous; near middle of costa is a linear black spot and a small spot of the same colour at apex; posterior costal area hyaline. In some specimens the vertex is without the testaceous stripes and black spots, both being replaced by a large but very obscure pale fuscous transverse spot. Length 4-4.5 mm."

External female genitalia as in figure 11. The drawing was made from a specimen from Myitta, India, from the BM(NH).

Idioscopus incertus (Baker) n. comb.

Idiocerus maculatus Distant, 1912, (nec Melichar 1896), Ann. Mag. Nat. Hist. vol. 8(10):605.

Idiocerus incertus Baker, 1924, Philippine Journ. Sci. 24:367, nom. nov.

Very close to *Idioscopus niveosparsus,* perhaps only a subspecies or an extreme variety. As the genitalia show some differences they should be considered as two species until breeding experiments are made to finally settle the point.

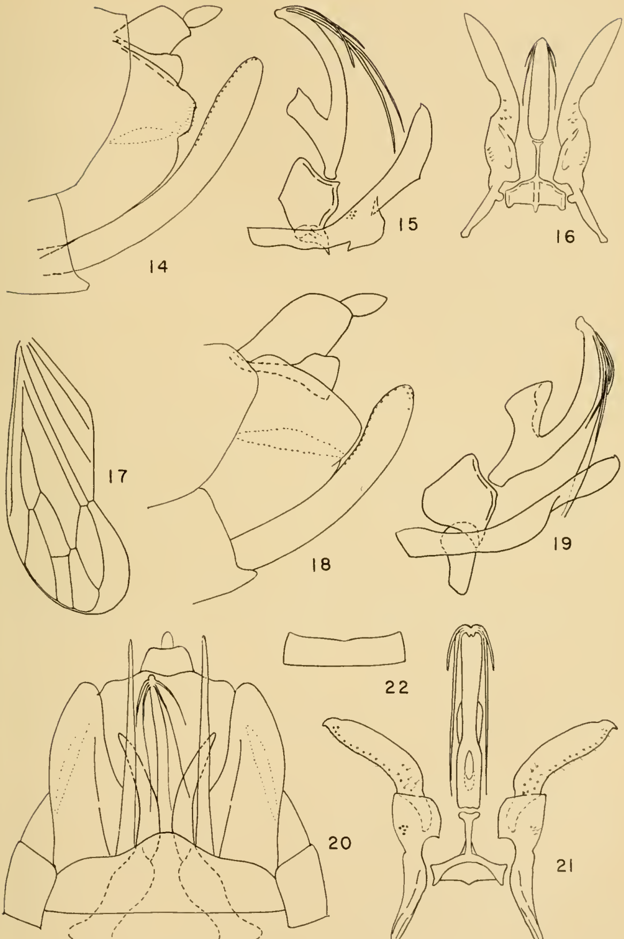
Male: vertex short, less than one-half as long as pronotum; finely transversely corrugate; anterior margin convex and parallel to posterior; eyes clearly extending beyond lateral margins of pronotum. Face finely transversely corrugate on upper half, shagreened on lower half. Upper extremities of clypeus well defined and reaching to ocelli; lateral margins of clypeus angularly bent near middle. Pronotum about one-third as long as wide, hind margin broadly and shallowly concave. Scutellum triangular, broader than long. Forewing venation as in figure 12. Vertex and pronotum ochraceous, the first with posterior and lateral margins yellowish, the latter irregularly spotted with brown, especially near anterior margin. Face (fig. 13), clypeus, and scutellum colored as in *I. niveosparsus*. Forewing bronzy subhyaline; veins brownish or ochraceous, conspicuous; costal margin pale brownish to about middle, following this an elongate costal brownish spot and a similar spot from before apex to base of appendix, between these a small ivory spot followed by a hyaline space; forewing ornamented with ivory white as follows: a broad band from humeral angle to inner angle of clavus, after the mid-costal brown spot, and with short dashes on each vein between the costal ivory spot and the apical angle of clavus. Male genitalia as in figures 14, 15, and 16.

Idioscopus niveosparsus (Lethierry) n. comb.

Idiocerus niveosparsus Lethierry, 1889, Indian Mus. Notes I, I:5.
Idiocerus basilis Melichar, 1903, Homopt. Fauna Ceylon, p. 147.
Idiocerus niveosparsus Lethierry. Distant, 1908, Fauna British India IV: 185.
Chunra niveosparsa (Lethierry). Baker, 1915, Philippine Journ. Sc. 10(6): 324.

Male: vertex short, about one-fourth as long as pronotum, very finely transversely corrugated. Eyes clearly extending beyond lateral margins of pronotum. Face very finely corrugated on upper half, remaining portions shagreened. Clypeus with upper extremities reaching ocelli, lateral margins curved to base of clypellus. Clypellus with base two-thirds as wide as apex, slightly longer than apical width. Lora reaching to about middle of lateral margin of clypeus, slightly elevated. Head across eyes wider than from crown to apex of clypellus. Pronotum over two and one-half times as broad as long, hind margin concave. Scutellum two-thirds as long as broad. Forewing venation as in figure 17.

Vertex with brownish suffusions on each side of a central pale line, posterior margin and laterally before eyes yellowish. Face with two discal subsquare piceous-brown spots not reaching laterally to eyes. Ocellus inside a round yellow spot, another spot of the same size and color contiguous and laterad to first. Lateral margins of face orange-yellow. Clypeus with mesal elongate piceous-brown spot reaching from base to apex and with small lateral fuscous striae. Pronotum dull virescent with brownish and yellowish spots and markings irregularly distributed all over, paler near outer angles. Scutellum pale ochraceous with three basal blackish or dark brown spots, the central elongate or transverse and reaching to disc, the lateral spots triangular, behind the central two very small spots; area from mid lateral margin to apex ivory white. Sterna transversely spotted with black. Legs ochraceous, apex of posterior tibia black. Forewing bronzy subhyaline; veins ochraceous or brownish, conspicuous; costal area to about middle straw-colored, followed by an elongate costal brownish spot and a similar spot near apex, between these spots a hyaline space; forewing orna-



Idioscopus incertus 14, genital capsule, lateral; 15, concealed genitalia, caudal view; 16, concealed genitalia, lateral view. *Idioscopus niveosparsus* (Lethierry). 17, male, forewing venation; 18, genital capsule, lateral view; 19, concealed genitalia, lateral view; 20, tip of abdomen, ventral; 21, concealed genitalia, caudal view. *Idioscopus niveosparsus* female. 22, seventh sternum, ventral.

mented with white as follows: near humeral angle, basally on the three claval cells, with short dashes of white on each vein distributed in a nearly straight line from apex of clavus to base of hyaline costal spot.

Internal and external male genitalia as in figures 18 to 21. Described from material in the BM(NH), specimens collected in Calcutta, India, from Distant's collection, 1911; No. 383.

Female: similar in coloration and body proportions as male. Seventh abdominal sternum as in figure 22, very shallowly concave medianly and slightly produced on caudal angles. Drawn from specimens from the same locality as the males.

The Philippine Islands *I. niveosparsus* is definitely the same species as the Indian. I have not studied the male genitalia of Baker's varieties. The genitalia of *I. n. palawensis* are very close to the studied specimens from Calcutta. The small cell at the base of the outer apical cell, shown in all of Baker's drawings of the varieties from the Philippines, is absent in one of the two wings in some specimens from the Philippines and totally mssing in some Indian specimens.

Idioscopus scutellatus (Distant) n. comb.

Idiocerus scutellatus Distant, 1908, Fauna British India, IV:187.

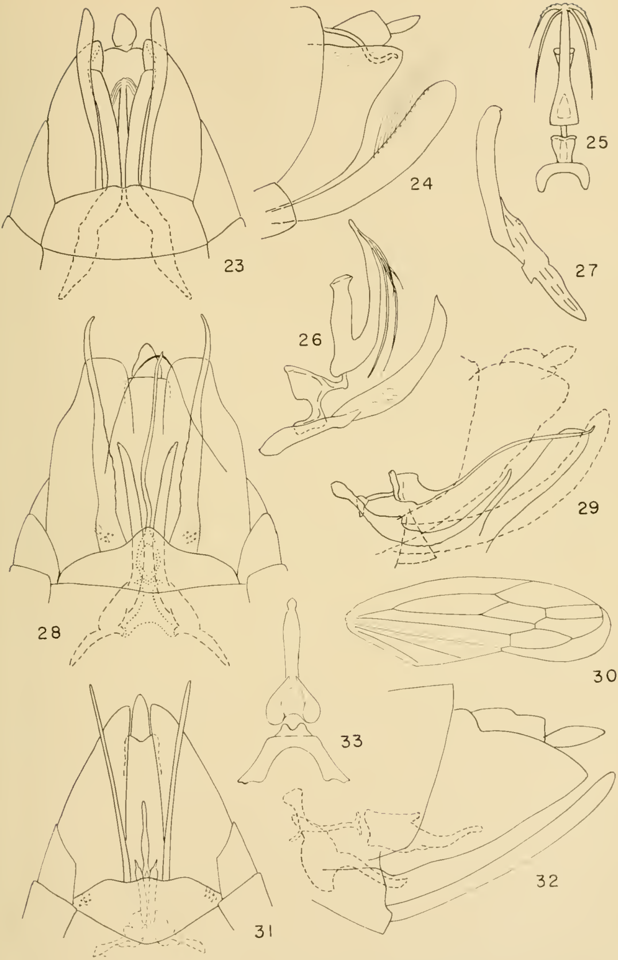
Male: vertex broad, about two-thirds as long as pronotum, shagreened. Eyes extending well beyond lateral margin of pronotum. Face shagreen; upper extremities of clypeus poorly defined, reaching ocelli; clypellus, because of position of its upper extremities, looks longer than in the other species, lateral margins arcuate. Clypellus elongate, wider apically than basally, sides slightly concave. Pronotum two and one-half times as broad as long, hind margin very shallowly concave. Scutellum equilateral.

Vertex, face, clypellus, pronotum, body beneath, and legs ochraceous. Clypellus black or with a median black spot. Scutellum ochraceous to tip of black spot on each lateral angle, apical half whitish. A black spot on each side of sternum between the anterior and intermediate coxae. Forewings pale bronzy, translucent; veins inconspicuous; costal margin yellowish-green, inwardly margined with brown.

External and internal male genitalia as in figures 23 to 27. Drawn from specimens from Calcutta, India. Distant (1908) on page 188 says "It remains to be proved whether it is only an extreme variety of that species (*I. clypealis*)." Judging by the genitalia this is a different species.

Key to the species of Idioscopus treated in this paper

1. Face and pronotum uniformly ochraceous, without black spots or black or brown irregular markings; clypellus black in some specimens .... **scutellatus** (Distant)
   Face and/or pronotum with spots or otherwise conspicuously marked with black or brown 2
2. Face with round black spots near upper margin 3
   Face irregularly marked with black or brown, spots not as above 5
3. Smaller species; face uniformly yellowish in males, with two smaller black dots near base of clypellus in females; pronotum unspotted .... **clypealis** (Lethierry)
   Larger species; face conspicuously spotted or infuscated with brown or black; pronotum with several dark markings 4



Idioscopus scutellatus (Distant), male. 23, tip of abdomen, ventral; 24, male, genital capsule, lateral view; 25, male, aedeagus and connective, caudal view; 26, concealed genitalia, lateral view; 27, male, style, dorsal view. *Paraidioscopus tagalicus* (Baker), male. 28, genital segments, ventral; 29, same, lateral; 30, fore-wing venation. *Paraidioscopus palawensis* (Baker), male. 31, genital segments, ventral; 32, same, lateral; 33, aedeagus and connective, ventral.

4. Clypeus with lateral margins yellowish; face infuscate on both sides of median yellowish line .... **atkinsoni** (Lethierry)
   Clypeus with lower lateral margins and contiguous areas in gena heavily infuscated; face with a transverse testaceous facia which is deflected on each side .... **fasciolatus** (Distant)
5. Style with anterior portion longer than posterior; apodeme of aedeagus not keeled .... **incertus** (Baker)
   Style with anterior portion shorter than posterior; apodeme of aedeagus keeled .... **niveosparsus** (Lethierry)

Paraidioscopus gen. nov.

Type of genus *Idioscopus tagalicus* Baker 1915, USNM Type No. 66826.

Habitus very similar to the smaller species of *Idioscopus.* Relatively small species, up to 5 mm. in length. Vertex short, about one-third as long as pronotum; clearly transversely rugose; anterior margin convexly round, parallel to posterior. Eyes close to hind margin of head. Head definitely wider than pronotum. Filament of antenna hair-like. Ocelli low on face, closer to eyes than to each other. Upper extremities of clypeus straight, well defined, reaching ocelli; clypeus not swollen, lateral margin somewhat angularly bent near middle. Clypellus longer than wide, sides slightly concave, apically as wide as basally. Pronotum with anterior margin convexly round, sides short, shorter than scutellum, hind margin concave. Scutellum triangular, wider than long, not swollen, medianly longer than head and prenotum together. Legs of moderate length with posterior margins and upper anterior margins strongly spinulose, lower anterior margin setose. Forewing longer than abdomen in both sexes; venation as in figure 30. with four apical cells and one anteapical cell, and with one or no discal cell; costal margin convex, narrow; appendix relatively narrow, reaching to third apical cell; outer apical cell the widest.

External female genitalia: seventh sternum longer medianly than sixth, rectangular; valve subequal in length to abdominal sterna together, glabrous, somewhat constricted subapically.

Male genitalia: valves spatulate, upcurved on lateral aspect, at rest held at about 45° to long axis of body; on apical half with long hairs on upper and lower margins. Aedeagus with basal apodeme well or poorly developed, aedeagus long or short, with or without apical filaments. Gonopore opening apically. Connective inverted V- or T-shaped on frontal aspect. Pygofer trianguluar on lateral aspect, produced caudad, finely scaly near caudal end. Styles relatively short, anterior end flattened laterally, shorter than posterior end.

The genus can be separated from other idiocerine genera as follows: scutellum and clypeus not swollen; upper extremities of clypeus well defined and reaching ocelli; four apical and one subapical cells; aedeagus variable, with or without apical filaments, basal apodeme short. Closer to *Idioscopus* Baker, but the male genitalia are quite different. Includes so far two species both from the Philippine Islands. As can be seen from figures 28 and 31 these two species may represent two genera. Externally the two species are very similar, but the internal genitalia suggest they may be generically distinct. Until more is known about this genus *I. tagalicus* and *I. palawensis* will be placed in *Paraidioscopus.*

Paraidioscopus tagalicus (Baker), n. comb.

Idioscopus tagalicus Baker, 1915, Philippine Journ. Sci. 10(6): 340.

Male: vertex about a third as long as pronotum, finely transversely corrugate. Face transversely corrugate almost to ocelli. Upper extremities of clypeus well defined, reaching inner margin of ocelli. Head from vertex to base of clypellus longer than wide to inner margins of eyes. Clypeus with lateral margins straight to apical two-thirds and thence angled mesad to base of clypellus. Clypellus nearly straight sided. Pronotum two and one-half times as wide as long, hind margin broadly and shallowly concave. Scutellum nearly two-thirds as long as wide. Forewing as in figure 30, costal margin narrow.

General color ochraceous. Vertex olive-tinted except along hind and lateral margins, spots on face narrowly visible on anterior margin. Face, clypeus, clypellus, and gena ochraceous; face near upper margin with two very conspicuous large spots. Pronotum olive-tinted except along anterior margin with or without two small spots near anterior margin. Scutellum yellowish with a large median basal spot, with or without two very small spots on basal angles. Forewing with clavus opaque yellow, translucent in some specimens (teneral?); corium faintly tinted with brown; the middle third of costa and a broad stripe adjoining claval suture that reaches to mid length of clavus black or dark brown; very small brownish area at apex of wing; veins inconspicuous. Ventrally thorax and abdomen yellowish.

Male genitalia as in figures 28 and 29. Drawn from a specimen from Baguao, Benguet, P. I., coll. Baker.

Female: coloration and body proportions much as in the male. Clypellus and ovipositor blackish. Seventh abdominal sternum almost rectangular, slightly longer medianly than laterally; ovipositor reaching well beyond pygofers.

Paraidioscopus palawensis (Baker) n. comb.

Idioscopus palawensis Baker, 1915, Philippine Journ. Sci. 10(6): 338.

Baker's description is copied: "Length 4.25 mm.; width of head, 1.5 mm. Ochraceous, olive-tinted on vertex and pronotum; basal field of scutellum reddish brown; large basal lunulae on scutellum, small pronotal lunulae back of eyes, two spots on anterior margin of head, small dots inclosing ocelli, basal two-thirds of clypeus, spot on mesopleurae, and the ovipositor black; antennal scrobes darkened; tegmina golden brown, paler apically, the region of outer apical cell clearer; costa broadly, alternately yellow and brown to the outer cell.

Vertex, and face to just below upper black spots, finely, transversely striate, remainder shagreened; head wider than pronotum; length of vertex into width between eyes four and one-third times; length at middle nearly the same as at eyes. Face slightly longer than broad; distance between ocelli two and a half times the distance between ocelli and eyes and twice the width of clypeus at base; front slightly broader than long; clypeus of medium width, about as wide basally as apically, apex truncate; lorae much longer than clypeus and two thirds as broad. Width of pronotum two and a half times the length, the length slightly less than three times that of the vertex. Scutellum as long as pronotum and about one half of the vertex together; transverse impressed line obtuse-angularly bent, the apex open, the lateral limbs not arcuate; surface just postrior to impressed line with a few, shallow, transverse wrinkles. Tegmina distinctly thickened and roughened on basal half, this area having numerous strong punctures along the veins. Hind margin of anal segment slightly produced medially. Palawan, Puerto Princesa, P. I. (coll. Baker)."

Male genitalia as in figures 31 to 33; seventh sternum longitudinally finely striate. The unique male at hand, apparently overlooked by Baker, has two spots each on vertex, pronotum, and scutellum as in the female. The clypeus is black on lower half whereas it is clear in the female, USNM Type No. 66827.

The two species in the genus can be easily separated as follows: *P. palawensis* with two black spots on scutellum anteriorly and *P. tagalicus* with a single large median black spot anteriorly on scutellum.

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PLATYPATROBUS LACUSTRIS DARLINGTON IN VERMONT

(Coleoptera: Carabidae)

Darlington (Entomologica Americana, 18: 135-183, 1938) founded the genus *Platypatrobus* on a single female specimen in the Museum of Comparative Zoology collection. It had been taken many years previously by Hubbard and Schwartz at Batchawaung Bay at the eastern end of Lake Superior. For 23 years it remained the only known specimen of the genus. Lindroth (Psyche, 69: 7-10) recently discovered a second, male specimen in the collection of the late C. A. Frost. It had been taken at a light trap in Sinclair in the northern tip of Maine. Lindroth described and figured the male genitalia, and discussed the taxonomic position of the genus. On July 28, 1963, we captured two more specimens, both females, near Stowe, Vermont. We were using a black light suspended in front of a sheet, facing westward on the western slopes of the Worcester range at an elevation of 1,450 feet. The locality is near Bedell Brook in the southwest corner of the Town of Elmore, about 5½ miles northeast of the village of Stowe. The beetles were collected within half an hour of one another, at 10:30 and 11:00 p.m., Eastern Daylight Saving Time. Both beetles appeared to be teneral, one more than the other. Both were covered with large numbers of mites. Despite extensive efforts, we were unable to find more specimens, either by light trapping or by collecting in nearby habitats.

—Ross T. *and* Joyce R. Bell, *University of Vermont, Burlington, Vermont.*

CARPOPHILUS FUMATUS BOH., A BEETLE NEW TO NORTH AMERICA

(COLEOPTERA: NITUDULIDAE)

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About three years ago Carl Parsons showed me specimens of *Carpophilus fumatus* Boheman, 2 females and 2 fourth-instar larvae, collected by Al Lundy from pine cones in Orange County, Florida, May 27, 1959 and forwarded for determination by H. V. Weems, Jr. Recently, I received additional material of this species from Florida, which suggests that it is established there. The latter group of specimens, 6 males and 5 females, were collected by D. A. Miller, Plant Quarantine Division, United States Department of Agriculture, July 15, 1963 in Miami, from flowers of *Cereus* sp.

C. fumatus is a member of the *dimidiatus* group. It is listed in the most recent world catalogue of the family (Grouvelle, 1913, Coleoptorum Catalogus *56:* 85) as a variety of *dimidiatus* (Fab.). It closely resembles *C. mutilatus* Er., so may also stand in collections under that name. Hinton (1945, Monograph of Beetles Associated With Stored Products, p. 95) recognized it as distinct from *dimidiatus*. Dobson (1954, Bul. Ent. Res. *45:* 389-402) pointed out distinctive morphological features. A convenient character for distinguishing *fumatus* from others of the *dimidiatus* group was noted by Hinton (loc. cit. p. 96). This is a small but definite swelling, which he terms a gibbosity, on the inner margin of the hind femur close to the trochanter.

Information on the distribution of *fumatus* is limited. Grouvelle, (loc. cit.) listed it only from South Africa. McFarlane, J. A. (1963, Tropical Agriculture, Trinidad *40:* 211-216) reported it from Jamaica, B.W.I., and I have 10 specimens collected by P. M. Schroeder, July 18, 1963, at Sabata, Ethiopia.

The majority of the members of the *dimidiatus* group are stored products pests. Dobson (loc. cit.) was not certain that *fumatus* had such a status and these North American records suggest that it may not be associated with stored materials.

—W. A. CONNELL

A NEW SPECIES OF ALEUROCYBOTUS

(HOMOPTERA: ALEYRODIDAE)

The following description is presented in response to a request for a name for this injurious whitefly. A detailed treatment of the species will appear in my revision of the genus *Aleurocybotus* Quaintance and Baker.

Aleurocybotus occiduus, new species

Habit.—Living on leaves, stems, and spikelets.

Pupa.—Dorsum entirely colorless, yellowish, or brownish, or only subdorsum brownish. Elliptical, 1-1.50 mm long and 0.30-0.50 wide.

Margin and submargin: Marginal crenulations weak, 16-25 in 100 μ; 2-4 mesad of each caudal seta, and a smooth, differentiated area between crenulations and median line. Submarginal ridges weak, extending to subdorsum.

Dorsal disk: Weakly sculptured by depressed lines and roughness. Submedian depressions conspicuous on abdomen, with axes of some longitudinal to median line of body. Vasiform orifice elongate triangular, 60-80 μ long and 48-60 wide; located about 4/5th its width from posterior intersegmental suture and from posterior body margin; rim not defined across anterior end, usually indicated at posterior end by a curved line; bottom extending slightly beyond posterior margin of operculum. Operculum 28-38 μ long and 40-52 wide, posterior margin straight. Cephalic, first abdominal, eighth abdominal, and caudal setae present, and a subdorsal or submarginal pair on abdominal segments 4-8. Disk pores and porettes numerous, at least 1 submedian pair on each body segment except cephalic; 13-15 submarginal pairs in ♂ and 24-34 in ♀.

Ventral surface: Antennae reaching just beyond base of hind legs in ♂ and beyond base of middle legs in ♀.

Third-stage larva.—Submedian depressions moderately defined on abdominal segments 2-7. Vasiform orifice wider in relation to length than in pupa. Disk pores and porettes present.

Second-stage larva.—Vasiform orifice as wide as long. Disk pores and porettes less numerous than in third-stage.

First-stage larva.—Eyespots present. Eighth abdominal setae cephalolaterad of vasiform orifice. Caudal furrow absent. Disk pores and porettes absent.

Adults.—In ♂, antennal segments IV, V, and base of VII subequal in length and each about 5/6th length of VI; VII with each of its 2 filaments about as long as remainder of antenna. In ♀, antennal segments IV and VI subequal in length and about ½ length of V, base of VII about 4/5th length of VI; VII with single filament as long as III-VI combined, and 1 sensory seta (in place of 1 membranous filament of ♂) as long as VI.

Hosts.—Gramineae: *Chloris sp.*, *Cyndon dactylon* (L.) Pers., *Echinochloa crus-galli* (L.) Beauv. or *Paspalum dilatatum* Poir, *Setaria italica* (L.) Beauv., *Sorghum halepense* (L.) Pers., *S. vulgare* Pers., *S. vulgare* Pers. var. *sudanense* (Piper) Stapf, *Zea mays* L., undertermined grass. Cyperaceae: *Cyperus rotundus* L.

Distribution.—Arizona: Gila Valley, Gilbert, North Gadsden, Perryville, Yuma. California: Blythe, Calexico, Coachella Valley, Indio, La Quinta, Riverside, Seeley, Thermal.

Described from hundreds of unmounted and mounted specimens (paratypes, and holotype pupa, in U.S. National Museum Collection) from the above named plants and localities. The holotype is from *Cynodon dactylon*, Coachella Valley, Oct. 2, 1951, L. D. Anderson.—LOUISE M. RUSSELL, *Entomology Research Division, A.R.S., U.S. Department of Agriculture.*

ENALLAGMA WESTFALLI, A NEW DAMSELFLY FROM EASTERN TEXAS, WITH REMARKS ON THE GENUS TELEALLAGMA KENNEDY

(ODONATA: COENAGRIONIDAE)

THOMAS W. DONNELLY, *Dept. of Geology, Rice University, Houston, Texas*

During the spring of 1962 and again in 1963 the writer collected in eastern Texas eleven males, eleven females, and a few nymphs of a remarkable new species of *Enallagma*. This species is most closely related to *E. pallidum* Root 1923 and *E. daeckii* (Calvert) 1903, and its discovery further indicates the close relationship between *E. daeckii* and other species of *Engallagma* which was first discussed by Byers (1927).

Enallagma westfalli n. sp.

Holotype male. Head.—Pale blue, black as follows. medial spot, and lateral basal spots on the labrum; lateral spots on postclypeus; antennae, except for venter of first segment; crescentic medial stripe on frons; dorsum of head, except for large postocular spots, which are not connected to the medial pale stripe posterior to the vertex, and irregular pale T-shaped spot on vertex, extending laterally toward antennae.

Prothorax.—Pale blue with two pairs of black stripes on medial lobe, the dorsal of which extends anteriorly to the fore lobe and posteriorly to the base of the hind lobe, stretching thence to the mid-dorsal carina. Ventral lateral black stripe less prominent. Margin of hind lobe entire.

Pterothorax.—Almost entirely pale blue with very thin black line on mid-dorsal carina; thin black line on antehumeral suture expanded into a small black spot posteriorly; black line posterior to mesostigmal laminae; small dorsal black spot on mesinfrapisternum, and another on antero-dorsal portion of mesepimeron; very thin, short black stripes posteriorly on first and second lateral sutures. Pale brown stripe on mesepisternum adjacent to mid-dorsal carina, grading into a small black spot posteriorly.

Legs.—Pale, black as follows: dark stripes on dorsal surface of femora, expanded apically; thin stripes in tibiae, confined in last two pairs of legs to short proximal internal stripes. Faint suggestion of apical ringing on interior surfaces of hind femora. Black femoral and tibial spines, and tips of tarsal claws black. The holotype male lacks one set of fore tarsi, and has the other set incompletely developed.

Wings.—Venation brown. Fore and hind wings petioled proximal to *ac*; *Rs* arising about 0.2 mm. from M_3 in fore wing and 0.25 mm. in hind wings, forming a narrow, subparallel-sided cell.

Abdomen.—Pale blue, black as follows: antero-dorsal spot and small postero-lateral spots on 1; dorsal stripe expanded posteriorly to maximum width one-quarter from apex of the segment, thence narrowed abruptly apically, on 2; dorsal stripes on posterior nine-tenths of 3 to 6, narrowed anteriorly and expanded posteriorly, narrowing abruptly at apex of segment; dorsal stripe extending entire length of 7, narrowed anteriorly and expanded posteriorly; dorsal stripe on 10 expanded posteriorly to form rounded, T-shaped spot.

Appendages.—Superior appendage black, forked. Superior arm prominent, hooked slightly in dorsal and lateral view. Inferior arm spatulate in dorsal view, extending medially beyond centerline of insect, with a small apical tubercle on dorsal surface. Inferior appendage typical for genus, not distinctly hooked in either view, pale except at tip.

Genitalia. Penis with third segment expanded at tip to form rounded, T-shaped tip. Lateral lobes of third segment prominent, typical for majority of genus.

Variation among paratype males.—The extent of dark color is variable in males of this species. The holotype male represents nearly the maximum extent of dark color on the head (Pl. II, fig. 1), and the paratype figured (Pl. II, fig. 2) is among the palest. Seven paratypes lack the small posterior black spots on the mesepisternum. Only in the holotype and one paratype is the dorsal spot on 10 interrupted anteriorly to form a T-shaped spot, though in another paratype there is a small pale antero-lateral spot included within the black on one side of the segment. Three paratypes have the dorsum of 10 pale; the remainder are totally dark. The origin of *Rs* is highly variable, ranging from about 0.1 to 0.3 mm. from M_3 in fore wings and from 0.2 to 0.6 mm. in hind wings. The petiolation is clearly proximal to *ac* in all but one paratype, which has one wing petioled to *ac* and another very close to *ac*.

Allotype female.—Differs from the male as follows: Dorsum of head paler and very similar to that of palest paratype male (pl. II, fig. 2). Pterothorax pale except for black on and posterior to mesostigmal laminae; very thin black line on mid-dorsal carina, and on posterior portion of antehumeral suture. Segment 8 with dorsal spot on basal third, narrowed posteriorly. Dorsum of 10 pale. Legs with outer edges of femora pale, dividing the black into longitudinal stripes. Hind femora very faintly ringed apically.

Mesostigmal laminae well developed, expanded laterally with prominent ventral margin and excavated anterior surface, with lobate antero-lateral corners. Venter of segment 8 with spine.

Wings as in male, *Rs* 0.25 mm. from M_3 in fore wing and 0.25 mm. in hind wing. Wings not petioled to *ac*.

Variation among paratype females.—Extent of black on dorsum of head variable, though less so than in males, with allotype representing the mean. One female has the black stripe through the median ocellus extending behind the bases of the antennae. Three females have the spot on 8 reduced to the basal quarter, three have a tiny spot extending only one-sixth, and two females have this spot lacking.

Measurements.—Male abdomen 25 to 26 mm. (holotype 25 mm.); hind wing 16 to 16.5 mm. (holotype 16 mm.). Female abdomen 25.5 to 27 mm. (allotype 26 mm.); hind wing 17.5 to 18.5 mm. (allotype 17.5 mm.).

Nymph.—The following notes are based on two mature and two imature exuviae. Because of the poor condition of the material, a complete description will not be given. The nymph differs from all others in the genus by its prominent dorsal tibial dark stripes, which extend the length of each leg. The mental setae number 2-3; the lateral setae 4-5. The dorsum of the head resembles that of *pallidum* and a number of other species in the genus, and has the rear corners more prominent than *daeckii*. The legs, in addition to the tibial stripes, have femoral ante-apical rings. Lateral keels are present on abdominal segments and have a few setae at the tip. The gills are variable, possibly because of varying degrees of regeneration shown. Juvenile specimens have the gills of slender, acuminate shape typical for genus, dark to nodus (about ¾ of length). Mature

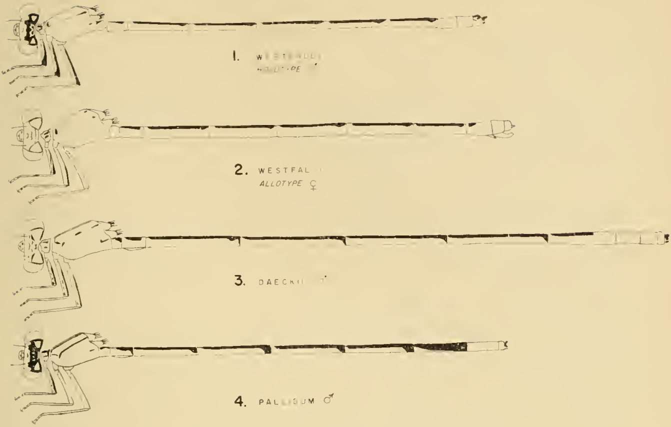

Plate I

Color patterns: fig. 1, *E. westfalli*, holotype male; fig. 2, *E. westfalli*, allotype female; fig. 3, *E. daeckii* (Texas), male; fig. 4, *E. pallidum*, topotype male.

specimens have gills about 6 mm. long, dark to nodus (½ of length), and with a dark band at tip. The gills of *daeckii* are wider, with pigment confined to thin patches along trachea. Those of *pallidum* are similar to *westfalli*, with pigmentation to nodus and small blotches of pigment in apical pale portion.

Related species.—The extremely reduced black coloration, the form of the male appendages, and the form of the penis relate this species to *E. daeckii* and *E. pallidum*. The three species are easily distinguished from one another. The male of *westfalli* has the dorsum of segments 8 and 9 pale, whereas *daeckii* has the apical third of 7 to 10 pale and *pallidum* has 8 to 10 pale. The superior appendage of the males (pl. II, figs. 8-13) are very distinctive; indeed these species display the greatest degree of innovation for North American species in the genus. The mesostigmal laminae of the females (pl. II, figs. 5-7) are analogous to the appendages of the males. Those of *daeckii* are the smallest and those of *westfalli* the largest. The laminae of *pallidum* are intermediate in size, and there are present on the anterior portion of the mesepisternum a pair of small pits, presumably to accommodate the pointed dorsal tips of the male appendages during mating. The female abdominal patterns are less distinctive than those of the male: the apical two-thirds of 8 to 10 is pale in *westfalli* and *pallidum*, but the pale color is restricted to 9 and 10 in *daeckii*. Many *westfalli* have segment 8 nearly entirely pale. The variable head color of *westfalli* makes this character of doubtful value, though I have found no overlap between *daeckii* (the palest), *westfalli*, and *pallidum* (the darkest) (pl. II, figs. 1-4).

In 1920 Kennedy erected the genus *Teleallagma* for Calvert's *Telagrion daeckii*. The new genus was characterized by a pair of subdorsal, apical points widened into small lateral lobes on segment 10, by a very slender abdomen, and by petiolation of the wing to *ac*. Curiously, Kennedy did not comment on the distinctive form of the male penis, of which organ he had made copious and exhaustive investigations in the preceding years in nearly all zygopteran groups. Garman (1927) further noted that in *Teleallagma* the vein Cu_2 terminated proximal to the origin of M_2, whereas in *Enallagma* the termination was at or distal to the origin of this vein.

Root (1923) noted that his new species *pallidum* resembled *daeckii* in general appearance, but he elected to place it in *Enallagma* because of its small size, because of the resemblance of its appendages to those of *E. antennatum* (Say), and because of its general resemblance to *E. traviatum* Selys. Byers (1927) discovered *pallidum* in Florida, and he proposed that it was congeneric with *daeckii* and with other *Enallagma* on the basis of general appearance, size (Florida *pallidum* approach *daeckii* in size), the proximate origin of R_S and M_3 in *pallidum* and *daeckii*, the petiolation of the wings to *ac* in these two species, and the resemblance of the male appendages and the nymphs of *pallidum* and *antennatum*. Byers did not comment on the subdorsal apical lobes on 10, which are better developed in *pallidum* than in *daeckii*. Byers has stood virtually alone in his abandonment of the name *Teleallagma*, but the discovery of *westfalli* supports his views.

The relatively small number of the three species that I have examined have shown that venational characters are variable and of doubtful value for generic criteria. One specimen of *daeckii* before me has all four wings clearly petioled proximal to *ac*, and in three more specimens the petiolation is variable or unclear. In seven *pallidum* before me (including six from Florida) none have the wings petioled to *ac* (*pace* Byers). One *westfalli* has two wings clearly petioled to *ac*. The origin of R_S is variable but in all three species tends to be closer to M_3 than in other *Enallagma*. All of the present specimens of *daeckii* and to topotype of *pallidum* have Cu_2 clearly terminating proximal to M_2.

The penis of *westfalli* (pl. 11, figs. 14, 15) is very similar to that of *traviatum*. A study of the penes of *Enallagma* (Donnelly, 1963) has shown that there is a rather uniform sequence of penis types from *E. praevarum* (Hagen) to *E. traviatum* to *E. westfalli* to *E. pallidum*

Figs. 1-4, dorsum of head: fig. 1, *E. westfalli*, holotype male; fig. 2, *E. westfalli*, paratype male; fig. 3, *E. daeckii* (Texas), male; fig. 4, *E. pallidum*, topotype male. Figs. 5-7, mesostigmal laminae of females (color pattern shown on left side; structure on right): fig. 5, *E. westfalli*, allotype; fig. 6, *E. daeckii* (Texas); fig. 7, *E. pallidum* (Florida). Figs. 8-13, male superior appendages, dorsal and lateral views: figs. 8, 11, *E. westfalli*, holotype; figs. 9, 12, *E. daeckii* (Texas); figs. 10, 13, *E. pallidum*, topotype. Figs. 14-19, penes, medial and lateral views. figs. 14, 15, *E. westfalli*, paratype male; fig. 16, 17, *E. daeckii* (Maryland); figs. 18, 19, *E. pallidum* (Florida).

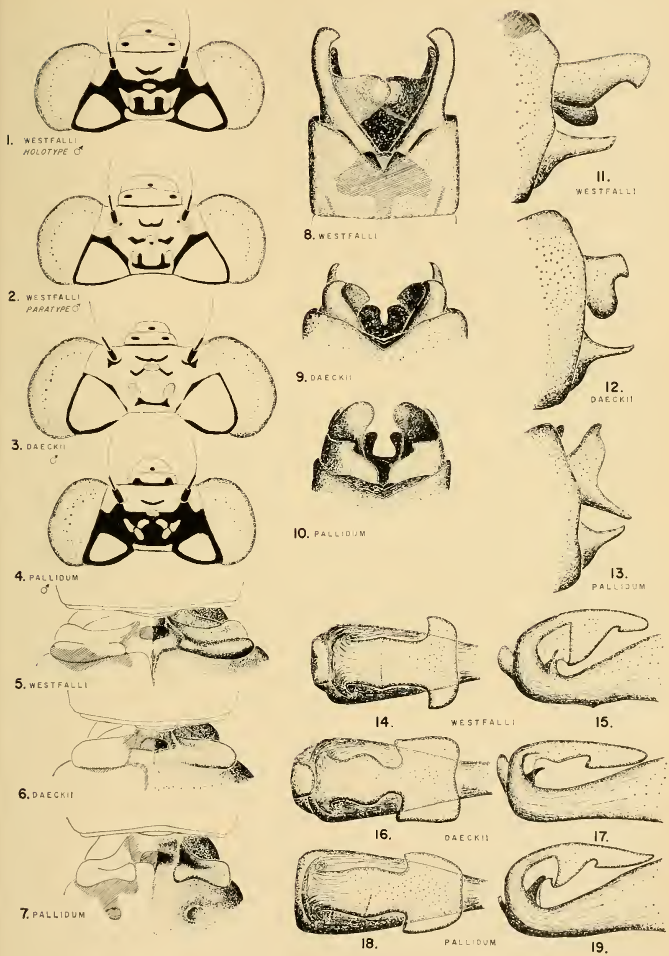
1. WESTFALLI
HOLOTYPE ♂
2. WESTFALLI
PARATYPE ♂
3. DAECKII
♂
4. PALLIDUM
♂
5. WESTFALLI
6. DAECKII
7. PALLIDUM
8. WESTFALLI
9. DAECKII
10. PALLIDUM
11.
WESTFALLI
12.
DAECKII
13.
PALLIDUM
14.
WESTFALLI
15.
16.
DAECKII
17.
18.
PALLIDUM
19.

Plate II

to *E. daeckii.* The sequence is distinguished by decrease in hooking of the terminal lobes of the third segment and by decrease in size of the lateral lobes of this segment. The species *E. anna* Williamson, *E. semicirculare* Selys, and an undescribed species from Guatemala have penes which are very similar to those of *E. praevarum*, and the penis of *E. aspersum* (Hagen) is very similar to that of *E. traviatum*. The sequence of penis types is paralleled by a decrease in dark coloration in the imagoes.

Clearly *westfalli* is congeneric with *traviatum* and equally clearly with *pallidum* and *daeckii*. The *westfalli-pallidum-daeckii* group shows striking innovations in the male appendages, nymph, and coloration, but there is no good criterion to separate these species from the remainder of the species in *Enallagma*. The name *Teleallagma* may be abandoned as a generic name, but it may be used as a subgenus, defined as follows:

Subgenus **Teleallagma** Kennedy 1920

Dark stripes on the pterothorax reduced to very thin lines or wanting; male superior appendages forked, with the inferior arm well developed and extending medially into a subhorizontal position; subdorsal apical lobes present on segment 10; penis with terminal lobes of third segment extended laterally, but not prominently hooked; R_s generally originating proximate to M_3, forming a cell with subparallel sides. Type species: *Telagrion daeckii* Calvert 1903. Other species: *Enallagma pallida* Root 1923, *E. westfalli*, new species.

Material examined.—All specimens of *E. westfalli* were collected at a small pond one-half mile west of Cleveland, Liberty County, Texas. Holotype male: 20 May 1962. Allotype female: 27 May 1962. Paratypes (ten males, ten females) also collected on these dates and on 3 June 1962 and 26 May 1963. A few nymphs collected during April 1963 emerged the first week of May. Additional specimens were seen on 12 May 1963. The holotype and allotype will be deposited in the collection of the University of Florida. Paratypes will be deposited in the collections of the U.S. National Museum and in the Williamson collection in Ann Arbor (University of Michigan Museum of Zoology). The remaining paratypes will be distributed among various collections.

E. daeckii.—Three males and two females, Fruitland, Wicomico Co., Maryland, Coll. T. Donnelly 15 June 1954; two males and two females, Merchants Mill, Gates Co., North Carolina, Coll. G. H. Beatty III, 28 June 1951; two males reared, Power House Dam Lake, Chattahoochee, Florida, Coll. M. Westfall, April 1956 and 1957; one male and female, Splendora, Montgomery Co., Texas, Coll. T. Donnelly, 6 May 1962.

E. Pallidum.—One male (topotype), Fruitland, Wicomico Co., Maryland, Coll. G. H. Beatty III, 4 July 1946; two males reared, Power House Dam Lake, Chattahoochee, Florida, Coll. M. Westfall, April 1955; one male and one female in cop., Nassau Co., Florida, Coll. M. Westfall, 7 June 1940; three females, Seminole Co., Florida, Coll. M. Westfall, 3 May 1941.

Habits.—The new species is remarkable among *Enallagma* for its tendency to fly predominantly in the shade. It is not especially active in the late afternoon (when *E. signatum* (Hagen) is abundant) but is found during the hottest part of the day lurking in shady places along the steep, brush-covered bank of the pond. The pond itself is not especially attractive for Odonata, and only a limited variety of dragonflies, chiefly libellulines and coenagrionines, but including a few cordulines, aeshnines, and gomphines, occur here. The most abundant damselflies are *Argia apicalis* (Say), *Ischnura ramburii* Selys, and *Enallagma exsulans* (Hagen) and *signatum* (Hagen). *Ischnura posita* (Hagen) and *Enallagma basidens* Calvert are less common.

The pond has no unusual physical or biological characteristics. The sides are steep, and emergent vegetation is sparse. Though the water was always very muddy, there was no particular reason to suspect pollution.

Acknowledgment.—I am grateful to Dr. Minter Westfall for the loan of some specimens and the gift of others used in this study. My dedication of this species to Prof. Westfall is but a small tribute to his position among workers in this order, and but insufficient recompense for many kind favors extended me over many years.

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TWO NEW ERYTHRAEIDS PREDACEOUS UPON COTTON BOLLWORM EGGS

(Acarina: Erythraeidae)

During the past few years, mites of the family Erythraeidae have been observed to be of some importance in biological control. These mites are known to be parasitic in their larval stage and predaceous in their nymphal and adult stages upon small arthropods. Recently, two undescribed species of erythraeids were found feeding upon the eggs of the cotton bollworm, *Heliothis zea* (Boddie), in Arkansas. Since names are needed for these two mites, a brief description of each is here given. A detailed description with figures will be published later.

Balaustium dowelli, new species

This species closely resembles *Balaustium aonidiphagus* (Ebeling), but the shape and setal pattern of the crista metopica will separate the two. It is distinctive in having a long slender crista metopica with two pairs of sensory setae, the posterior pair being about one-third longer than the anterior pair; in having two pairs of subequal ciliated setae adjacent to the crista metopica which are about equal in length to the posterior sensory setae; and in having ciliated dorsal body setae. The body, excluding the gnathosoma, is 1066 μ long.

Holotype. Female, U.S. National Museum No. 3036, taken on cotton, Conway County, Arkansas, July 26, 1963 by W. H. Whitcomb.

Paratypes. Nine females with the above data.

This species is named for Grover C. Dowell, Department of Agriculture and Home Economics, University of Arkansas, Little Rock, Arkansas.

Erythraeus whitcombi, new species

This species is distinctive in having a long, slender crista metopica, the anterior portion being round and with three pairs of ciliated setae, and the posterior portion having two sensilliae but no setae. Most of the dorsal body setae are short and simple, and scattered among these are a few serrate setae which are much longer and stronger. The anal setae are minute and simple. The body, excluding the gnathosoma, is 1866 μ long.

Holotype. Female, U.S. National Museum No. 3037, collected from cotton, Conway County, Arkansas, July 26, 1963 by W. H. Whitcomb.

Paratypes. Seven females with the above data.

This species is named for W. H. Whitcomb of the Department of Entomology, University of Arkansas, Fayetteville, Arkansas.

—Robert L. Smiley, *Entomology Research Division, A.R.S., U.S. Department of Agriculture, Washington, D. C.*

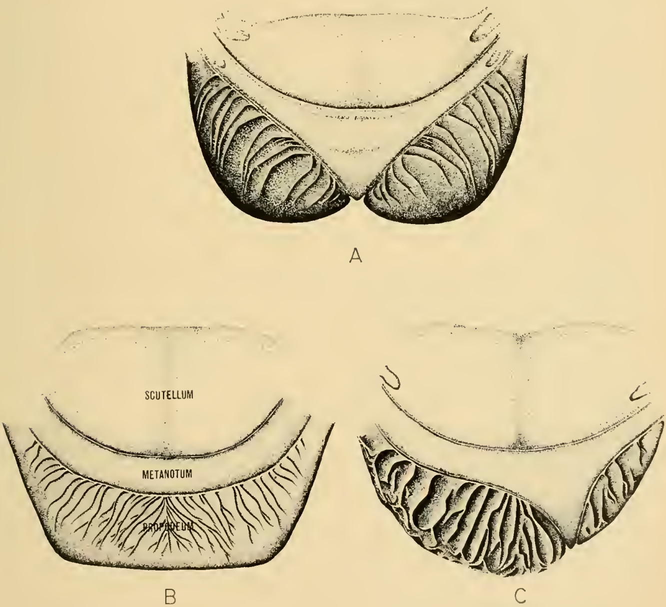
METANOTAL ANOMALIES IN SWEAT BEES[1]

(HYMENOPTERA: HALICTIDAE)

G. KNERER and C. E. ATWOOD[2]

This note reports rare instances of morphological aberrations in the metanota of halictine bees belonging to the genus *Dialictus*.

Anomalies of gross characters in bees have been studied for some time, especially by Enderlein (1913), Mitchell (1929) and Michener (1943). These writers reported sex anomalies and intersexes from a large variety of genera but true gynandromorphs appear to be rather rare. Salt (1927) surveyed the extensive changes caused by strepsipterous endoparasitism while Rodeck (1943) and Sivik (1962) described isolated instances of antennal anomalies. Most reported



A, Regular metanotal anomaly in a female of an undescribed *Dialictus* sp.; B, Scutellum, metanotum and propodeum of a normal bee, *Dialictus imitatus* (Sm); C, Asymmetric metanotal anomaly in a male *Dialictus lineatulus* (Crawford).

[1]The research on which this study is based was supported by a grant from the National Research Council, Ottawa, Canada.

[2]University of Toronto, Toronto, Ontario.

aberrations deal with changes in mandibles, antennae, abdominal shape and pubescence, especially in the pollen collecting organs.

The discovery of the female of an apparently undescribed species of *Dialictus* with a metanotal anomaly (fig. A) was therefore of some interest to the authors. The bee was collected in Haliburton Co., Ontario in the summer of 1961 and did not exhibit any other irregularities apart from the extended metanotum and the bisected propodeum (the first embryonic abdominal segment). Despite regular collecting at the same location in the following year, no further specimens resembling this species were obtained. Although the implication of some morphological aberration was always present, the possibility of a previously unknown feature could not be excluded *a priori*, especially in view of its regularity. Additional information became available last year when two more bees with similar anomalies were discovered in the collection of Dr. R. A. Morse, Cornell University, when part of this material was determined by the authors. Both specimens, one a female and the other a male (fig. C) were identified as *Dialictus lineatulus* (Crawford). The asymmetry of the metanotal extension clearly indicates the abnormal nature of the character under study.

Nothing is known, as yet, concerning the causes of such anomalies. Their incidence is low since only three specimens, out of a total of more than 25,000 halictine bees examined by the authors exhibited this feature.

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STUDIES OF THE GYPONINAE, THE GENUS DRAGONANA BALL AND REEVES[1]

(Homoptera: Cicadellidae)

Dwight M. DeLong and Paul H. Freytag, *Department of Zoology and Entomology, The Ohio State University, Columbus 10*

The genus *Dragonana* was described by Ball and Reeves in 1927. At that time and up to the present only one species, *dracontea* (Gibson), was known. The present study is an attempt to bring up to date our knowledge of the species of this genus.

Dragonana contains small, dark leafhoppers. Head, pronotum, scutellum, and forewings pitted, each pit usually bearing a fine seta. Head narrower than pronotum; anterior margin foliaceous; crown with surface obscurely striate. Pronotum broad, transversely striate. Forewings with appendix small, venation weak with irregular reticulations on apical portion. Hind tibia without outer secondary setae. Male aedeagus simple, without basal processes.

The species of this genus are known only from Mexico and the Southwestern part of the United States.

Key to Species

1. Female seventh sternum with a slightly produced posterior margin (fig. 41). Male styles broadened near apex, then deeply notched, forming a long diagonally produced apical spur (fig. 26) .... **chelata**, sp. n.
   Female seventh sternum with posterior margin excavated bearing a median sunken tooth (in all following species). Male styles not notched near apex 2
2. Male pygofer simple, without an apical extension, spines near apex (fig. 34). Aedeagus a simple shaft without apical processes. Male plate without spines on surface but clothed with fine hairs (fig. 28) .... **dracontea** (Gibson)
   Male pygofer with apical extension, at the base of which is a transverse ridge set with a row of spines (fig. 35). Male plates bearing spines on at least the apical half of surface (fig. 29) 3
3. Male aedeagus a simple shaft without terminal processes (fig. 7) .... **comata**, sp. n.
   Male aedeagus with terminal processes 4
4. Male plates with surface entirely covered with short spines (fig. 31). Male aedeagus short, broad, widened at apex (ventral view) with a curved spine arising at apex, on each side, curved basad and inwardly to aedeagal shaft, extending one-third the distance to base (fig. 10) .... **cillia**, sp. n.
   Male plates with short spines on apical half only. Male aedeagus long, not widened at apex, or with shorter terminal processes 5
5. Terminal processes of male aedeagus very short, less than one-eighth the length of shaft (fig. 12). Male styles broad at base (fig. 25) .... **crinita**, sp. n.

[1]This work was supported by the National Science Foundation. (Grant NSF-G 9803.)

Terminal processes of male aedeagus longer, about one-fourth the length of shaft (fig. 8). Male styles narrowed and pointed at base (fig. 21) .... **horrida**, sp. n.

Dragonana dracontea (Gibson)

(Figs. 1-5, 16, 17, 28, 34, 40)

Gypona dracontea Gibson, 1919, p. 100.

Dragonana dracontea Ball and Reeves, 1927, p. 489.

A small, short headed species tawny to brown in color. Length: male 6 mm., female 6.5 mm.

Crown rather broadly, roundedly produced, more than twice as wide between eyes at base than median length.

Color: Head with face tawny, heavily irrorate with red; crown pale, heavily marked with reddish punctate spots. Pronotum yellow to tawny, anterior margin often appearing reddish. Scutellum pale, basal angles darker, central portion marked with many reddish punctate spots. Forewings heavily punctate, white with reddish coloration on basal two-thirds, claval area mostly white.

Genitalia: Female seventh sternum with strongly produced lateral angles between which posterior margin convexly emarginate either side forming a small notch on each side of a broad, slightly produced, median tooth which is slightly notched at center (fig. 40). Male plates about three times as long as median width (fig. 28). Styles, in lateral view, broadened at middle, narrowed at both ends, apex slender and curved dorsally forming a long, sharply pointed apical terminal process (fig. 17). Aedeagus rather short, simple, apical half cleft forming two sharp tips (fig. 4). Pygofer tapered to a bluntly pointed apex (fig. 34).

This species is known only from Arizona.

Dragonana comata, sp. n.

(Figs. 6, 7, 18, 19, 29, 35)

In form and general appearance resembling *dracontea* but larger and with distinct male genitalia. Length: male 7 mm., female 7.5 mm.

Crown short, broadly rounded, depressed, more than twice as wide between eyes as median length.

Color: Crown, face, pronotum, and scutellum tawny, rather thickly covered with minute red punctate spots. Forewings dark brown, veins conspicuous.

Genitalia: Female seventh sternum with posterior margin almost straight, notched either side of a median sunken tooth which reaches to the length of the posterior margin. Male plates about four times as long as broad, apex rounded (fig. 29). Styles elongate, with apical fourth tapered, forming a slender apical portion which curves dorsally caudad about one-fifth length of style (fig. 19). Aedeagus short, simple, tubular, with a long V-shaped opening on apical half (fig. 6). Pygofer with a large caudal portion (fig. 35), as in some *Gypona* spp.

Holotype male: Mexico City, D. F., S in Canyon, 10-20-45, DeLong. Allotype female: Mexico City, D. F., 5-5-44, Plummer. Paratypes: 2 males, 1 female, Mexico City, D. F., 5-5-44; 2 males, Puebla Rd., Mexico City, 5-13-38, W. E. Stone; 1 male, 2 females, Real de Arriba, Temescaltepec, Mexico, 7-13-33, Hinton and Usinger. Holotype and allotype in the DeLong Collection. Paratypes in the DeLong Collection and the California Academy of Science Collection.

Dragonana horrida, sp. n.

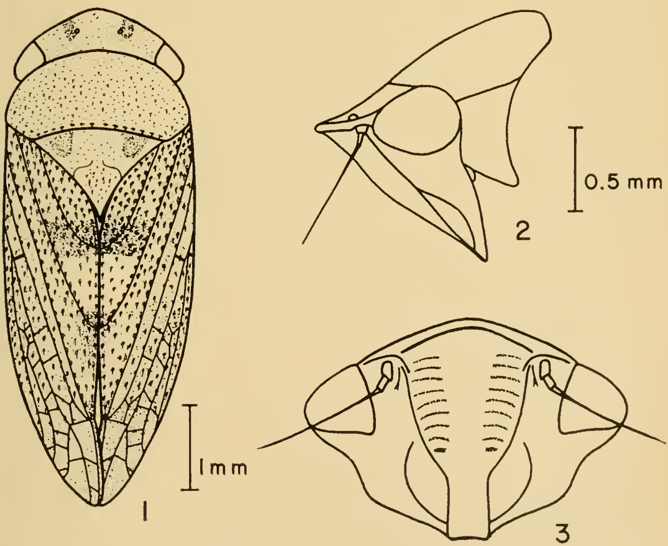
(Figs. 8, 9, 20, 21, 30, 36)

In form and general appearance resembling *dracontea* but with head a little longer and with distinct male genital structures. Length: male 6.5 mm., female 7 mm.

Crown broadly rounded, about twice as broad between eyes at base as median length.

Color: Face dark brown; crown, pronotum, and scutellum tawny, thickly covered with minute red speckled spots. Forewings dark brown, darker on basal half.

Genitalia: Female seventh sternum with posterior margin appearing truncate, deeply notched either side of a median tooth which is produced to length of margin. Male plates parallel sided, about four times as long as wide (fig. 30). Styles long, curved, in lateral view, appearing almost equal in width throughout to apex which is abruptly narrowed forming a very narrow, long, hair-like process (fig. 21). Aedeagus simple, rather broad, bearing a pair of processes at apex



DRACONTEA

Dragonana dracontea (Gibson). Fig. 1, Dorsal view of male; Fig. 2, Lateral view of head and pronotum; Fig. 3, Face. (scale same as fig. 2).

which extend basally on each side almost one-third length of shaft (fig. 8). Pygofer with a rather large caudal portion which is tapered toward apex and bluntly pointed (fig. 36).

Holotype male: Guadalajara Rd., Mexico, Km-118, 6-20-43. Allotype female: same data as holotype. Paratypes: 4 females, same locality and date; 1 male, Zitacuaro, Michoacan, Mexico, Km-160, 9-29-41, DeLong, Good, Caldwell, and Plummer. All type material in the DeLong Collection.

Dragonana cillcia, sp. n.

(Figs. 10, 11, 22, 23, 31, 37)

Resembling *comata* in form and appearance but with distinct male genital structures. Length: male 6.5 mm., female 7 mm.

Crown short and broadly rounded, more than twice as wide between eyes at base as median length. Forewings with short bristles.

Color: Face tawny marked with red. Crown, pronotum, and scutellum tawny, marked with reddish punctate spots. Forewings brown marked with reddish spots. Female more intensely marked with red than male.

Genitalia: Female seventh sternum with posterior margin almost straight, notched either side of a small, sunken median tooth which extends to length of posterior margin. Male plates long and narrow, about three and one-half times as long as broad at middle, entirely clothed with bristles (fig. 31). Styles, in lateral view, curved, then recurved near apex which is narrowed, forming a long, curved, slender, apical spur which is directed dorsally (fig. 23). Aedeagus tubular, apex broadened and appearing cleft in ventral view, a pair of lateral processes arising at apex and curving toward base extending about one-fourth length of shaft (fig. 10). Pygofer with apex tapered and bluntly pointed (fig. 37).

Holotype male: Jalapa Rd., Veracruz, Mexico, Km-241, 10-13-45, Shaw, DeLong, and Hershberger. Allotype female: same data as holotype. Both types are in the DeLong Collection.

Dragonana crinita, sp. n.

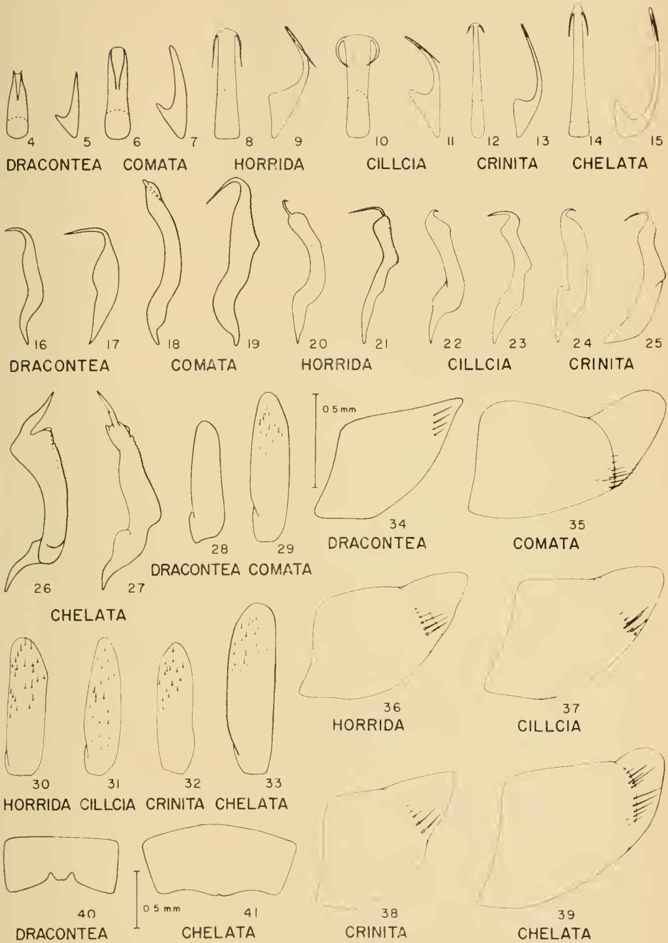
(Figs. 12, 13, 24, 25, 32, 38)

Resembling *dracontea* in form and appearance, but with distinct male genital characters. Length: male 6 mm., female 7 mm.

Crown short and broadly rounded, more than twice as wide between eyes at base as median length.

Color: Crown, pronotum, and scutellum tawny to pale brown marked with a few reddish punctate spots. Face pale brown. Forewings pale brown with reddish and dark brown punctate spots.

Genitalia: Female seventh sternum almost straight to median third which is notched either side of a sunken, median tooth which is produced to the posterior margin. Male plates about three times as long as broad, apical half clothed with short bristles (fig. 32). Styles, in lateral view, almost parallel margined to near apex which is constricted to form a narrow, elongate apical spur which curves dorsally (fig. 25). Aedeagus long, narrow, tapered to apex from which two very short processes arise, each about one-ninth the length of shaft (fig. 12). Pygofer with caudal portion tapered to form a bluntly pointed apex (fig. 38).



Figs. 4-15, Aedeagi. Figs. 16-27, Styles. Even numbers refer to ventral views, odd numbers to lateral views. Figs. 28-33, ventral views of plate. Figs. 34-39, lateral views of pygofer (male structures drawn to same scale). Figs. 40-41, female seventh sterna (both to same scale).

Holotype male: Carapan, Michoacan, Mexico, 10-2-41, Km 432, DeLong, Good, Caldwell, and Plummer. Allotype female: same data as holotype. Paratypes: 1 male, 3 females, same data as holotype. All type specimens in the DeLong Collection.

Dragonana chelata, sp. n.

(Figs. 14, 15, 26, 27, 33, 39, 41)

Resembling *comata* in form and appearance, but paler in color and with different male genital structures. Length: male 7.5 mm., female 8 mm.

Crown short and broadly rounded, more than twice as wide between eyes at base as median length.

Color: Face pale yellow. Crown, pronotum, and scutellum tawny marked with reddish punctate spots; disc and posterior portion of pronotum darker. Forewings tawny subhyaline with reddish punctate spots.

Genitalia: Female seventh sternum almost truncate, slightly excavated either side of median third which is slightly produced and notched at middle (fig. 41). Male plates about three and one-half times as long as median width, apex broad and rounded, apical third clothed with stout bristles (fig. 33). Styles, in lateral view, broadened before apex, deeply notched on ventral side to form a long, tapered, apical fourth which is sharp pointed at apex, resembling a chela claw (fig. 26). Aedeagus long, slender, tapering to apex where a pair of very short, slender, lateral processes arise which are about one-fifth length of shaft and directed basally (fig. 14). Pygofer with apical portion comparatively short, narrowed, and blunt at apex (fig. 39).

Holotype male: Jalapa Rd., Veracruz, Mexico, Km-241, 10-13-45, Shaw, DeLong, and Hershberger. Allotype female: Rio Frio, D. F., Mexico, October 18, 1941, DeLong, Good, Caldwell, and Plummer. Both types are in the DeLong Collection.

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THE SYNONYMY OF CULICOIDES HISTRIO JOHANNSEN

(DIPTERA: CERATOPOGONIDAE)

Johannsen described *Culicoides histrio* as a variety of *guttifer* Meijere from Guam, and figured the male paramere. Tokunaga and Murachi, in their comprehensive work on Micronesian Ceratopogonidae, described Palau and Truk Islands material under the name *guttifer* and compared their material with Johannsen's description of the variety *histrio*. Their figures differ in some respects from Asian material of *guttifer* which I have been studying, and a closer comparison seemed desirable. Through the courtesy of Dr. L. L. Pechuman, I borrowed the holotype male, allotype, and three female paratypes of *histrio* from the Cornell University collection, and made slide mounts of two female paratypes. From the study of this material it is evident that *histrio* is distinct from *guttifer*, and is identical with *mackayensis* Lee and Reye. The complete synonymy is as follows:

Culicoides histrio Johannsen

Culicoides guttifer Meijere, var. *histrio* Johannsen, 1946, B. P. Bishop Mus. Bull. 189: 190 (Guam; fig. male paramere).

Culicoides guttifer (misident., not Meijere), Tokunaga and Murachi, 1959, Insects of Micronesia 12: 327 (Palau, Truk; fig. wing, spermatheca, male genitalia).

Culicoides mackayensis Lee and Reye, 1953, Proc. Linn. Soc. N. S. Wales 77: 383 (Queensland; fig. eyes, antenna, palpus, wing, spermatheca); Tokunaga, 1962, Pacific Insects 4: 470 (New Ireland). **NEW SYNONYMY.**

The known distribution of *histrio*, based on the literature and on material in the U.S. National Museum, is Guam, Truk, Palau, New Ireland, Queensland, New South Wales, North Borneo, Thailand, Malaya, and Ceylon.

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LOCALITY RECORDS AND A HOST PLANT FOR THE STINKBUG EDESSA FLORIDA BARBER[1]

(HEMIPTERA: PENTATOMIDAE)

In 1935 H. G. Barber published in our Proceedings (Vol. 37: 48) a description of *Edessa florida* stating it is very close to *bifida* Say. *Bifida* has punctures on the ventral surface, *florida* does not. Only one locality was given for the new species: Paradise Key, which is approximately 10 miles SW of Homestead, Florida.

Four years later nearly fifty specimens of *florida* were collected on St. George's Island, Maryland, near the mouth of the Potomac, and deposited in the U.S. National Museum. A number of bugs were taken May 14 "In house" by C. F. Hartung. More were taken May 21

[1]Miscellaneous Publication No. 497, Contribution No. 3529 of the Maryland Agricultural Experiment Station, Department of Entomology.

and still more in October by H. G. Barber; these bear the label "On *Convolvulus sepium*". The Museum has additional specimens from Louisiana, South Carolina, North Carolina and Virginia.

September 4, 1960 and September 1, 1963, I found adults and young of this stinkbug on the same plant species, commonly known as hedge bindweed, at Lexington Park, St. Mary's County. The plant clings to marsh grasses growing a few feet inland from the shore of the Chesapeake Bay.

Further collections have shown the insect to be a household nuisance in tidewater areas. In October 1957, just after a heavy storm, a hundred or more bugs were seen on porch screens of a waterfront home at Lottsburg, Virginia, near the shore of the Potomac. In February, 1961 specimens were received from a home in East Newmarket, Dorchester County and in October, 1962, from homes at Deale, Anne Arundel County, Maryland.

—THEO L. BISSELL, *University of Maryland, College Park.*

BOOK REVIEW

Guide to the Insects of Connecticut. Part VI. The Diptera or true flies of Connecticut. Eighth fascicle. Scatopsidae and Hyperoscelidae by Edwin F. Cook; Blepharoceridae and Deuterophlebiidae by Charles P. Alexander; and Dixidae by Wesley R. Nowell. State Geological and Natural History Survey of Connecticut Bulletin No. 93, 115 pp., 20 pls., June, 1963.

This, the latest portion of the important and lasting series "Guide to the Insects of Connecticut," is intended to be the penultimate fascicle concerning the Diptera Nematocera. The information is presented following the usual format of the series.

Each of the five families included in this fascicle contains an excellent account of general morphology and taxonomic characters, and where possible, a good discussion of the biology and immature stages; also included are short sections concerning the techniques for collection and study, some ecological and descriptive notes on the various taxa (the four blepharocerid species covered are described in detail and include a new species), and a selected bibliography of each family. Keys to the species of the Northeastern region (defined as "Virginia to Labrador, westward to the Great Plains"), and also keys to all North American genera and to the higher taxa of the World, are included for each family. All families are amply and well illustrated.

In general, this work is an excellent reference for the beginning student and a helpful guide for collectors and for more established workers in the five families involved. For it is a good upto-date resumé of the available knowledge of these groups of Diptera with information required for their study, together with modern comprehensive keys and illustrations for the determination of North American genera and northeastern species.—JACK R. COULSON, *Entomology Research Division, A.R.S., U. S. Department of Agriculture, Beltsville, Md.*

PRICE GODMAN PIQUETT

1908-1963

Price G. Piquett, 55, U. S. Department of Agriculture, Entomologist and member of the Entomological Society of Washington, died July 2, 1963, at a nursing home in Catonsville, Md. "Piq," as he was known to his friends, had been ill during the last year and had a malignant tumor removed in November 1962. "Piq" was a native Baltimorean, born May 5, 1908. He attended public school in Baltimore, as well as the Massanutten Military Academy, Woodstock, Va. He majored in entomology at the U. of Maryland where he graduated in 1937. He also did graduate work there in later years. He worked in Baltimore from 1937 to 1942 under the State plant quarantine program. In January 1942 he joined the Division of Control Investigations of the Federal Bureau of Entomology and Plant Quarantine located at the Agricultural Research Center, Beltsville, Md. He remained throughout his career with this group which eventually became part of the present Pesticide Chemicals Research Branch of the Entomology Research Division. His work was mostly concerned with the evaluation of new insecticidal materials which involved testing and rearing of the insects.

He was the author or co-author of more than 60 scientific papers on entomology. He was a member of the Insecticide Society of Washington, serving as secretary-treasurer in 1946, the Entomological Society of Washington, serving as treasurer in 1959-1961; the Entomological Society of America; the American Institute of Biological Sciences; and the A.A.A.S.

"Piq" was musically inclined all of his life. He was a past president of the Optimist Club of Ellicott City, Md. He is survived by his wife, the former Marie Naomi Brown, whom he married on July 27, 1940.

JOHN H. FALES

SUMMARY REPORTS OF SOCIETY OFFICERS FOR 1963

CORRESPONDING SECRETARY

(For the fiscal year 1 November 1962 to 31 October 1963)

Membership on 1 November 1962		493
Reductions:		
Resigned	7	
Dropped	26	
Deceased	5	
Total	38	
Increases:		
Elected to membership	23	
Reinstated	3	
Total	26	
Net loss in membership	12	
Membership on 31 October 1963		481
Classes of Membership:		
Dues paying	455	
Life	5	
Retired	18	
Honorary	3	
Total	481	

The membership is distributed among 45 states, the District of Columbia, 2 territories, and 19 foreign countries.

Circulation of the Proceedings (September 1963 issue):		
States	478	
District of Columbia	80	
U. S. Possessions	9	
Foreign Countries	159	
Total		726
Distribution of the Proceedings (September 1963 issue):		
To members	463	
To subscribers	263	
Total		726

The *Proceedings* goes to members and subscribers in 50 states, the District of Columbia, 2 Territories and 50 foreign countries.

Respectfully submitted, PAUL J. SPANGLER, *Corresponding Secretary.*

TREASURER

(For the period 1 November 1962 to 31 October 1963)

	General Fund	Publication Fund	Total
Cash on Hand November 1, 1962	$ 942.38	$8,228.36	$ 9,170.74
Receipts November 1, 1962 to October 31, 1963	5,150.07	491.49	5,641.56
Totals	6,092.45	8,719.85	14,812.30
Expenditures November 1, 1962 to October 31, 1963	5,655.47	None	5,655.47
Cash on Hand October 31, 1963	436.98	8,719.85	9,156.83
Totals	$6,092.45	$8,719.85	$14,812.30

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

Respectfully submitted, C. C. BLICKENSTAFF, *Treasurer.*

CUSTODIAN

(For the period 1 November 1962 to 31 October 1963)

The value of items sold by the Custodian's office amounted to $180.65. Of these items, $132.30 was for 19 copies of the *Memoirs*, $2.00 for 1 copy of the Weld volume, $45.85 for miscellaneous volumes and numbers of the *Proceedings*, and $0.50 for miscellaneous reprints.

Sales of the *Memoirs* were as follows: No. 3, 3 copies; No. 4, 11 copies; No. 5, 5 copies.

A copy of the complete, detailed report is on file with the Recording Secretary.

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

EDITOR

(For the calendar year, 1963)

Four numbers of the *Proceedings* were published in 1963. Of the 316 pages published, 6 were devoted to advertising and 310 to scientific papers, notes, obituaries, book reviews, minutes of meetings and announcements. Fifty-one scientific papers and notes were published during the year. The Society and the *Proceedings* benefited measurably from 5 paid papers totaling almost 60 pages. None of these caused the articles of regular contributors to be postponed.

Respectfully submitted, JON L. HERRING, *Editor.*

SOCIETY MEETINGS

720th Regular Meeting, November 7, 1963

The 720th meeting of the Society was called to order by the President, Dr. W. E. Bickley, on November 7, 1963, at 8 p.m. in room 43 of the U. S. National Museum. Thirty-four members and eighteen guests were in attendance. Minutes of the previous meeting were accepted.

R. B. Eads was accepted to membership. Four candidates to membership were announced: *H. Iran Rainwater, John Thomas Polhemus, Robert L. Smiley,* and *Burruss McDaniel, Jr.*

R. A. St. George, chairman of the nominating committee, presented the following slate of nominees for the coming year: President, Ross H. Arnett, Jr., President-elect, Paul A. Woke, Recording secretary, W. Donald Duckworth, Corresponding secretary, Paul J. Spangler (assisted by Donald M. Anderson), Treasurer, Carl C. Blickenstaff, Custodian, Herbert J. Conkle (assisted by Robert L. Smiley), Editor, Jon Herring, Chairman, Program Committee, Roy J. Barker, Chairman, Membership Committee, George E. Cantwell.

Mrs. Snodgrass announced the last publication of Dr. Snodgrass, *Some mysteries of life and existence*, printed in the Smithsonian Annual Report for 1962.

W. E. Bickley said that the University of Maryland had made tape recordings of Dr. Snodgrass's last three lectures, and that these could be borrowed.

George Steyskal reviewed another of Dr. Snodgrasss' later publications, *A contribution toward an encyclopedia of insect anatomy,* which was published in the Smithsonian Misc. Collections. This is a series of essays on various phases of insect anatomy.

T. J. Spilman favorably reviewed a new book, *Classification of the Animal Kingdom,* by Richard E. Blackwelder. This handy book contains a simplified list of phyla, classes, and orders, as well as a complete list of these groups, both living and fossil, with all their synonyms.

F. L. Campbell announced that the next meeting of the Washington Academy of Sciences on November 21 will hear a talk by Dr. Wallen on the international Indian Ocean survey.

It was announced that the December meeting will be held on the 12th at Symons Hall, University of Maryland.

Dr. Jacobus van der Vecht from the Leiden Museum, The Netherlands, gave the evening's talk on "Form and Function in Fig Insects." In this very interesting illustrated lecture he discussed the relationship between the insects and the hosts, the morphological adaptations of both, and some of the influences of the parasites on the insect-host plant complex.

Oliver S. Flint, Jr., *Recording Secretary*

721st Regular Meeting, December 12, 1963

The 721st meeting of the Society was called to order by the President, Dr. W. E. Bickley, on December 12, 1963 at 8 p.m. in the auditorium of Symons Hall, University of Maryland. Thirty-eight members and twenty-three guests were in attendance. Minutes of the previous meeting were accepted as read.

Robert Yamamoto was announced as candidate to membership. *H. Iran Rainwater, John Thomas Polhemus, Robert L. Smiley,* and *Burruss McDaniel, Jr.* were accepted to membership.

A film on Japanese Equine Encephalitis showing its experimental transmission to horses was shown.

R. I. Sailer showed slides of some of the activities of the European Parasite Laboratory, Entomology Research Division, USDA, near Paris, France.

The first speaker for the evening, Dr. Kenneth D. Quarterman, reported on the research projects of the various branches of the U. S. Public Health Service. The second speaker of the evening, Dr. William M. Upholt, discussed the size and scope of the contract research and grants made by the Public Health Service, citing the various granting agencies, their emphasis and differences.

After the introduction of visitors the gavel was turned over to the new president, who adjourned the meeting at 10 p.m. After the meeting, coffee and doughnuts were served by the faculty and wives of the Entomology Department of the University of Maryland.—Oliver S. Flint, Jr., *Recording Secretary*

722nd Regular Meeting, January 2, 1964

The 722nd meeting of the Society was called to order by the President, Dr. Ross H. Arnett, Jr., on January 2, 1964 at 8:00 p.m. in Room 43, U.S. National Museum. Minutes of the previous meeting were accepted as read.

There were no committee reports.

President Arnett noted the need for increased attendance at the Society's meetings and toward that end encouraged each one present to attend the February meeting and bring two persons with them.

The first speaker for the evening, Dr. Richard H. Foote, gave an illustrated report on the entomological activities in Egypt. The second speaker for the evening, Col. Frank G. Favorite, gave a thought provoking discussion of Information Centers and the problem of storage and retrieval of biological literature. Special emphasis was given semi-automated, non-conventional systems such as is presently in use at the Armed Forces Pest Control Board.

A. B. Gurney noted the death of Dr. William A. Riley (January 10, 1876-October 2, 1963), former Head of Entomology and Economic Zoology, University of Minnesota. Born in Mankato, Minnesota, and long associated with Cornell University until assumption of teaching at Minnesota in 1918, Dr. Riley was widely respected as a teacher whose own specialties were Medical Entomology and Parasitology.

After the introduction of visitors, the meeting was adjourned at 10:00 p.m.—W. Donald Duckworth, *Recording Secretary*

723rd Regular Meeting, February 6, 1964

The 723rd meeting of the Society was called to order by the President, Dr. Ross H. Arnett, Jr., on February 6, 1964 at 8:00 p.m. in Room 43, U.S. National Museum. Forty-three members and eighteen guests were in attendance. Minutes of the previous meeting were accepted as read.

Robert T. Yamamoto was accepted for membership. Two candidates for membership were announced: *Philip A. Hubert, Jr.* of Bellport, Long Island, New York and *Robert M. Altman* of the Preventive Medicine Division, Office of the Surgeon General.

The first speaker for the evening, Dr. William E. Bickley, in the presidential address, discussed a number of axioms of interest to entomologists and their status in light of present day knowledge. The second speaker for the evening, Dr. Jean Adams, discussed the use of electron microscopy in entomological research, emphasizing both the advantages and disadvantages.

K. V. Krombein noted the death of Dr. Henry S. Fuller, a member of the Society, who for the past ten years was chief of the Departments of Entomology and Rikettsial Diseases at the Walter Reed Army Institute of Research. President Arnett assigned Dr. Krombein and Dr. Baker to prepare an obituary for publication in the Proceedings.

C. C. Blickenstaff exhibited a large termite queen chamber constructed of mud which he collected while on a trip to West Africa. Color slides of the area and nest were also shown.

Bagworms, *Thyridopteryx ephemeraeformis* (Haworth), which had recently hatched in the office from bags collected in November, were shown by T. L. Bissell. The larvae moved across a cabinet top toward a window and up some vials. There they gnawed appreciably on the corks and constructed bags of the material. Later hatching larvae climbed an 8 inch glass jar, which had replaced the vials, apparently seeking a high point in the light. In Maryland the first bagworms hatch in the field in June.

F. L. Campbell noted that Dr. Thomas E. Snyder was celebrating his seventy-ninth birthday and extended the Society's congratulations. Dr. Campbell also distributed literature concerning the International Biological Program being planned by the International Council of Scientific Unions.

C. W. Sabrosky noted the receipt of two larvae of a stomach bot from a white rhinoceros in the Oklahoma City Zoo.

President Arnett noted the complete membership list prepared by Dr. Bickley and read a list of the members who have belonged to the Society fifty years or more.

After the introduction of visitors, the meeting was adjourned at 9:45 p.m.—W. DONALD DUCKWORTH, *Recording Secretary*

PUBLICATION DATE

The date of publication of Vol. 66, No. 1 was March 5, 1964. The date of publication of Vol. 66, No. 2 will be found in Vol. 66, No. 3.

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PROCEEDINGS
of the
ENTOMOLOGICAL SOCIETY of WASHINGTON

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON
· 1884 ·

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

PUBLISHED QUARTERLY

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THE
ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884

MEETINGS

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

MEMBERSHIP

Members shall be persons who have demonstrated interest in the science of entomology. Annual dues for members are $5.00; initiation fee is $1.00 (U. S. currency).

PROCEEDINGS

Published quarterly beginning with March by the Society at Washington, D. C. Members in good standing are entitled to the *Proceedings* free of charge. Non-member subscriptions are $6.00 per year, both domestic and foreign (U. S. currency), payable in advance. All remittances should be made payable to *The Entomological Society of Washington*.

The Society does not exchange its publications for those of other societies.

All manuscripts intended for publication should be addressed to the Editor. Acceptable papers submitted by members only will be published in the order received. Immediate publication may be obtained at a cost to the author of about $15.00 per printed page, plus cost of *all* engraving. Titles of papers should be concise but comprehensive and should indicate the systematic position of the subject insect. By-lines should indicate present mailing address of the author and his organizational affiliation, if possible. Citations in the text of papers longer than one printed page should be by author and date and should refer to a list of concluding references in which author, year, title, name of publication, volume and page are given in that order. In shorter articles, references to literature should be included in parentheses in the text.

Proportions of full-page illustrations should closely approximate 4-5/16 x 6" (26 x 36 picas); this usually allows explanatory matter to appear on the same page. Cost of illustrations in excess of that for one-full-page line cut will be borne by the author.

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PROCEEDINGS OF THE
ENTOMOLOGICAL SOCIETY OF WASHINGTON

Vol. 66 SEPTEMBER 1964 No. 3

THE ANT LARVAE OF THE SUBFAMILY DORYLINAE: SUPPLEMENT

George C. Wheeler and Jeanette Wheeler, *Department of Biology University of North Dakota, Grand Forks*

This article has been prepared as a supplement to "The Larvae of the Army Ants" by G. C. Wheeler (1943). It includes (1) earlier references in the literature which has been overlooked, (2) subsequent references in the literature, (3) additional information on species described by G. C. Wheeler (1943), and (4) the description of one species not previously described.

In the twenty years elapsed since the previous article on this subfamily most of the literature has come from the pen of Dr. T. C. Schneirla and has dealt with the relation of larvae to the colony cycle. Two of his students (Lappano and Tafuri) have treated development and polymorphism. Other citations are mostly based on G. C. Wheeler (1943). The larvae of three additional species have been described by other authors.

Subfamily Dorylinae

Fig. 1*b* shows a generalized (or synthetic) profile of a doryline larva. In our study of the body shapes of ant larvae we have used only profiles (i.e., outlines in side view), since dorsal and ventral views rarely show anything distinctive. To facilitate comparison of profiles we decided that all drawings would need to be of the same size. This, however, presented a problem with flexible larvae, because such larvae are preserved with various amounts of curving and contraction. Hence it was necessary to establish a standard measurement to be the same for the profiles of all genera. We chose the distance (on the drawing) from the anus to the first abdominal spiracle, for two reasons: (1) the abdomen is relatively inflexible and scarcely extensible; (2) these are two easily located points (in contrast, for example, to the posterior end, which would have to be designated arbitrarily on a curve). For our actual procedure see Wheeler and Wheeler, 1960. The generalized profile (Fig. 1*b*) for the subfamily was obtained by a sort of averaging of the three generic profiles.

Fig. 1*a* shows a generalized (or synthetic) doryline mandible derived by the same technique (see above), using the apex and the anterior condyle as the points of reference.

REFERENCES TO THE SUBFAMILY

Bernard, 1951:—"Larves eucéphales, carnivores; nourries par les ouvrières" (p. 1041). Brief description of larvae (after G. C. Wheeler, 1943) on p. 1048. Brief reference (p. 1049) to G. C. Wheeler's article on leg vestiges (1938).

Emery, 1899, p. 8—"Quello delle *Dorylinae* con la sua forma cilindrica allungata, la struttura speciale delle mascelle e la mancanza di peli d'attacco o di altre appendici del tegumento che non siano peli semplici."

Emery, 1910, p. 4—"Larves plus ou moins cylindriques, à poils courts, sans poils d'accrochage."

Gantes, 1949, p. 76:—"Les larves de dorylidés se rapprochent également beaucoup de *Formica* leur corps est couvert de poils simples et courts. La tête est grande, mais les pièces buccales sont plus courtes que chez les *Poneridae*. Ceci est donné d'après la description que G. C. Wheeler a faite d'un *Eciton*."

Wheeler (1920, p. 48) stated that the Dorylinae were exceptional in not having a beautifully developed trophorhinium.

Genus **CHELIOMYRMEX** Mayr

Borgmeier, 1955, p. 59:—Description after G. C. Wheeler (1943).

Cheliomyrmex megalonyx Wheeler

Borgmeier, 1955, p. 68:—"Die Larve wurde von G. C. Wheeler (1943) beschrieben und abgebildet. Ich habe dei wichtigsten Charaktere bie der Gattungsdiagnose angefuehrt."

Genus **DORYLUS** Fabricius
Subgenus **ANOMMA** Shuckard

Bernard, 1951, p. 1051:—"Elles ne laissent pas les larves au soleil."

Emery, 1901, p. 430:—"È particolarmente interressante la presenza di un rudimento di antenna nelle larve di *Dorylus* . . . . Nella larva di *Dorylus* il capo è più piccolo e le mandibole più piccole e più deboli che nelle altre Doriline; le mascelle non hanno punte, e in generale l'armatura boccale è molto ridotta, condizione che indica un grado più inoltrato di perfezionamento delle cure materne, per parte della popolazione operaia . . . .Le larve . . . hanno la . . . forma cilindroide."

Schneirla, 1957, p. 124:— "No larval-excitatory factor seems indicated in Dorylus as far as influencing the arousal of an emigration is concerned."

Trabert (1957, p. 299) makes brief reference to G. C. Wheeler, 1943.

Dorylus (Anomma) nigricans Illiger

Cohic (1948, p. 237) translated into French G. C. Wheeler's description (1943, p. 322 and 324) of the male larva. He described (p. 233-237) and illustrated (Fig. 5-16) the soldier ("*macrocephale*" larva, which seems to be generally similar to the larva of *D. wilwerthi* Emery described by G. C. Wheeler (1943, p. 321); however, close comparison is not possible, because his drawing of the head is not in full-face view and because our material is damaged.

Genus **AENICTUS** Shuckard

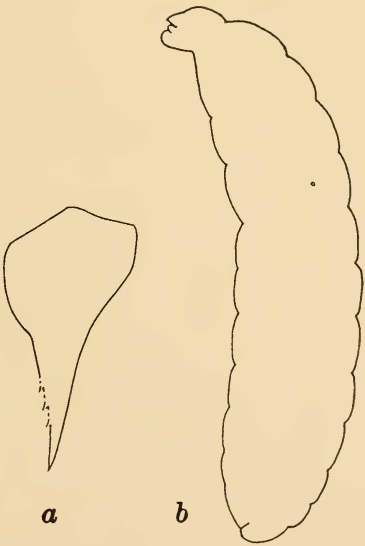
REVISED DEFINITION—Body hairs simple. Integument with few or no spinules; no papillae. Head hairs moderately numerous. Maxillary palp a short stout projection bearing three to six sensilla.

Aenictus leviceps (F. Smith)

CORRECTION—The maxillary palp has two apical sensilla.

Aenictus turneri Forel

Length (through spiracles) 2.6 mm. Generally similar to *Aenictus* (*T.*) *leviceps* (F. Smith) except as follows: Integument with short rows of minute spinules on the dorsal surface of abdominal somites IX and X. Maxillary palp an irregular projection with four sensilla; galea a short frustum with two apical sensilla. Opening of sericteries a short transverse slit on the anterior surface near the base of the labium. (Material studied: ten larvae and semi-pupae from Queensland, courtesy of Dr. W. L. Brown.)



a b

Fig. 1: *a*, generalized mandible (anterior view) for the subfamily Dorylinae; *b*, generalized body profile for the subfamily Dorylinae.

Genus **ECITON** Latreille

Subgenus **ECITON** Latreille

Borgeier, 1955, p. 163—Brief description of larva (after G. C. Wheeler, 1943 and Weber, 1943).

Emery (1901, p. 430) reported that the larvae have a cylindroid shape; he did not find antennal rudiments.

Emery (1911, p. 5) characterized the larvae as "à peu près cylindrique."

Marcus, 1954:—"Mi idea es, que las larvas nutridas con trozos de Termitas producen sexuales y que las larvas que no reciben esta substancia T resultan trabajadoras" (p. 6). Outline drawing of larva of *Eciton* sp. in side view (Fig. 6a on p. 11).

Wheeler, 1903, p. 207:—Larvae are carried by the neck, with the long slender body extending back between the legs of the worker. On p. 209 he compared the larvae with those of *Cerapachys*.

Eciton burchelli and **E. hamatum**

Dr. T. C. Schneirla has published 30 articles on the behavior of these two species. The following account is based on two of these articles (1954, 1957).

The worker brood is always a unitary population of great size (approximately 30,000 individuals in *E. hamatum* and 50,000 in *E. burchelli*) and all of its members are at essentially the same stage of development. There are, however, individual differences in size.

Eggs are laid only in the middle of the statary phase. By the beginning of the following nomadic phase (induced by the ecolsion of the previous brood) the newly hatched larvae are concentrated in a single small mass near the center of the bivouac, where they are tended by minims; consequently their stimulative effect on the colony is negligible. By the fourth or fifth day of the nomadic phase the larvae have grown considerably and their stimulative effect has begun to accelerate. They occupy an expanding central portion of the bivouac, the larger larvae near the periphery, the smaller near the center. After the middle of the nomadic phase, an ever increasing number of intermediate and large workers take part in the care of the larvae—stroking, licking, holding, feeding and carrying them on migration. As the larvae mature there is a progressive increase in the intensity of nomadism, as evidenced by the enhanced vigor of raiding and by the greater distance of emigration.

With the approach of maturity the largest larvae (the potential major workers) are the first to cease feeding. The workers carry them out of the bivouac and lay them in near-by wood dust or other detritus, which soon covers them and in which they are able to spin cocoons. Smaller individuals spin later.

With the completion of spinning the stimulation of the workers by the larvae ceases abruptly and the colony enters upon the statary phase, which persists while this brood is in the pupal stage and terminates when the callows emerge; then the next nomadic phase begins. As mentioned above, the next brood has already been started by eggs laid in the middle of the statary phase.

After discussing (1957, p. 110-111) trophallaxis between larva and worker Schneirla extended the definition of that[1] term "from the effects of exchange of nutrient as such to the many and varied ways in which specific stimulation independent of nutrient gains arouses or increases action or serves to facilitate physiological processes in the colony . . . . The brood-energizing factor is therefore held to be the *necessary* factor for nomadic behavior and for propagation of the cyclic pattern itself."

Bernard, 1951, p. 1049-1051—A resumé of Schneirla's work on the influence of larvae on the behavior of the colony.

Schneirla, 1948, p. 109:—"Results show that a male brood has trophallactic stimulative relationships with workers comparable to those ordinarily exerted by a worker brood. Once larval development is well under way, the energizing effect of a male brood is comparable to that exerted by a worker brood roughly ten times its population size. Since male developmental phases are largely the same as those of worker broods, the appearance of the male broods occasions no substantial modification of the (nomad-statary) cycle of colony behavior changes."

Eciton burchelli (Westwood)

Bernard, 1951, p. 1048:—Stomach and food of larva (after Wheeler and Bailey, 1920, p. 254-255).

Emery, 1899, p. 6:—"Nella larva di *Eciton* (fig. 6) il capo è più piccolo e meno staccato dal tronco; le mandibole strette e minute non oltre passano il labbro superiore, anzi, non lo raggiungono neppure. Il cono laterale delle mascelle è sostituito da un gruppo di piccoli tubercoli (fig. 6 *c*)."

Lappano (1958) described polymorphism, external anatomy, internal anatomy and histology. "The description of the external morphology . . . herein presented conforms to and extends the general descriptions given . . . by Emery (1899 and 1901) and G. C. Wheeler (1943)" (p. 49). Photographs (p. 51) of larvae of three sizes (Fig. 1) and of the head in anterior view (Fig. 2) and side view (Fig. 3).

Marcus, 1954, Fig. 6 b and c (p. 11):—Outline drawings of larvae in side view (after Schneirla).

Schneirla, 1945:—"During bivouac-change the larvae were carried individually, gripped anteriorly in the carrier's mandibles and slung underneath her body in the typical Eciton manner. In general, larvae were transported in the latter half of the movement" (p. 177).

Schneirla, 1948, p. 91:—A male brood numbers about 3000 larvae, which are subcylindrical and of approximately the same size. Mature larvae are 22-24.8 mm long. The production of males seems to be confined to the dry months. Photographs of male larvae of three sizes and of a male semipupa, Pl. I.

Schneirla and Brown, 1952, Pl. I:—Photographs of queen and male larvae.

Wheeler, 1921, p. 304:—"From what is now known of ant-larvae it can be positively asserted that Müller's description and Fig. 2 refer to larvae of the Ponerine genus *Pachycondyla*," not to *Eciton* larvae.

Eciton burchelli jeanae Weber

Weber, 1943, p. 90:—"Larvae slender, curved, with numerous fine, flexuous hairs which are mostly simple and of variable size but are sometimes bifid, trifid or multifid; mandibles slender, falcate."

Eciton hamatum (Fabricius)

IMMATURE MALE LARVA—Length (through spiracles) 5.6 mm. Generally similar to the worker larva except in the following details: Body hairs 0.036-0.132

mm, longest and most slender anteriorly, shorter ventrally and stouter posteriorly. Labrum feebly bilobed and with six sensilla on the ventral border near the middle. Maxillary palp with seven to nine sensilla. Hypopharynx with short rows of spinules.

MATURE MALE LARVA—Length (through spiracles) 24 mm. Generally similar to the worker larva. Body hairs longer (0.08-0.23 mm long), longest posteriorly and dorsally. Head hairs moderately numerous (about 60). Labrum with six sensilla on the ventral border near the middle.

Material studies: numerous larvae from the Panama Canal Zone, courtesy of Dr. T. S. Schneirla.

Allee et al., 1949, p. 432:—A photograph of workers transporting larvae slung under their bodies during change of bivouac. (Same as Buchsbaum, 1948, p. 292-26.)

Bernard, 1951, Fig. 949 on p. 1048:—Larva in side view, head in anterior view (after G. C. Wheeler, 1943).

Morley, 1953, Fig. 2a on p. 21:—Head in anterior view (after G. C. Wheeler, 1943); erroneously labelled *Acromyrmex*.

Schneirla, 1944:—Developmental period (p. 186); embryonic and early larval growth (colony statary), 10 days; compeltion of larval growth (colony nomadic), 17 days; pupal period (colony statary), 19 days; total, 46 days. Mature larvae ranged in length from 0.36 to 0.73 mm (p. 171).

Tafuri, 1955:—The largest larvae are fed to the limit; the smallest are deprived of food and forced to pupate while small. The following characteristics were correlated with days of the nomadic phase: size and development of leg discs; shape of head; appearance of imaginal discs; transparency; and pilosity. The leg discs have a growth rate independent of body length, which makes possible the separation of larvae of equal lengths into different developmental stages of the different worker castes; they also indicate larval age. Pl. I, photographs of larvae of assorted sizes in side view. Pl. II, drawing of head in anteroventral view and three drawings of thorax in ventral view. Pl. III-IV, photographs of larvae in ventral view.

Trabert, 1957, p. 299:—Brief reference to G. C. Wheeler, 1943.

Eciton conquistador Weber

Weber, 1949, Fig. 5 on p. 4:—"Outline of 4.5 mm. larva from below. The uniformly simple hairs are not indicated."

Eciton rapax F. Smith

Marcus, 1953, p. 63-66:—An account of glandular hairs of what is alleged to be *E. rapax*. But a correction slip pasted in the reprint reads: "De los valiosos trabajos de George C. Wheeler, que permiten determinar las larvas de hormigas, me he convencido, que, las larvas transportadas por Eciton rapax no son las suyas, sino larvas raptadas de Odontomachus". In the German summary (p. 68): "Die Larven von Odontomachus besitzen Nesselhaare aenlich wie die Raupen (Fig. 51 u 52)."

Subgenus **LABIDUS** Jurine

Borgmeier, 1955, p. 81:—"Annaehernd cylindrisch. Behaarung einfach. Tegument papillenartig. Labrum klein. Maxillarpalpen mit einigen Sensillen. Mandibeln laenglich, spitz, mit gezaehntem Innenrand."

Eciton (Labidus) coecum (Latreille)

Weber, 1941, p. 329:—"Larvae slender, curved, with numerous fine, simple hairs." Fig. 4 on p. 327, larva in side view (hairs not shown).

Eciton (Labidus) hartigi (Westwood)

Borgmeier, 1955, p. 136: "Annaehernd cylindrisch. Haare einfach. Tegument spinuloes. Mandibeln laenglich, spitz, ohne Zaehne am Innenrand." (Borgmeier placed this species in a separate genus, *Nomamyrmex*.)

Subgenus **NEIVAMYRMEX** Borgmeier

Borgmeier, 1955, p. 278:—Brief description after G. C. Wheeler (1943, called *Acamatus*.)

Eciton (Neivamyrmex) nigrescens (Cresson)

Schneirla, 1958:—The nomad-statary cycle of this species is similar to that of *Eciton s. str.* The nomadic phase is set off by the eclosion of a mature pupal brood and is maintained by stimulation from the next brood in the larval stage. In *Neivamyrmex*, however, this phase does not end abruptly with larval maturity but endures through the semipupal stage to end at pupation. This difference results from the fact that the worker larvae of *Neivamyrmex* do not spin cocoons. A worker brood was estimated to comprise 37,000 larvae.

Schneirla, 1961:—Sexual broods consist of approximately a thousand male larvae and a few queen larvae. These broods are over-stimulated and over-fed, which accelerates their growth; consequently larval development and the nomadic phase are shortened to about ten days. As in *Eciton s. str.* potential male and queen eggs are produced in response to a period of dry weather. Fig. 3 on p. 11, photograph of queen larva, body length 17 mm. Fig. 4 on p. 12, photograph of male larva, body length 15 mm. Duration (p. 13) of developmental stages (in days) of male brood (compared with worker brood, in parentheses): egg 2-3 (3-4); embryonic 2-3 (2-3); larva in statary phase 6-8 (2-7); larva in nomadic phase 10-12 (14-18); prepupa and pupa 20-21 (20-23); estimated total 42 (48).

Eciton (Neivamyrmex) schmitti Emery

Trabert, 1957, p. 299:—Brief reference to G. C. Wheeler, 1943.

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THE THIRD SPECIES OF NEOANTHYLLA KORMILEV, 1951, FROM PERU

(HEMIPTERA: PHYMATIDAE)

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I wish to express my sincere gratitude to Dr. Jon L. Herring of the United States National Museum, Washington, D. C., by whose kind offices I have had the privilege to study the third species of the genus *Neoanthylla* Kormilev, 1951.

Neoanthylla was first established as a subgenus of *Phymata* Latreille, 1802, for the reception of a single species, *Phymata* (*Neoanthylla*) *bucki* Kormilev, 1951, from Rio Grande do Sul, Brazil (1951:56). Later, *Neoanthylla* was elevated to generic rank, and to it I transferred the second species, *Phymata horvathi* Handlirsch, 1898, from Minas Geraes, Brazil (1960:307). Now I am able to describe the third species, from Peru, as *Neoanthylla peruviana* n. sp.

The genus *Neoanthylla* Kormilev, 1951, may be separated at once from other genera of the subfamily Phymatinae by elongately ovate, shiny, and sometimes translucent, fore femora, with unarmed upper edge, and smooth, flat, or slightly concave, exterior surface. It is closely allied to the genus *Anthylla* Stal, 1876, in having the middle and hind tibiae with convex, rounded upper surfaces, and without lateral rims, which are characteristics of the genera *Phymata* Latreille, 1802, and *Paraphymata* Kormilev, 1960 (1962).

All three species of *Neoanthylla* have sexual dimorphism, best seen in the differentiation of the antennae: the male has abbreviated antennal segment III, shorter than II, and very long, cylindrical segment IV, whereas the female has segment III longer than II, and segment IV much shorter, and fusiform.

KEY TO THE SPECIES OF **Neoanthylla** KORMILEV

1. Frontal processes of the head directed upward, and slightly displaced backward from the tip of the frontal plate, so that the latter is seen in front of

them. Fore femora narrow and concave on the exterior surface, more than three times as long as wide ---------------------------- **peruviana** n. sp., Peru

Frontal processes terminal, and slightly inclined forward; the tip of the frontal plate not visible. Fore femora wider and flat on the exterior surface, only two and a half times as long as wide -------------------------- 2

2. Postero-lateral-anterior borders of the pronotum deeply and almost angularly cut out; postero-lateral angles of the same dentiform and acute; postero-exterior angles of the connexiva II to IV provided with a blunt knob; connexivum is bicolor: yellow brown and reddish brown ------------------------------ **horvathi** (Handlirsch), 1898, Brazil (Minas Geraes).

Postero-lateral-anterior borders of the pronotum shallowly sinuate; postero-lateral angles form a right angle; PE-angles II to IV slightly protruding, but do not form a knob; connexivum also bicolor, but yellow brown and black ---------------- **bucki** (Kormilev), 1951, Brazil (Rio Grande do Sul).

Neoanthylla Kormilev, 1951

Neoanthylla peruviana n. sp.

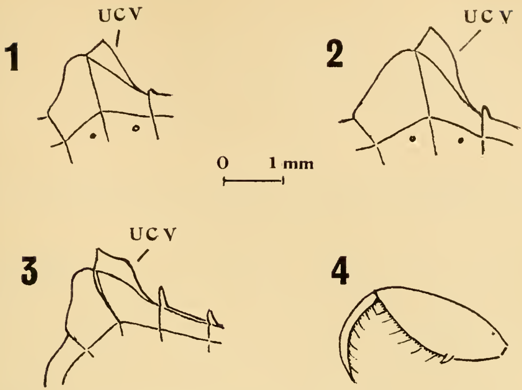
Male. *Head* slightly longer than wide through the eyes (12:10); anterior processes dentiform and directed upward, slightly displaced backward so that the tip of the frontal plate is seen in front of them as two (1 + 1) small tubercles. Preocellar processes do not rise above the level of the frontal plate; ocellar processes dentiform, directed up—and slightly forward. Ocelly lateral and slightly visible from above. Eyes large, semiglobose, exerted. Antennal groove wide and smooth, open from above. Antennae very long, with cylindrical segment IV; proportions of the antennal segments, I to IV, are: 3:4.5:2.5:25. Granulation sparse, more limited to the borders and genae.

Pronotum shorter than wide across the lateral angles (21:27.5); antero-lateral borders (anterior and posterior together) three times sinuate, covered with sparse, semiobliterated granulation; lateral notch (the middle sinuation) shallow; lateral angles dentiform, acute, directed up—and slightly sideways; postero-lateral-anterior borders very short, and shallowly sinuate; postero-lateral angles angular, form a right angle, with slightly protruding tip; postero-lateral-posterior borders twice as long as PLA-borders, and almost straight; posterior border also straight. Fore disc smooth, with a row of fine granules only along its lateral borders. Hind disc moderately convex; median depression reaching to 4/5 of its length; carinae clearly marked from the base to the tip, and slightly divergent, more divergent posteriorly, covered with a few, spaced granules. Hind disc finely and deeply punctured, and slightly rugose between the carinae posteriorly.

Scutellum shorter than wide at the base (7.5:10); lateral borders finely carinate, very slightly sinuate, and almost without granulation; median carina linear, with one large granule at the base, and a few smaller at the tip.

Hemelytra reaching to the tip of the abdomen; venation simple: two basal closed cells, and ramificated veins.

Abdomen almost as long as wide (43:42); PE-angles of the connexiva dentiform, increasing in length from II to IV; connexiva II to IV long and narrow, their exterior borders straight (II and III), or very slightly sinuate (IV); connexivum V provided with an ultraconnexivum, its exterior border in the shape of an "S", first sinuate



Neoanthylla bucki (Kormilev). Fig. 1, lateral angles of the ♂ abdomen seen from below. *Neoanthylla horvathi* (Handlirsch). Fig. 2, lateral angles of the ♀ abdomen seen from below. *Neoanthylla peruviana* n. sp. Fig. 3, lateral angles of the ♂ abdomen seen from above. *Neoanthylla peruviana* n. sp. Fig. 4, fore femur and tibia of ♂. Note: UCV—ultraconnexivum of segm. V.

then strongly convex; PE-V dentiform, acute; connexivum VI firstly strongly convex, then slightly sinuate; posterior border convex in the middle, and slightly sinuate laterally. Venter without granulation.

Propleura long; antennal groove wide and deep reaching to the lateral angles of the pronotum; fore border sinuate and finely denticulate; antero-inferior angles with slightly larger teeth.

Mesosternal cross has fore branch slightly convex and granulate.

Legs: fore coxae long and naked, with only one small tooth near the base; trochanters free; fore femora elongately ovate, more than three times as long as wide (25:7.5), translucent; exterior surface concave, smooth, and shiny; lower edge with a small tooth; fore tarsi present.

Color: yellow brown mottled with red brown; exterior borders of connexiva bicolor: yellow brown and red brown; fore disc of the pronotum, the middle depression of the hind disc, median carina of the scutellum, and corium, are dark red brown.

Total length 8.4 mm.; width of the pronotum 2.75 mm.; width of the abdomen 4.2 mm.

Holotype: ♂ Peru, Satipo—P. Paprzycki coll. VIII. 24, 1941; in the U. S. National Museum, (Type No. 67555).

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A REVIEW OF THE GENUS XANTHOMYIA PHILLIPS

(Diptera: Tephritidae)

The Nearctic genus *Xanthomyia* was established by Phillips (1923, Jour. New York Ent. Soc. 31: 140) for *Trypeta platyptera* Loew (1873, Smiths. Misc. Collect. 256, Pt. III: 306), a species with 2 pairs of lower fronto-orbitals; 2 pairs of upper fronto-orbitals (the anterior pair of which is dark and very strongly developed, the posterior pair, like the outer verticals, white); a short, pointed third antennal segment; a very wide frons clothed with very minute setae; pale postoculars; the dorsocentral at the level of the anterior supra-alar; 2 pairs of scutellars; and a very broad, dark wing with vein r-m distinctly apicad of the middle of cell 1st M_2. Curran (1934, Families and Genera of No. Amer. Diptera, p. 288, fig. 18; p. 289) keys the genus and illustrates the wing pattern of *platyptera*. The genus is closely related by many morphological features to *Eurosta* Loew, *Eutreta* Loew, *Xenochaeta* Snow, and *Jamesomyia* Quisenberry, all but one of which are included in Curran's key.

A long-overlooked name in the Tephritidae, *Eutreta nora* Doane (1899, Jour. New York Ent. Soc. 7: 184) was synonymized with *platyptera* (then known as a *Tephritis*) by Coquillett (1899, Jour. New York Ent. Soc. 7: 264), and although Doane (1900, Jour. New York Ent. Soc. 8: 48) and Aldrich (1907, Jour. New York Ent. Soc. 15: 6) argued that the two names represented distinct species, *nora* has nowhere appeared in the North American tephritid literature since 1907 either as a distinct species or as a synonym.

To resolve the element of doubt residing in the literature cited above, I recently examined the type of *nora* through the kindness of Maurice James, Washington State University, Pullman, and found it to be, in fact, the representative of a species of *Xanthomyia* distinct from *platyptera*. Differences in the wing patterns of *platyptera* (see Curran, 1934, p. 288, fig. 18) and *nora* (see Doane, 1899, Pl. III, fig. 9) are evident upon comparing the excellent illustrations of these two authors. The wing disk is darker in *nora* than in *platyptera*, the round hyaline spots in all cells are less numerous, the marginal hyaline areas tend to be rounded rather than open to the wing margin, and the hyaline spots in cell R_1 are separated by more extensive dark areas. In addition, the anterior margin of the third antennal segment of *nora* is more deeply emarginate than that of *platyptera*, and the scutellum of the former does not exhibit the dorsal mark so prominent in *platyptera*.

I have seen specimens of *platyptera* from an area bounded by Michigan, Vermont, Indiana, and Virginia; but *nora* is known to me only from Science Lodge (Boulder Co.), Grand Mesa, and Spring Creek Pass, all in Colorado, and from Moscow Mt., Idaho, the type locality. Nothing is known about the hosts or biology of these two rare species.

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PROSIMULIUM ESSELBAUGHI N. SP., THE ALASKAN P. HIRTIPES 2 (DIPTERA: SIMULIIDAE)

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Cytological studies in the Botany Department at the University of Toronto by Drs. Rothfels and Basrur, as well as improved preservation and rearing techniques, more detailed morphological studies of larvae, pupae, males and females, and additional information on habitat and bionomics, have all contributed to the realization that *Prosimulium hirtipes* (Fries) of authors actually involves a complex of species. The *P. hirtipes* 2 of Rothfels (1956) was later named *P. mixtum* S. & D. Lewis Davies (1957), Syme and D. Davies (1958) and Sommerman (1958, 1962) respectively, referred to one entity of this *hirtipes* complex as *P. hirtipes* (Alaska), Alaskan *P. mixtum* and Alaskan *P. hirtipes* 2. Some of the earlier Alaskan records of *P. hirtipes* (Fries), such as those given in the comprehensive papers by Stone (1952), Sommerman (1953) and Sommerman *et al* (1955) refer in part to this species, which is of particular interest because it is known to bite humans here in Alaska. The following description and definition are presented to clarify the species concept and facilitate future reference to it.

I am especially grateful to Drs. M. Wood and D. Davies for providing specimens of *P. mixtum* for study. Also, the descriptions and illustrations in the references listed have been of tremendous value in defining this species.

Descriptive comments refer to alcoholic specimens. Adults were reared from pupae as described by Sommerman (1956). Reared adults allowed to live only a day or two are not completely pigmented so the basal antennal segments and pattern on femora and tibiae etc. are pale brown, instead of darker brown as in older specimens. Light source and direction of light are critical in determining the color of the overall vestiture, therefore the head is directed toward the light source for all color comments except those referring to the terminalia, ventral view, which are also directed toward the light source. An incandescent not a fluorescent bulb was used with a steroscopic microscope.

Prosimulium esselbaughi, new species

Prosimulium esselbaughi is named in honor of the late Charles O. Esselbaugh, who gave so unstintingly of his time while participating in the biological studies conducted by the Alaska Insect Project in the summer of 1948. His pertinent notes and keen observations during the collecting, rearing, and initial sorting of all stages of black flies taken in the Fairbanks area greatly simplified the task of identifying the specimens and organizing and analyzing the data.

All type specimens were individually reared from pupae and each is accompanied by the pupal exuviae and case. The larval head capsule also accompanies a few. The pupae of the types were all collected by the author at Station 272 on Fort Richardson, Alaska, between May 17 and July 16, 1956 to 1959. For habitat description see Sommerman *et al* (1955). *HOLOTYPE*: Female, Fort Richardson, Alaska, Sta. 272, July 14, 1959. *ALLOTYPE*: Male, (same data as holotype). *PARATYPES*: 21 males 13 females. The holotype, allotype, and 7 male and 5 female paratypes, are deposited in the collection at the United States National Museum. In addition, 7 male paratypes and 4 female paratypes are deposited in the Canadian National Collection as well as at the Illinois Natural History Survey. Larvae and pupae from the type locality and additional larvae, pupae, and reared specimens from another typical habitat are also deposited in the above-mentioned collections.

Female.—General color brown (dark brown in aged specimens) and beige, with blond and brownish black vestiture. Wing length 3.5 to 4.2 mm. Head brown, setae blond; frons and clypeus brown. Antennae with eleven segments, the first and second brown like clypeus, the second widest, and remaining ones tapering and with light pile. Last segment of palps longer than sensory segment; sensory organ usually with large opening, about equal to width of organ. Mandibles serrate, maxillae with retrorse teeth. Pronotum, scutum and post scutellum brown, the first two with blond vestiture; scutellum beige to pale brown (like tibiae) with erect long blond hairs. Pleuron mostly brown and beige with a purple hue to the membraneous areas near the spiracles especially. Mesosternum brown. Setae on base of costa mixed brownish and blond, on stem vein blond. Legs beige and brown as follows:-forecoxae brown with continuous rectangular beige patch on anterior and median surface; all femora beige to pale brown with narrow distal brown band at tip; tibiae beige to pale brown with narrow proximal and distal brown band; tarsi brown. Claws without teeth. Membraneous portion of abdomen with purple hue especially posteriorly; tergites mottled beige and brown, less mottled and darker posteriorly; fourth tergite about as wide as scutellum; the whole abdomen covered with fine blond pubescence. No sclerotized sternal plates cephalad of seventh sternite; anterior gonapophyses shorter than last segment of palps, and with an oblique bend about midway, tips somewhat rounded or bluntly tapered, pigmentation and sclerotization along the mesad margin for the most part not extending much beyond the anterior half in young adults, but in more aged specimens brownish sclerotization extends almost to tip.

Male.—General color brown to dark brown, with vestiture blond and blackish brown. Head dark brown; two basal segments of antennae darkest, second segment widest, third narrower but almost as long as second; sensory organ of palps with rather wide opening; last segment of palps longer than sensory segment; scutellum light brown to brown, but ligher than scutum and post scutellum which are brown to dark brown. Wing length 3.8 to 4.4 mm; setae on base of costa mostly blond, on stem vein blond. Ventral plate with tip of lip slightly concave and rounded.

Pupa.—The preserved pupa is 3.5 to 5.0 mm long, exclusive of the respiratory organ, which is usually lighter in color than dorsum of thorax of exuviae. The trunk of the respiratory organ supports three branches. The anterior and laterad branches each terminate in four filaments and the dorsal branch has eight, making a total of sixteen filaments per organ. The dorsal and laterad branches are somewhat unidirectional, so from side view, L1 tends to obscure D1. L1 is usually longer than D1 or A1, and D2.3 is often much shorter than L1. The pupal case is dense but rather loosely assembled, generally with only the respiratory organ exposed, but sometimes the entire top of the thorax is bare.

Larva.—The mature preserved larva is 7.0 to 8.5 mm long, with the head capsule light brownish yellow and the rest of the body smoky. The dorsal head pattern usually consists of a slightly darker median spot about opposite the upper end of the mandibular phragma, accompanied by two smaller less distinct lateral spots behind the median spot and about half way to the sutures. Sometimes there is a slight indication of a median posterior spot. The capsule is darker (but not banded) along the posterior margin. The throat cleft is rather shallow and rounded at the corners, with an indistinct "dash" and "dot", on each side before the tentorial pits. The terminal lateral submental teeth are not quite so high as the tip of the median tooth; the other lateral teeth are below the tips of secondary teeth on median tooth. The mouth fan contains 20 to 28 rays.

Under the name *P. hirtipes* and *P. hirtipes* 2, *esselbaughi* was distinguished from *doveri* Somm., *frohnei* Somm., *fulvum* (Coq.) and *travisi* Stone by Sommerman (1953, 1958, 1962). According to Rothfels (correspondence) further study of salivary gland chromsome patterns of mature larvae indicate *esselbaughi* is more closely related to the preceding four Alaskan species than it is to *mixtum*.

The following characters of *mixtum* differentiate it from *esselbaughi*. Both sexes are generally darker and more robust; antennae tapering from third segment; last segment of palps about as long as sensory segment. In addition, the female has the two basal antennal segments lighter than the rest; abdominal tergites less mottled and darker; anterior gonapophyses rather flat, long and tapering, about as long as last segment of palps, with median sclerotization extending far into posterior half. Male ventral plate with lip tapering to an attenuated carina. Pupal respiratory organ with lateral branch directed somewhat anteriorly, so from side view, L1 tends to obscure A1; A1 is usually longer than L1 or D1; D2.3 is much longer than L1. For terminology of the respiratory organ see Sommerman (1962). The larval head pattern is more complex, consisting dorsally of four "dots" and four "dashes", the latter in the form of a median inverted "T", the stem and cross-bar of which are each composed of two "dashes", end to end. One pair of "dots" (lateral spots) is about opposite the break in the stem, and the second pair of spots is behind the first. The throat cleft is shallow, with a "dash" and a "dot" on each side before the tentorial pit. The tips of the lateral submental teeth are all above height of secondary teeth on side of median tooth. The mouth fan contains 33 rays. Excellent illustrations of *mixtum* are given by Stone (1964).

The *P. esselbaughi* examined during this study were all collected within fifty miles of Anchorage. Larvae and pupae has been found in cold, permanent streams, from a little above timberline to sea level. Streams where specimens were taken were 3 to 25 feet wide, 4 to 18 inches deep, with speeds from 2.5 to 4.5 feet per second to tumbling. But *esselbaughi* was the dominant black fly species (in terms of population density) only in clear, cold, permanent, spring-fed, forest streams, 3 to 4 feet wide, 1 to 4 inches deep, flowing 3 to 4 feet per second; with little fluctuation in depth and maximum stream temperatures ranging from 40 to 45° F while larvae and pupae were present. It is assumed such is the typical or preferred habitat of *esselbaughi*, and there *fulvum*, and sometimes also *Eusimulium pugetense* (D. & S.) were relatively abundant and in direct association with *esselbaughi*, though they pupated and emerged a bit earlier.

P. esselbaughi has but one generation a year, with larvae overwintering. The following information was obtained from populations in the typical habitats only. Hatching apparently started in late August and early September. The larvae usually attached to the deflecting surfaces of rocks and the under surface of loose stones in riffles, or to large roots that formed the brink of falls. Larval development required about nine months, mature larvae becoming abundant the latter half of May and the first week of June when the stream temperatures were 38 to 39° F. At this time of year, however, before the leaves are out, the stream temperatures fluctuate considerably through out a twenty-four hour period on a clear day. The larvae often pupate in groups forming patches of silken cases attached to the under surfaces of loose stones, as well as in niches and cracks on the deflecting surfaces of any rocks. Pupae were present from late May to mid-July and were most numerous during the last three weeks of June. Most of the adults emerged during the latter half of June and early July, with the males starting to emerge slightly before the females, as usual.

A few adults that emerged in the lab from pupae collected in the streams, were kept in cubic inch plastic emergence cages described by Sommerman (1956). The adults had access to water from the cotton-filled tubes supporting the pupa, and a few grains of dextrose were put in the cage the day after emergence. The adults discovered them quickly and appeared to feed. The females survived 10 to 13 days and contained well-developed eggs; males survived up to 14 days. Several females deposited a few eggs on the wet cotton and pupal cases in their cages. Other adults had access to maple syrup on the lid and some of those survived 12 to 14 days; the females also contained well-developed eggs. Most of these females were given an opportunity to bite me on one or more occasions, but none did,—their chief interest seeming to be escape. This species was more active and could cling to the cages more tightly and dart out much more quickly than *fulvum*, *doveri*, *frohnei*, or *travisi*.

Females were attracted to me at the typical habitats from mid-June to mid-July, from about sunset throughout the twilight hours, which lasted through the night during much of that period. They often landed and probed but did not bite readily. However, these same wild-caught specimens did bite readily in captivity but laboratory conditions were unsatisfactory for survival at that time and all died within three days. They usually fed three to four minutes and left an oozing drop of blood; a welt developed shortly thereafter which itched and burned for several days.

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SOME TARSONEMIDAE FROM THE REPUBLIC OF THE CONGO (Acarina)

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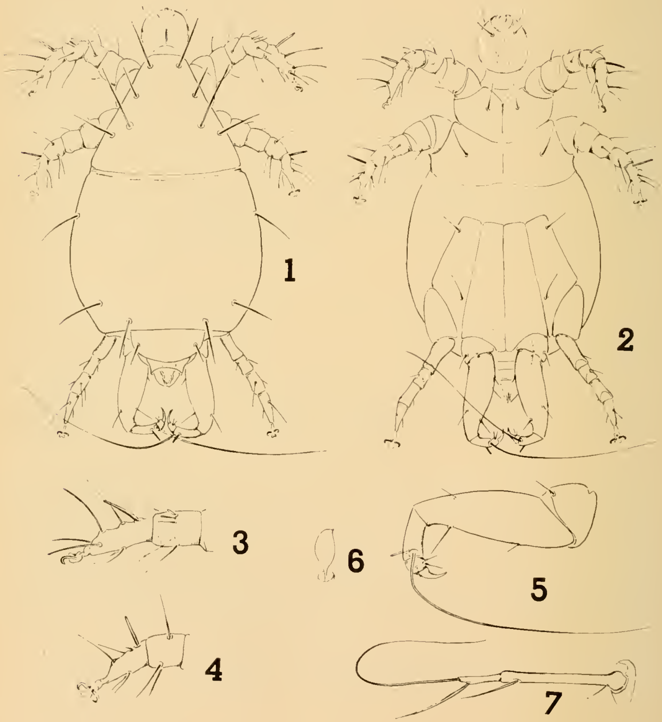
Very little is known about the tarsonemid mites of Africa, even though some are of economic importance. Being small and inconspicuous, few tarsonemids are collected, and so it is with some interest that mites belonging to this family were collected by E. W. Baker during a trip to the Congo in 1955. In the collection are undescribed species belonging to the genera *Tarsonemus* Canestrini and Fanzago, *Steneotarsonemus* Beer, and *Hemitarsonemus* Ewing. Known species of *Tarsonemus* and *Fungitarsonemus* were also found.

Tarsonemus cromroyi, new species
(Figs. 1–7)

This species is characterized by the presence of an extremely long rodlike solenidion on tarsus I and II of both sexes.

Male. Dorsal body setae short, strong, as figured; third pair of propodosomals longest, only slightly longer than second pair; second pair slightly longer than first pair. First three pairs of hysterosomals of equal length, about as long as fourth pair of propodosomals; fourth pair short, about one third as long as others. Ventral apodemes as figured. Leg IV as figured; femur with very short anterior inner seta and longer distal setae; genu long, slender, with whiplike seta longer than leg; tibia-tarsus short, with short, slightly curved claw; tarsus I and II distinctive in having long rodlike solenidion. Body 135 μ long by 71 μ wide.

Female. Distinctive in having long rodlike solenidion on tarsus I and II, and in having the pseudostigmatic organ drawn to a point distally. Body 199 μ long by 96 μ wide.



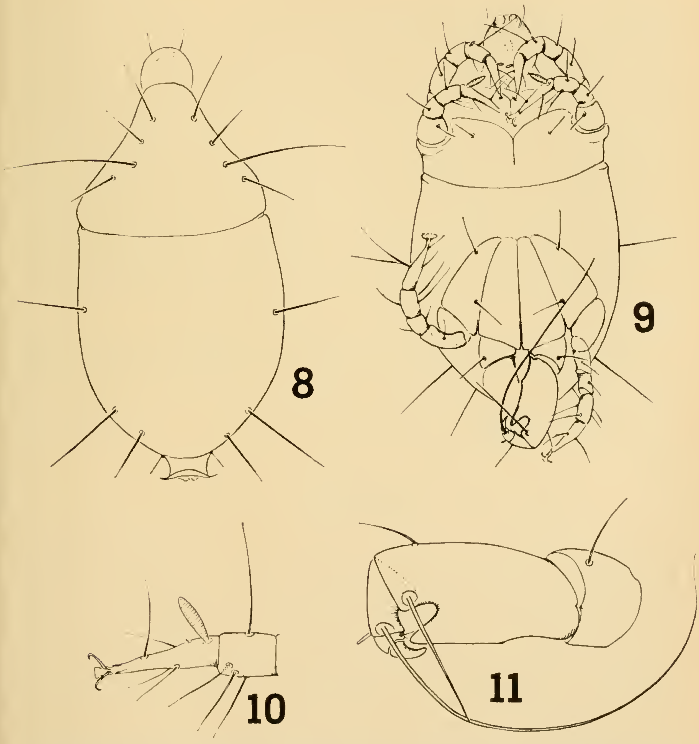
Tarsonemus cromroyi, new species. Fig. 1, dorsum, male; fig. 2, venter, male; fig. 3, tarsus and tibia I, male; fig. 4. tarsus and tibia II, male; fig. 5, leg IV, male; fig. 6, pseudostigmatic organ, female; fig. 7, leg IV, female.

The male holotype, U. S. National Museum No. 2953, and a female paratype were collected on *Hibiscus*, Mt. Hoyo, Congo, May 5, 1955 by E. W. Baker. The species is named for Dr. Harvey Leonard Cromroy, National Institutes of Health.

Tarsonemus setifer Ewing

Tarsonemus setifer Ewing, 1939. U. S. Dept. Agr. Tech. Bull. 653:1–63.

A single male specimen of this species was collected from *Spathodea campanulata* P. R., Lwiro, Congo, by E. W. Baker.



Steneotarsonemus mansoni, new species. Fig. 8, diagrammatic presentation of dorsal setal pattern, male; fig. 9, venter, male; fig. 10, tarsus and tibia II, male; fig. 11, leg IV, male.

Fungitarsonemus borinquensis Cromroy

Fungitarsonemus borinquensis Cromroy, 1958. Jour. Agr. Univ. Puerto Rico XLII (2): 39–144.

This species, originally described from Puerto Rico, was collected on "tree", Leopoldville; on *Berlinia* sp., Stanleyville, on *Datura* and peach, Mt. Hoyo; and on quinine leaf, Mulunga, all in the Congo, by E. W. Baker.

Steneotarsonemus mansoni, new species
(Figs. 8–11)

The male is separated from others in this genus in that the femur of leg IV is so constructed that when the distal segments are folded a pincer is formed; the solenidion of leg II is enormously enlarged. The female is not known.

Male. Body setation distinctive; all setae long, except for a pair of small posterior propodosomals. First pair of propodosomals longer than second and fourth, but about one-half as long as third; second and fourth equal in length and about two-thirds as long as the first. First and third pair of hysterosomals about as long as first pair of propodosomals; second pair longer than others but not as long as third pair of propodosomals; fourth pair of hysterosomals small, about one-third as long as third pair. Ventral setae and coxal apodemes as figured. Tarsus and tibia I each with a small lanceolate solenidion; tarsus II with a large solenidion long and strongly swollen. Leg IV characteristic in having the femur so constructed as to form a pincer with the distal segments when they are folded at genu; distal outer setae of femur short, inner distal seta straight, two to three times as long as outer; inner proximal seta lacking. Body 160 μ long by 77 μ wide.

A single male, the holotype, U. S. National Museum No. 2954, was collected on *Spathodea campanulata* P.R., Lwiro, Congo, May 17, 1955 by E. W. Baker.

This species is named for Mr. D. M. C. Manson, New Zealand Department of Agriculture.

Hemitarsonemus beeri, new species
(Figs. 12–18)

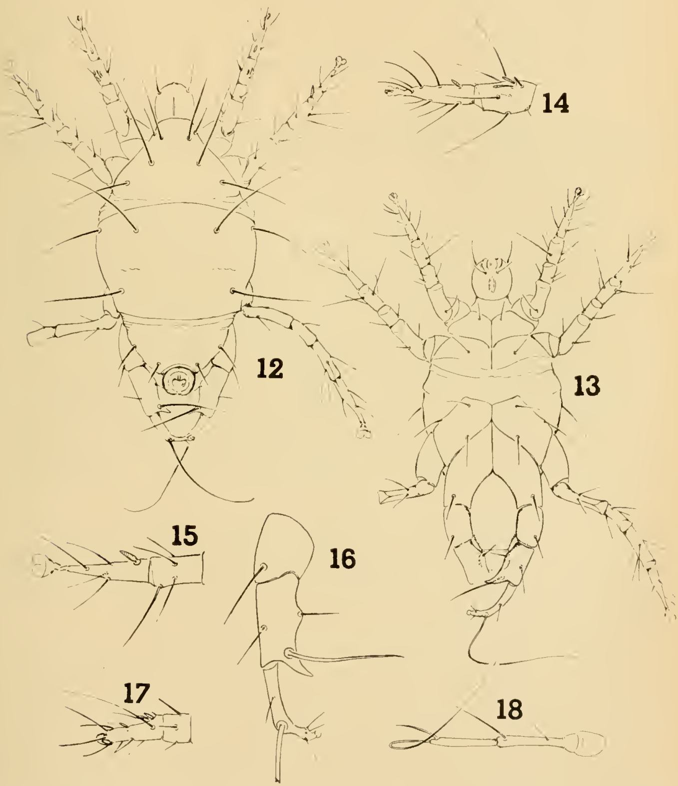
Although the legs of the male are similar to those of *Hemitarsonemus latus* (Banks), the long dorsal body setae separate these two species; also, all four pairs of propodosomal setae are present here, whereas in *latus* the second pair is lacking.

Male. Most dorsal body setae very long; the first pair of propodosomals short, about half as long as second pair; third pair the longest, slightly longer than the second and fourth which are about the same length. Hysterosomal setae long, the anterior inner pair the longest; the anterior outer pair not quite two-thirds as long as inner pair; third pair of hysterosomal setae about two-thirds as long as anterior inner pair; two posterior pairs equal in length. Venter as figured; the concave anterior apodemes of coxae III and IV characteristic; apodemes III and IV are joined anteriorly to the posterior median apodeme. Legs characteristic, as figured; leg IV similar to that of *Hemitarsonemus latus*, ending in a knob; femur with inner hook, slightly buldging in region of inner seta. Body 167 μ long by 96 μ wide.

Female. Female, associated with the above male, similar to female of *Hemitarsonemus latus*. Body 200 μ long by 96 μ wide.

The holotype male, U. S. National Museum No. 2955, 14 paratype males, and 3 females were collected on *Ficus* sp., Lwiro, Congo, May 17, 1955 by E. W. Baker.

This species is named for Dr. Robert Beer, Department of Entomology, University of Kansas.



Hemitarsonemus beeri, new species. Fig. 12, dorsum male; fig. 13, venter, male; fig. 14, tarsus and tibia I, male; fig. 15, tarsus and tibia II, male; fig. 16, leg IV, male; fig. 17, tarsus and tibia I, female; fig. 18, leg IV, female.

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BOOK REVIEW

Index Literaturae Entomologicae. Serie II: Die Welt-Literatur uber die gesamte Entomologi von 1864 bis 1900. Band I: A-E By Dr. Walter Derksen and Dr. Ursula Scheiding. Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin 1963 xii + 697 pp. Price: 55 DM.

The first volum in series II is a continuation of the work by Dr Walther Horn and Dr. Sigmund Schenkling, which was a revised edition of Hagen's Bibliotheca Entomologica. As is obvious from the title, this series deals with world entomological literature from 1864 to 1900. It is expected that the entire series will be completed in 4 or 5 volumes and will contain approximately 90,000 titles which are classified under the author's name or pseudonym in alphabetical order. Following the "A" entries are all of the papers that were published with an author's initials only and then all of the anonymous contributions in chronological order.

The two-column format is an improvement over the Horn-Schenkling work. Each author's name is on a separate ine and set in boldface type making it very easy to read. A most useful feature is a short biographical note on the author and references to all of his obituary notices. All entries are listed in the original language but where necessary (i. e. Slavic and Hungarian languages) a transliteration and translation is made of the author's name and title of the paper. These are enclosed in brackets.

It is stated in the introduction that seven years of work have gone into this Index. Drs. Derksen and Scheiding are to be commended for their thoroughness; I fail to find any serious omissions in this first volume. However, it is certainly unfortunate that the volume was printed on a grade of paper of newsprint quality and will not stand up to repeated usage.

This Index has been needed for many years and will be of great assistance to research workers. It will doubtless find a place beside the Zoological Record in all libraries and entomological institutions throughout the world.

Jon L. Herring

THE ENTOMOLOGICAL WORK OF BENTLEY B. FULTON

ASHLEY B. GURNEY, *Entomology Research Division, A.R.S., U.S. Department of Agriculture, Washington, D. C.*

Bentley Ball Fulton was born at Newark, Ohio, August 29, 1889, and died at Raleigh, North Carolina, December 8, 1960. He wrote 75 entomological papers, a list of which is here appended. A portrait and brief biographical account have been published (C. F. Smith, Jour. Econ. Ent. *54:* 613-614, 1961). So far reaching were his achievements and so broad and keenly original were his interests and methods that a fuller and more personal review of his life and work will be useful to future biologists. He was a man who brought bionomics in the fullest sense into systematics. This biography is more than a tribute to his scientific accomplishments and fine human qualities; it is a look into his background and an appreciative summary of what he produced.[1]

The imprint of meticulous study and original ideas was left on both Dr. Fulton's researches in applied entomology and his investigations of insect biology and taxonomy. Crickets, which he studied throughout his mature life, seem common and well known to entomologists, but actually are incompletely collected and poorly understood. Richard D. Alexander (Systematic Zool., *11:* 59, 1962) has concisely expressed an appreciation of Fulton's results: ". . . the principal groundwork for a satisfactory classification of North American crickets was laid between 1915 and 1956, by the late Bentley B. Fulton's straightforward analyses of cricket behavior and its significance in taxonomic contexts. Fulton's work not only directly stimulated all four of the present North American cricket biologists (Richard Davenport, Robert Bigelow,[2] Thomas Walker, and the present writer) but it also gave them most of the clues that have accelerated progress toward a reasonable classification."

Dr. Fulton was graduated from Ohio State University in 1912, and by that time his interests, abilities, and resourceful character were fixed. His parents had not had the advantage of higher education, but both strongly encouraged their son's ambitions. How soon he became interested in natural history is not known, but by his junior year, 1910-11, when he was busy with courses in geology, botany, and allied subjects, he already was avidly becoming a naturalist after the manner of the "old school." An indelible influence that year, in

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[1]I am deeply indebted to the following individuals who have given me information on Dr. Fulton's early years: Carl J. Drake, Washington, D. C.; Wencel J. Kostir, Columbus, Ohio; Frank H. Lathrop, Arden, N. C.; and B. W. Wells, Wake Forest, N. C. Without this assistance, so kindly given, I could not have brought a personal touch to this account nearly so well. Likewise, Clyde F. Smith, North Carolina State College, has supplied information about Dr. Fulton's work there, and he has furnished the bibliography of his publications.

[2]Now working in New Zealand.

addition to that of his professors, who will be mentioned later, was his association with three other young students who roomed in the same house with him. They were J. L. King, who likewise became an entomologist; W. J. Kostir, the zoologist; and B. W. Wells, the botanist. The latter two became renowned teachers at Ohio State University and North Carolina State College, respectively; and King was outstanding for his work on the introduction of parasites of the Japanese beetle, for the U.S. Department of Agriculture. It was in the preparation of laboratory notebooks at this rooming house, surrounded by kindred spirits and appreciative friends, that Fulton developed his technique for pen and ink drawings, later used so effectively.

In the summer of 1911 these four congenial friends of comparable interests spent 10 weeks together in a hilly and then remote section of Hocking County, Ohio. They lived in a log cabin and a hay barn, tramped the woods, and studied natural history. Everything, including a borrowed microscope and a good assortment of reference books that significantly included Kostir's copy of Blatchley's "Orthoptera of Indiana," was carried in from the nearest railroad town 5 miles away; furniture was made from slabs. The summer's experience was

Fig. 1. J. L. King (left) and B. B. Fulton, at Raleigh, N. C., August 1944. (Photograph loaned by W. J. Kostir.)

significant because of their observations in natural history. Fulton and Kostir became much interested in Orthoptera and each made a small collection of them. For Fulton, the summer brought a closer association with a botany professor, Dr. Robert F. Griggs, who had introduced the four friends to the Hocking County region. Griggs visited the boys in their rough surroundings and was so impressed by Fulton's native ability and practical resourcefulness that a few years later he invited him to participate in the exploration of Mt. Katmai.

The close friendships of the summer were permanent, though all four friends were together only three times after 1911; the last time was in 1944 when the picture of Fulton and King was made (fig. 1).

In addition to Griggs, Ohio State University professors who had a profound influence on Fulton included the entomologists Herbert Osborn and James S. Hine, and the zoologist F. L. Landacre. Apparently Professor Osborn so stimulated Fulton during his junior year that he decided then to become an entomologist.

From 1912, following his graduation, until 1919, Fulton was a staff entomologist at the New York Agricultural Experiment Station, in Geneva. He found time to acquire a master's degree (1916) from the University of Chicago, and those years were otherwise memorable for several reasons. He was the sole author or contributed jointly to the preparation of 15 papers (see list). The orderliness of his mind which showed in his observations, the infinite care with which biologies were traced, and the masterly perfection of his drawings, qualities already evident in his student days, came into full development. The outstanding paper of the Geneva period was his bulletin on tree crickets of New York (1915c).

Mt. Katmai, at the base of the Alaska Peninsula, had erupted violently in 1912, and Robert F. Griggs led National Geographic Society exploring parties there during 4 summers, as described in the 1917, 1918 and 1921 volumes of the National Geographic Magazine. The initial party, in 1915, consisted of Griggs, Fulton, and Lucious G. Folsom, a manual-training teacher living near Kodiak. Parties in succeeding years were larger; and Fulton's former teacher, J. S. Hine, participated in some of them. Several photographs by Fulton were published in 1917, and a map showed Fulton's Fall, so-named by Griggs on a river in the Katmai area. The 1915 exploration was mainly of Mt. Katmai, and it was not until the following year that the now famous "Valley of Ten Thousand Smokes" was discovered.

Professor Kostir has written me of his own participation in the teaching of invertebrate zoology at the Marine Biological Laboratory, Woods Hole, Massachusetts, during the summers of 1917 and 1918. His enthusiasm must have found its way to Fulton because the latter came to Woods Hole in 1918 to take the famous course in General Physiology founded by Jacques Loeb, who was still on the staff. In Kostir's words, "In those years, the great advances in biology were being made in physiology and genetics, and these subjects were 'in the air' at Woods Hole, for many of the men doing this work spent their summers there. I feel that Bentley Fulton profited greatly from the facts and ideas which he absorbed that summer. To a considerable degree he became interested in the dynamic side of taxonomy—in speciation, and in physiologic characters of varieties."

In 1919 Fulton joined the staff of the Oregon Agricultural Experiment Station, Corvallis, Oregon, where he remained until 1924. He continued to study insect pests of fruit, as he had in New York, but broadened his responsibilities to deal with such topics as the biology and control of earwigs, and grasshopper control. Here, too, his love of the outdoors had an opportunity for expression. Professor A. L. Lovett, Head of the Department of Entomology, Fulton, and a third entomologist, Frank H. Lathrop, took many hiking and collecting trips together.

For the first few years at Oregon, both Fulton and Lathrop were bachelors, owning a house together, and Bentley's cooking ability came to be appreciated. One of his specialties was Irish stew. "We had a large kettle, holding about two gallons. He would cut up beef, potatoes, onions, etc. to fill the kettle. Every day we would boil the stew, and eat as much as we wanted, until it was gone. It was excellent stew, and the longer it lasted and the more it was boiled, the better it tasted!"

"Fulton characteristically was a man of few words. One year he made a trip to his old home in Ohio. His train ticket permitted him to stop off at any desired place enroute, remain there as long as he wished, and take a later train. He stopped off at several places to collect tree crickets, in which he was especially interested at that time. Upon boarding the train after one of his collecting stops, he went into the men's smoking room to change from his rough field clothes. This aroused the mild curiosity of another man in the smoking room. 'Doing some engineering work?' queried the man. 'No,' said Fulton. After a few minutes of silence, 'Are you a surveyor?' 'Nope,' responded Fulton. Another period of silence, 'What kind of work were you doing?' 'Just catching bugs,' replied Fulton. The man's mouth snapped shut, and there were no further questions!"—Two foregoing quotations from Frank H. Lathrop, letter of Dec. 27, 1962.

Many interesting western Orthoptera came under Fulton's scrutiny while he was in Oregon. Among the papers resulting from his critical observations was one on tree crickets and the 1930 faunistic paper, on Oregon Orthoptera. Four of the seven species and subspecies of Orthoptera which he described as new were proposed in the latter paper. Another observation in Oregon was that some oedipodine grasshoppers which "crackle" in flight do so by striking the posterior margin of the tegmen (front wing) against the anterior margin of the hind wing (1930c, p. 615).

Fulton moved to Iowa in 1924, to become an entomologist at Iowa State College. Here he obtained a doctorate in 1926, and remained until 1928. Then he went to North Carolina State College as a Professor of Entomology. He remained at Raleigh the remainder of his life, and retired as Emeritus Professor in 1954 because of gradually failing health. By 1959 he was confined to a wheelchair with Parkinson's Disease. During the North Carolina years he produced his most important work on crickets, especially those distinguished by biological differences as well as by morphological characters. He had previously pioneered with populations of tree crickets (*Oecanthus*) which, on the basis of songs, host-plant relationships, and life histories, he regarded as physiological races. In revisionary work published by Thomas J. Walker in 1962 (Ann. Ent. Soc. Amer. *55:* 303-322), some of those populations were considered distinct species.

In several papers, published in the 1930's on the small ground crickets of the genus *Nemobius,* Fulton searched even further than he had done with *Oecanthus.* To characterize various populations, he utilized genitalic characters where possible, mating behavior and cross-breeding experiments, and habitat preferences. Field crickets of the genus *Gryllus* (then called *Acheta*) were similarly studied, and conclusions regarding four "races" observed in North Carolina were published in 1952. All are now accepted as distinct species, and have been given formal names by Richard Alexander and others; Fulton had modestly refrained from applying scientific names, although he felt the degree of reproductive isolation between the "races" was "as complete as between true species."

Fulton's last paper (1956) dealt with the United States crickets of the genus *Anaxipha,* small delicate "bush crickets" which mainly inhabit the eastern half of the country. Except for cross-breeding experiments, he employed the same methods as for *Gryllus* and *Nemobius;* and he successfully used several previously overlooked types of morphological characters. Specific names were applied to all of the populations except two uncertain races of *Anaxipha exigua;* these await restudy by some patient investigator.

His most significant scientific contributions were in the field of cricket biology, and probably his ability to utilize the songs in recognizing species and interpreting behavior was the outstanding key to his success.

Only Harry A. Allard,[3] of approximately the same generation, demonstrated a comparable skill in his publishing of field observations of American cricket songs. But Allard, primarily a botanist, did not pursue the subject as completely nor reach as finished conclusions as Fulton. The new generation of cricket biologists, at present typified by Richard Alexander and Thomas Walker, supplement natural listening with audio equipment in both field and laboratory. Dr. Fulton's study of orthopteran stridulation enabled him to prepare, in 1932, a key to the sound-producing species of North Carolina based on their songs. He also discovered that the females of a considerable number of katydid species are able to make weak sounds; females had been generally supposed to be mute.

Dr. Fulton's work was of great value to systematists. To those concerned with the identification of North American Orthoptera, sev-

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[3] See "Harry A. Allard, Naturalist: His life and work (1880-1963)," by Ashley B. Gurney (Bull. Torrey Bot. Club *91:* 151-164, 1964).

eral of his papers are standard references; and, as already indicated, he pointed the way for current cricket biologists who are revising the genera with which he worked. More importantly, however, the basic truths concerning biological distinctions between many species, which scarcely can be told apart by morphological characters and which he painstakingly learned and modestly suggested, have been a vital stimulating force in systematics throughout the world. Those at the forefront of scientific thought on evolution and speciation have used his conclusions in developing principles explaining the nature and relationships of species.

He will be long remembered for his illustrations of insects, especially his drawings of tree crickets and of their eggs. Several drawings of the European earwig have also been used widely by other writers.

In 1938, in the mountains of western North Carolina, he discovered the larvae of a fungus gnat, later named *Platyura fultoni* by Elizabeth Fisher. These larvae are luminous and construct a delicate web in which small prey such as Collembola are caught. The two plates he made of the webs and larvae of this species, the first luminous dipterous larva found in the United States, are striking demonstrations of his art.

Dr. Fulton's official duties usually involved little teaching, and most of his work was done in the capacity of a research entomologist. However, at both Iowa State College and North Carolina State College, he taught courses in applied entomology; he also directed the studies of several graduate students. In Iowa his research emphasized the control of insect pests of apples, and in North Carolina the stress was on vegetable insects, with special attention to southern corn rootworm, cabbage maggot, and pickleworm. He also worked on strawberry insects, those attacking blueberries, the cheese skipper, tobacco hornworm, and other important pests.

He had a dry wit and a keen sense of humor, which were well demonstrated at Geneva when for a station party he drew some appropriate cartoons of various staff members; they were displayed in a "Rogues' Gallery" with a "crime" specified under each picture.

It was the nature of Bentley Fulton to be honest, unassuming, and straightforward. He was so dependable, so considerate of others that friendship with him was just that, in the finest sense of the word.

Dr. Fulton was a devoted family man. He is survived by his wife, Mrs. Ida Timm Fulton, whom he married in 1923, and two daughters, Mrs. Margaret Fulton Hart of Atlanta, Georgia, and Mrs. Dorothy Fulton Crews of Long Island, New York.

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1913b. Apple insects (with W. J. Schoene). N. Y. Agr. Expt. Sta. Cir. No. 25: 1-11.

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1914b. The cabbage aphis (with P. J. Parrott). N. Y. Agr. Expt. Sta. Cir. 30: 1-4.
1914c. Tree crickets injurious to orchard and garden fruits (with P. J. Parrott). N. Y. Agr. Expt. Sta. Bull. 388: 417-461.
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BOOK NOTICE

How to Know the Grasshoppers, Cockroaches and their Allies. By Jacques R Helfer. 21 cm. Wm. C. Brown Co., 135 S Locust St., Dubuque, Iowa. 1963. 353 pp., 579 figs. Price: $4.25 (cloth), $3.50 (spiral).

This book is the latest volume in the "Pictured-key Nature Series" edited by the late Prof. Harry E. Jacques. In addition to Orthoptera (broad sense), it includes Dermaptera, Isoptera and Zoraptera from America north of Mexico, and as a result of the mainly original keys, drawings which are excellent for the most part, and novel methods of presentation, it is a very refreshing and attractive addition to the growing number of handbooks on American insects. The book is intended for nonprofessional readers, but such a large portion of the Nearctic species are discussed and illustrated that many people at or close to the professional level will find it of interest. The author, a businessman, experienced amateur naturalist, and artist of Mendocino, Calif., shows a close familiarity with the standard sources of information on orthopteroid insects, reflecting his own general competence and the cooperation received from several systematists.

DIFFERENTIATION OF THE LARVAL INSTARS OF AEDES SOLLICITANS (WALKER) AND A. TAENIORHYNCHUS (WIEDEMANN) (DIPTERA: CULICIDAE)

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The separation of fourth-instar larvae of the salt-marsh mosquito species, *Aedes* (*Ochlerotatus*) *sollicitans* (Walker) and *A.* (*Ochlerotatus*) *taeniorhynchus* (Wiedemann), presents no difficulty since the comb scales are markedly different in the two species. Additionally, several other clearly defined differences exist. However, the other larval instars are not so precisely separable. This is particularly true of the second-instar larva. Because of this, a comparative study of all four larval instars has been made. This paper presents the difference found. The need for such a study is particularly indicated in view of the fact that these two species are commonly found breeding together.

The chaetotactic nomenclature used in this paper is after Belkin (1950).

Aedes (Ochlerotatus) sollicitans (Walker)

The fourth-instar larva of this species has been described in more or less detail by a number of authors, including Smith (1904), Mitchell (1907), Carpenter, Middlekauff, and Chamberlain (1946), Dyar (1928), Lane (1953), Matheson (1944), Ross (1947), and Carpenter and LaCasse (1955). However, no one has described all of the thoracic and abdominal chaetotaxy. Accordingly, the complete chaetotaxy is figured here (figs. 1-5). Furthermore, counts of numbers of branches have been made for nearly all of the hairs on a small number of specimens (available upon request from the author as mimeographed tables).

The other larval instars have not been previously described. However, Elmore and Fay (1958) reported that the first-instar larva of *A. sollicitans* has two long terminal antennal hairs (fig. 10: hairs 2 and 3) and is thereby readily distinguishable from the first-instar larva of *A. taeniorhynchus*, which has only one long terminal hair (hair 2) on the antenna.

Fourth-Instar Larva.

Antenna (figs. 1 and 11). Shaft rather dusky beyond antennal hair, cylindrical, slightly tapered distally, sparsely spiculate. Antennal hair (hair 1) inserted dorsally slightly before the middle, with 3-7 branches; hairs 3 and 4 short; hair 2 longer and apically bent.

Head (fig. 1). Clypeal spine (hair 1) evenly tapered, acute, curved; hair 2 not seen; hair 3 minute, slender, hair 4 inconspicuous, with 2-4 branches; hair 5 single; hair 6 single, shorter than hair 5; hair 7 with 7-10 spiculate branches; hair 8 single; hairs 9 and 10 single or double; hair 11 with 4-6 branches; hair 12 single; hair 13 with 4-6 branches; hair 14 single or double; hair 15 with 2-4

[1]This work was accomplished at the Naval Medical Field Research Laboratory, Camp Lejeune, N. C.

branches (occasionally single). Mentum with 9-11 even teeth on either side of middle tooth. Median elements of mouth brushes with comblike tips.

Thorax (fig. 2). Smooth. Prothorax: Hairs 1, 5, 6, 7, and 8 large, spiculate. Hair 8 is 0.56 to 0.72 as long as hair 7. Mesothorax: Hairs 5, 6, 7, 8, 9, 10, and 12 large, spiculate. Hairs 13 and 14 small, densely branched. Metathorax: Hairs 7, 9, and 10 large, spiculate. Hairs 8 and 13 small, densely branched.

Abdomen (figs. 3, 4, and 5). Smooth. Seg. I: Hairs 6 and 7 large, spiculate. Seg. II: Hair 6 large, spiculate; hair 7 shorter, spiculate. Segs. III to V: Hairs 6 and 13 large, spiculate. Seg. VI: Hair 6 large, spiculate. Seg. VII: Hairs 1 and 13 most pronounced. Seg. VIII: Comb consisting of a patch of 10-46 spines, each spine bearing short baso-lateral spinules. Hair 1 with 4-8 branches; hairs 2 and 4 single; hair 3 with 7-11 branches; hair 5 with 4-8 branches. Siphon: Pale; index 2.03-2.37; acus present; single pair of hair tufts (hair 1) just distal to terminal pecten tooth, with 3-7 finely spiculate branches; pecten composed of a line of 18-28 teeth, rather evenly spaced, most of the teeth with a rather prominent denticle just before the middle and with 1-3 smaller denticles basally. Anal Segment: Anal plate complete; a paired detached acus-like structure basolaterally; spiculation very fine, inconspicuous, without stout spicules laterally on the dorsoposterior margins; hair 1 (*lh*) single, shorter than width of anal plate; hair 2 (*isc*) with 6-14 branches; hair 3 (*osc*) single, about twice length of *isc;* hair 4 (ventral brush) with 16 (once 17) tufts, each tuft arising from the barred area, posterior 4 bars not laterally connected. Anal gills variable in length, shorter than anal plate when larva is reared in brackish water, as long or slightly longer than anal plate when reared in fresh water.

Third-Instar Larva.

Similar to the fourth-instar larva except as follows: Antennal hair 4 less sharply bent. Hair 8 of the prothorax is 0.21 to 0.44 as long as hair 7. Area of sclerotization of siphon reduced basaly, as shown in figure 9. Anal plate incomplete. Two to four of the basal ventral brush tufts not arising from well-defined grid elements (of the barred area). In general, all hairs have fewer branches than they do in the fourth-instar, and on the average there are fewer comb spines and pecten teeth.

Second-Instar Larva.

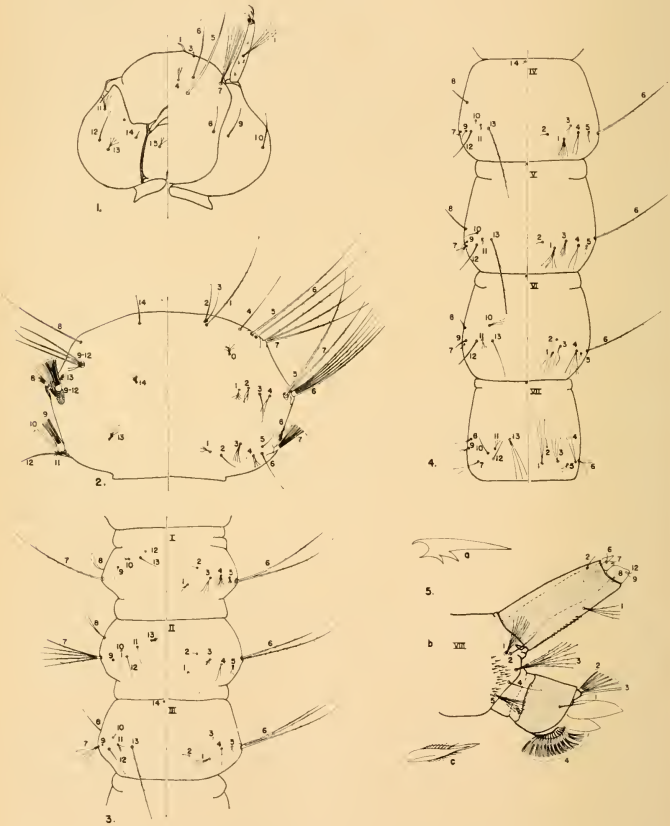
Generally similar to the third instar. Area of sclerotization of siphon still more reduced basally, as shown in figure 8. Differing principally in the even more incomplete development of the ventral brush, which has six to nine of the basal tufts not arising from well-defined grid elements. Comb spine and pecten teeth generally fewer in number (table 1).

First-Instar Larva.

Conspicuously differing from the other larval instars in having the egg burster (*eb* in fig. 6) present on the head, and in completely lacking the ventral brush (fig. 7). Terminally, the antennae each have two long hairs and two short ones (fig. 10).

Aedes (Ochlerotatus) taeniorhynchus (Wiedemann)

The fourth-instar larva of this species has been described in some detail by the following authors: Lane (1953), Carpenter, Middlekauff, and Chamberlain (1946), Dyar (1928), Matheson (1944), and Carpenter and LaCasse (1955). However, as with *A. sollicitans*, no one has described all of the chaetotaxy. Since there are no basic differences in the type and position of the body hairs, drawings were not prepared. However, counts of numbers of branches have been



Larva of *Aedes sollicitans*. Fourth instar. (All figures with a center line illustrate the ventral surface on the left and the dorsal surface on the right). Fig. 1, Head; Fig. 2, Thorax; Fig. 3, Abdominal segments I-III; Fig. 4, Abdominal segments IV-VII; Fig. 5, Terminal abdominal segments.

made for all hairs on a small number of specimens (available upon request from the author as a mimeographed table). The first-instar larva has been figured and included in a key to the first-instar larvae of California *Aedes* by Bohart (1954). The other larval instars have not been previously described.

Fourth-Instar Larva.

Differing from the fourth-instar larva of *A. sollicitans* principally as follows: integument of thorax and abdomen densely spiculate (spicules easily visible at 90x). Hair 8 of prothorax is 0.06 to 0.13 as long as hair 7. Comb consisting of a patch of scales, each scale with a rather even apical fringe of spinules. Anal plate without an acus-like structure; with stout spinules laterally on the dorso-posterior margin. Siphon index 1.5-1.8; most of the pecten teeth with several basodorsal denticles, as well as 1-4 closely spaced ventral denticles before the middle.

Third-Instar Larva.

Similar to the fourth-instar except as follows: antennal hair 4 less sharply bent. Hair 8 of the prothorax is 0.05 to 0.07 as long as hair 7. Area of sclerotization of siphon reduced basally similar to that shown for *A. sollicitans* in figure 9. Anal plate incomplete. One to three of the basal ventral brush tufts not arising from well-defined grid elements. Body spiculation present but not as pronounced as in the fourth stage. In general, all hairs have fewer branches than they do in the fourth stage, and there are fewer comb spines and pecten teeth. This instar differs from the equivalent instar of *A. sollicitans* in the same manner that the fourth instar does.

Second-Instar Larva.

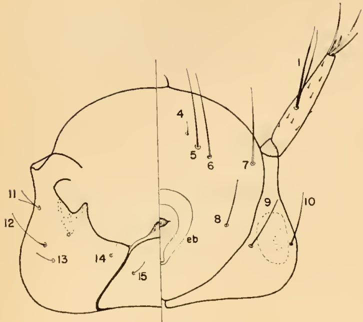
Differing from the third-instar larva in the same manner as described for *A. sollicitans.* This instar differs from the equivalent instar of *A. sollicitans* principally on the shape of the comb teeth. While tending to overlap with the shape of the comb teeth typical for *A. sollicitans,* the patch of comb teeth found on this stage of *A. taeniorhynchus* will differ in that inevitably some of the teeth will have more than one strong apical spine and/or an apical fringe of spinules. The spiculation of the body, so prominent on the fourth instar and less so on the third, is absent or quite indistinct here.

First-Instar Larva.

This stage is closely similar to the same instar of *A. sollicitans* but differs in the easily determined characteristic of having only one long terminal hair on the antenna.

Separation of Instars

Details sufficient for distinguishing between instars are contained in table 1. Measurements of the head capsule were made in the region of greatest width, which occurred commonly between the ocular areas. Care was taken to use only unflattened specimens for this purpose. The second and third instars are often difficult to distinguish from one another. Reference to figures 8 and 9 shows that the siphonal



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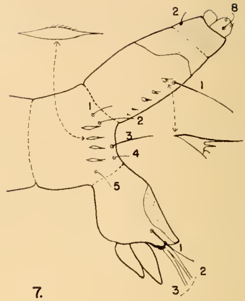

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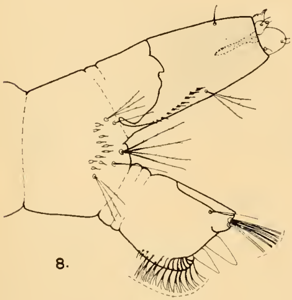

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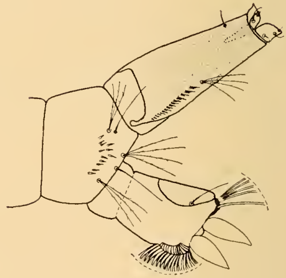

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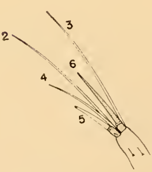

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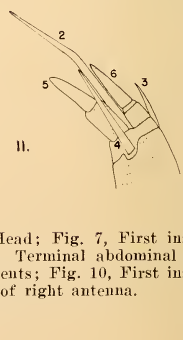

11.

Larva of *Aedes sollicitans*. Fig. 6, First instar. Head; Fig. 7, First instar. Terminal abdominal segments; Fig. 8, Second instar. Terminal abdominal segments; Fig. 9, Third instar. Terminal abdominal segments; Fig. 10, First instar. Apex of right antenna; Fig. 11, Fourth instar. Apex of right antenna.

Table 1. Table for separation of the larval instars of *Aedes sollicitans* and *A. taeniorhynchus.*

Instar	Egg burster (*eb*, fig. 6)	Width of head capsule (in mm.) (range)	Number of comb scales (range)	Number of pecten teeth (range)	Anal plate	Ventral brush: Number of basal tufts not arising from grid elements
1st	Present	0.25-0.40	4-6	3-5	Incomplete	No ventral brush
2nd	Absent	0.44-0.58	8-13	8-12	Incomplete	6-9
3rd	Absent	0.70-0.92	10-24	11-21	Incomplete	1-4
4th	Absent	0.92-1.35	9-46	18-28* 12-19**	Complete	0

A. sollicitans.
**A. taeniorhynchus.*

Table 2. Table for separation of *Aedes sollicitans* and *A. taeniorhynchus* in the various larval stages.

Instar	Character	*A. sollicitans*	*A. taeniorhynchus*
1st	Terminal antennal setae	Two long setae	Only one long seta
2nd	Comb teeth	With only one pronounced spine (fig. 7)	At least some with apical fringe instead of apical spine
3rd	Prothoracic hair 8	0.21 to 0.44 as long as hair 7	0.05 to 0.07 as long as hair 7
	Body spiculation	Absent	Present (not pronounced)
	Comb teeth	Same as in 2nd instar	Same as in 2nd instar
4th	Prothoracic hair 8	0.56 to 0.72 as long as hair 7	0.06 to 0.13 as long as hair 7
	Comb teeth	Each one a spine, bearing short baso-lateral spinules (fig. 5c)	Each with rather even apical fringe of spinules
	Anal plate	With a paired detached acus-like structure basolaterally	Without such a structure
		Without stout spiculation	With stout spicules laterally on the dorso-posterior margins
	Pecten teeth	Without baso-dorsal denticles	Most of teeth with several baso-dorsal denticles

sclerotization of the third instar is more complete than that of the second. However, in addition to differences in head capsule width, these two stages are best distinguished on the number of the basal tufts of the ventral brush not arising from lateral grid-element bars, the third stage having significantly fewer (1-4) than the second stage (6-9).

Separation of Species

Table 2 summarizes the characters which aid in the separation of *A. sollicitans* and *A. taeniorhynchus* in the various larval instars. The larvae of these two species are most difficult to separate in the second stage. The only character presently known to be useful for this purpose is the shape of the comb teeth. Although considerable intergradation in shape and spinulation of the comb teeth occurs between the two species, the comb patch of *A. sollicitans* was not seen to have teeth other than with a single strong central spine; whereas, at least some of the comb teeth of *A. taeniorhynchus* have only an apical fringe of spinules or else more than one strong apical spine.

A count of the number of branches of all head and body hairs for a small number of fourth instar larvae of both species is available upon request to the author.

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APHIDS ON A ROOFTOP

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Dorchester House, where I live, is a 9-story apartment building situated at the corner of Euclid & 16th Streets, N. W., in Washington, D. C. The roof of the building is about 200 feet above the street level. Across 16th St. to the east is Meridian Hill Park, an area of about 12 acres with about 60 very large red and white oaks and many large elms as well as a number of hawthorns, dogwoods and a considerable variety of ornamental shrubs and other plantings. Less than a mile to the west is the National Zoological Park of approximately 175 acres with many trees and shrubs, and northward this continues into wooded Rock Creek Park, an area of nearly 1800 acres extending along Rock Creek. Most of this area is native woodland with many kinds of wild plants.

One section of our roof is finished off as a sundeck with a number of Cape Cod chairs, several of which are painted yellow. On June 3 and 4, 1961, following rains in the night, I collected about 100 winged specimens of the oak aphid, *Myzocallis multisetis* Boudreaux and Tissot, which were stuck to the wet surface of the yellow chairs. None were on the red, white or green chairs. With this experience in mind, in 1962 I conceived the notion of putting out a Moericke Trap on an unused section of the roof to see if aphids would come to it. No trap has been operated elsewhere in such a location as far as I know. I painted a shallow, 11 x 7 inch, cake tin a rich yellow and kept it filled with water. The pan was first put out on May 8 and was finally taken in on October 18. The aphids were removed daily. Due to my absence from Washington, it was not in place from May 20 to June 1 and from September 12 to October 9. The total exposure was 118 days.

During the season just described, a total of nearly 1000 winged aphids were taken in the water pan—a tiny spot of yellow on the dark roof surface and under the vast expanse of open sky. These aphids represented 24 genera, 48 identified species, seven determined with a query and several determined only to genus. Eleven of the species had not been identified previously from the District of Columbia or vicinity (within a radius of about 40 miles), six others only once before, and several of the rest have been collected here only a few times. Thus this trap revealed the presence of aphids rarely or never before taken in this area in the examination of plants.

Although the aphids represented a rather wide range of food plants, the predominating ones came from oaks, presumably from the trees across the street. Nearly 500 individuals represented eight species in the genus *Myzocallis* and about half of the oak aphids were *M. punctata* (Monell) which is partial to white oak. About 40 specimens of the beautiful black and yellow birch aphid, *Calaphis betulella* Walsh, were taken. Although hickories and walnuts have not been observed by me in the neighborhood, about 90 examples of the black pecan aphid, *Melanocallis caryaefoliae* (Davis), were caught, and four or five other hickory aphids were taken in small numbers. Only a few maple aphids of the genus *Drepanaphis* came to the pan, although by early October two 40-50 foot maples on the lawn just below the location of the pan had built up an enormous population.

My thanks are extended to J. O. Pepper for making a great many determinations, and to A. T. Olive, W. R. Richards, C. F. Smith, A. N. Tissot and Louise M. Russell for determinations and opinions.

The ahids, with the number caught in the trap each month, are as follows: *Acyrthosiphon pisum* (Harris), 30 Apr., 4 on yellow chair. *Anuraphis maidiradicis* (Forbes), 1–19, May, 2; June,11; July,8; Aug.,8. **A. rumexicolens* (Patch), 1–19 May, 1; June,5. **A. helichrysi* (Kaltenbach), June, 2. *A. tulipae* (Fonsocolombe), 1–19 May, 1. **Aphis armoraciae* Cowen, June, 1. *A. craccivora* Koch, Aug, 2. *A. fabae* Scopoli, June, 2; July, 1. *A. gossypii* Clover, 1–19, May, 5; June, 4; July, 2. *A. illinoisensis* Shimer, June, 1. *? *A. oestlundi* Gillette, June,1. ? *A. pomi* DeGeer, June, 2. ? *A. rumicis* (Linnaeus), Aug., 2. *A. spiraecola* Patch, 1–19 May, 1; June, 1; July, 3. *Brevicoryne brassicae* (Linnaeus), 1–11 Sept., 2. *Calaphis betulella* Walsh, June,37; July, 3. *Capitophorus glandulosus* (Kaltenbach), June, 2. [1]*C. hippophaes* (Walker), July, 1. *Capitophorus* sp., June, 1. *Chaitophorus* sp., June, 1; Aug., 1; 10–18 Oct., 1. *C. populicola* (Thomas), June, 1. **Dactynotus erigeronensis* (Thomas), July, 1. *Dactynotus* sp., 1–2 May, 2 on yellow chair. *Drepanaphis acerifolii* (Thomas), July, 3; Aug, 2. **D. carolinensis* Smith, 1–19 May, 1; June, 5; July, 2; Aug., 1; 10–18 Oct., 12. *Eriosoma lanigerum* (Hausmann), June, 2. **Euceraphis mucida* (Fitch), Aug., 2. *? *Eulachnus agilis* (Kaltenbach), Aug., 1. **E. rileyi* (Williams), July, 1; 10–18 Oct., 1. *Hamamelistes spinosus* Shimer, June, 1. *Hyadaphis pseudobrassicae* (Davis), 1–19 May, 2; June, 2. [1]*Hyalopterus atriplicis* (Linnaeus), June, 5; July, 7; Aug., 1. *Macrosiphoniella sanborni* (Gillette), June, 1. *Macrosiphum euphorbiae* (Thomas), 30 Apr., 1 on yellow chair; *Macrosiphum* spp., June, 11. *Melanocallis caryaefoliae* (Davis), 1–19 May, 82; June, 9. *M. "fumipenellus"* (Fitch), 1–19 May, 1; June, 6. [1]? *Monellia caryae* (Monell), June, 2; July, 1. ? *M. caryaella* (Fitch), 1–19 May, 6; June, 1. *M. costalis* (Fitch), 1–19 May, 1; June, 4; July, 2. *M. nigropunctata* Granovsky, June, 5; July, 2. [2]*Myzocallis alhambra* Davidson, 1–19, May, 37; June, 130; July, 4, Aug., 11. *M. discolor* (Monell), 1–19 May, 3. [1]*M. exultans* Boudreaux & Tissot, June, 1. *M. granovskyi* Boudreaux & Tissot, 1–19 May, 1; July, 1. [1]*M. melanocera* Boudreaux & Tissot, June, 1. [1]*Myzocallis multisetis* Boudreaux & Tissot, 1–19 May, 16; June, 27; July, 4. [2]*M. punctata* (Monell), 1–19 May, 169; June, 76. **M. punctatella* (Fitch), 1–19 May, 2; June, 1; July 1. *M. tiliae* (Linnaeus), June, 1; July 3; Aug., 1. *M. ulmifolii* (Monell), June, 30; July, 3. *M. walshii* (Monell), 1–19 May, 2; June, 47; July, 10; Aug. 1. *Myzus circumflexus* (Buckton), Aug, 1. *M. persicae* (Sulzer), 1–19 May, 4; June, 4; July, 17; Aug. 34. *Neosymydobius annulatus* (Koch), 1–19 May, 1; 10–18 Oct., 1. [2]*Prociphilus imbricator* (Fitch), 1–11 Sept., 1. **Rhopalosiphum* n. sp., June, 1. *Rhopalosiphum maidis* (Fitch), July, 3 Aug., 1; 10–18 Oct. 1. *Schizaphis graminum* (Rondani), June, 2.

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* First record for D. C. and vicinity.
[1] Second record for D. C. and vicinity.
[2] Third record for D. C. and vicinity.

THE CHRYSOGASTER (ORTHONEVRA) BELLULA GROUP IN NORTH AMERICA

(DIPTERA : SYRPHIDAE)

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Confusion has existed for some time concerning the identification of the members of the genus *Chrysogaster* Meigen. This paper is the first of a series to treat the genus.

The North American species of the subgenus *Orthonevra* Macquart can be divided into several groups based on eye maculations. The species to be treated here exhibit several vertical brown stripes in addition to a single transverse stripe. The Central and South American species of this group will be covered in a later paper.

The species of the *bellula* group show close similarity in basic structure. The following description will serve as a general guide to their characteristics.

GENERAL MORPHOLOGY OF THE bellula GROUP

Head. Face black with bluish reflections; purplish reflections predominate in the area adjacent to the lateral silvery gray pollinose side-spots present at the level of the antennae; a triangular azure-blue spot is typical of the upper portion of the supraepistomal concavity; epistoma projects to or slightly beyond the gradual facial bulge below the antennae; the lateral areas of the face roughened into the form of longitudinal wrinkles which continue onto the front; lateral triangular pollinose side-spots small, not extending more than 1/4 the distance across the face; median facial area below antennae devoid of deep wrinkles or pile, with very fine transverse striations; front aeneous medially, excavated with deep, more or less irregular grooves; cheeks polished black; antennae elongate, brownish, usually lighter below, with light pile below and dark pile above on second antennal segment; eyes light brown with dark brown markings in the form of vertical stripes and a single transverse stripe; head clothed with whilte pile or scales, generally rather sparse.

Thorax. Scutum shining light blue, with deep, coarse punctures, and four subopaque broad brown to purple vittae, and usually one pair of linear lateral vittae; mesopleura, pteropleura, and hypopleura, with numberous coarse punctures and sparse white ple, with bluish reflections anteriorly and purplish posteriorly; remainder of pleural area polished black and devoid of pile; wings with apical crossvein at right angles to the third longitudinal vein; wings with brownish clouds along the crossveins and with diffuse brownish spots in the wing cells; squamae white, often brown below; halteres white to yellow, the knob darker; legs shining black, often with purplish reflections, the basal tarsal segments and portions of the tibiae, yellow; scutellum subquadrate, blue along the margin and purple medially, without a ventral fringe; post-scutellum with a shining blue area surrounded by a white pollinose area.

Abdomen. Dorsal opaque surface bluish or green, usually with opaque purple or bronze at apices of second and third, and sometines fourth, segments; lateral shining

[1] This study was supported by a National Science Foundation grant (GB-1336).

black margin of abdomen with varying amounts of shining purple which is continuous with the purple of the dorsum; ventral surface shining black with appressed white pile; fourth sternite asymmetrical in male, with a weak lobe at right apical extremity; last tergite of female pre-abdomen (segment five) gently concave posteriorly.

Length. Overall length, excluding antennae, of males 4.5–6 mm., females 5–7 mm.

The following key will separate the species of this group known to occur in North America, north of Mexico.

Key to the Species of the bellula Group

1. Face with normal pile, devoid of scales 2
   Face without pile, clothed with scales 4
2. Second antennal segment subequal in length to third .... **bellula** Williston
   Second antennal segment definitely shorter than third, usually one-half as long as third 3
3. Eyes with three vertical stripes (fig. 7) .... **nitidula** Curran
   Eyes with two vertical stripes (fig. 6) .... **sonorensis,** n. sp.
4. Second longitudinal vein terminates at same level as the junctio between the third longitudinal vein and apical crossvein (last section of fourth longitudinal vein); brown wing markings on these veins forming a broad band at right angles to costa (fig. 12) .... **flukei,** n. sp.
   Second longitudinal vein ends basad of the junction between the third longitudinal vein and apical corssvein; brown markings on these veins disconnected or curve , never forming a straight single broad band (fig. 14) .... **nitida** Wiedemann

Chrysogaster (**Orthonevra**) **bellula** Williston

Chrysogaster bellulus Williston, 1882, Trans. Amer. Phil. Soc. 20: 304.

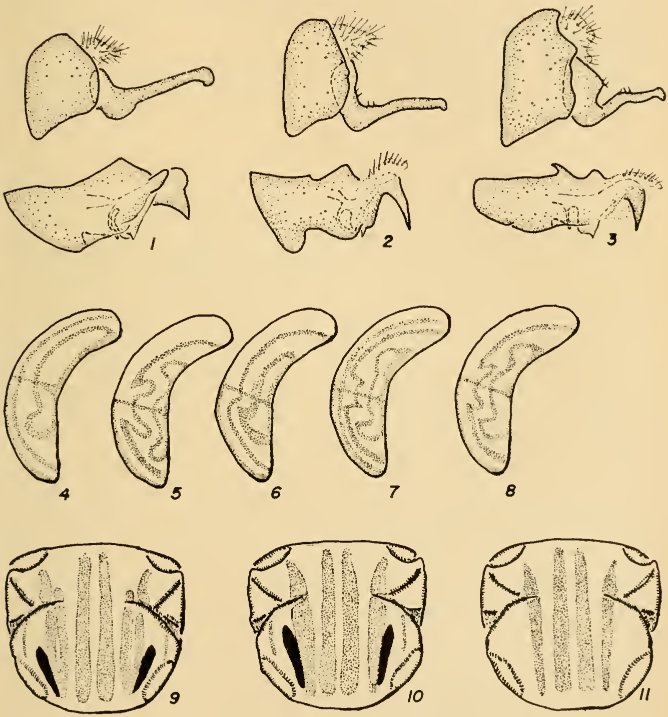
This is a relatively large and distinctive species. The hairy face which is almost shaggy, elongate second antennal segment, simple eye markings (fig. 4), and distinctive male genitalia (Sedman, 1959), will separate this species from all others in the group. The second antennal segment is always shorter than the third, but it is subequal in length to the third. The male genitalia are quite aberrant and their general enlargement results in the hook-like ejaculatory hood being exposed in dried specimens. The purple scutal markings are rather unique. This is the only species of the group which does not possess a linear stripe between the posterior calli and thoracic suture, nor is a shining purple area visible lateral to the outer scutal stripes (fig. 11). The length of the males is 5-6 mm., the females 6-7 mm.

The geographic distribution is also distinctive. The species is common at high elevations in Washington, Oregon, and Idaho, and is also common throughout Utah, California, Arizona, Nevada, and New Mexico. I have not seen any specimens from Mexico.

C. (O.) nitidula Curran

Chrysogaster nitidula Curran, 1924, Kans. Univ. Sci. Bull. 15: 116.

Although this species had not been recognized since its description, it is an easily distinguished species. The following combination of characteristics will separate it from the other members of this group: three



Figs. 1–3, Male genitalia. Fig. 1, *Chrysogaster* (*Orthonevra*) *sonorensis*, n. sp.; fig. 2, *C.* (*O.*) *nitidula* Curran; fig. 3, *C.* (*O.*) *flukei*, n. sp. Figs. 4–8, Eye markings. Fig. 4, *C.* (*O.*) *bellula* Will; fig. 5, *C.* (*O.*) *nitida* Wied; fig. 6, *C.* (*O.*) *sonorensis*, n. sp.; fig. 7, *C.* (*O.*) *nitidula* Curran; fig. 8, *C.* (*O.*) *flukei*, n. sp. Figs. 9–11, Scutal pattern, stippled areas represent opaque purple, black areas represent shining purple. Fig. 9, *C.* (*O.*) *nitida* Wied.; fig. 10, *C.* (*O.*) *flukei*, n. sp. (identical with *sonorensis*, n. sp. and *nitidula* Curran); fig. 11, *C.* (*O.*) *bellula* Will.

vertical stripes separated from the eye margins, anterior two sinuous, posterior one gently curved (fig. 7); second antennal segment almost one-half of the length of the third; wing with apex of second vein and junction between apical crossvein and third longitudinal vein approximately the same distance from wing base, and with a broad brown cloud over and connecting them (fig. 15); face with sparse, normal white hair.

I have not examined the type of this species, but a number of topotypes were available and there can be no mistake about the identity of the species. The male genitalia are symmetrical and distinctive, and are illustrated for the first time (fig. 2).

The geographic distribution of this species is limited to southern Arizona, Texas, and New Mexico. It would appear that further collecting will result in records from the states of Northern Mexico.

C. (O.) sonorensis, n. sp.

Male. Eyes with two median brownish stripes which are moderately sinuous below the transverse stripe, otherwise gently following the contour of the eye; the anterior and posterior margins of the eyes with normal brown markings (fig. 6). Facial color black with bluish reflection; pile normal, white. Antennae with third segment approximately twice as long as the second; color reddish, brownish above on third segment. Pile sparse.

Scutum bluish with four opaque longitudinal purple stripes which are broadened posteriorly; a linear stripe between the posterior calli and the scutal suture. Scutellum bluish on margin and shining purple elsewhere. Legs shining black, yellow on basal two segments of the tarsi. Wings with broad brown cloud on apical crossvein and over marginal cell; 2nd longitudinal vein proximal to apical crossvein, the latter slightly recurrent, and the cloud slightly diagonal in position (fig. 13).

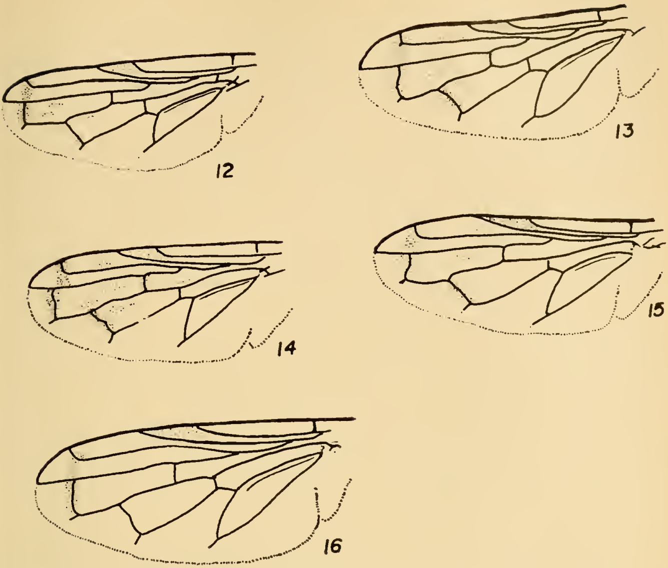
Abdomen washed-out opaque blue, with opaque purplish markings at base of segments two and three, and sometimes four; this purple broadened laterally, and shining on the polished black margins. Genitalia of the male symmetrical; the ejaculatory hood shows some variation from that illustrated (fig. 1), and in some individuals is closer to the shape illustrated for *flukei*, n. sp. (fig. 2).

Female. Front with definite longitudinal groove, apical crossvein not quite so recurrent, otherwise like male.

Length. Male 4.5 mm., Female 5.5.

Holotype, male, from Catalina Mts., Ariz., Htchk. Hwy. Mi. 19, 18 July 1955, F. G. Werner and G. D. Butler, in the collection of the University of Arizona. Allotype, female, same data.

Paratypes. ARIZONA: Catalina Mts., Htchk. Hwy. Mo. 19, 18 July 1955, F. G. Werner and G. D. Butler, *Ceanothus*, 2 males; 22 Aug. 1955, *Ceanothus Greggi*, 1 male. Chiracahua Mts., 5 July 1950, D. E, Hardy, 2 males; 3 July 1947, L. D. Beamer, 1 male. Rustler's Park. Chiracahua Mts., 5 July 1940, D. E. Hardy, 1 female. Santa Catalina Mts., 14 July 1950, L. D. Beamer, 1 male, 1 female. NEW MEXICO: Jemez Springs, 1 July 1941, B. Hodgen 2 males.



Figs. 12–16. Wings. Fig. 12, *C. (O.) flukei*, n. sp.; fig. 13, *C. (O.) sonorensis*, n. sp.; fig. 14, *C. (O.) nitida* Wied.; fig. 15, *C. (O.) nitidula* Curran; fig. 16, *C. (O.) bellula* Will.

The geographic distribution is limited to southwestern United States. Like *nitidula* Curran, it seems reasonable that it also occurs in the northern states of Mexico.

This species may be confused with *nitidula*, since it has a similar distribution, short second antennal segment, and lacks facial scales. It is easily separated from *nitidula* by the distinctive genitalia and by the eye markings. In *sonorensis*, the superior lobes of the male genitalia are well developed and spinose, while in *nitidula* the lobes are degenerate and merely appear as weak ridges along the anterior margin of the penis sheath. The eye maculations are similar to those of *bellula* Will., but the short second antennal segment and sparse facial pile of *sonorensis* separate these species.

C. (O.) flukei, n. sp.

Male. Eye markings sinuous, varying from two parallel brown bands to coalescing bands which result in one or more sets of circular markings (fig. 8). Face aeneous black with some purple and bluish reflection; devoid of normal pile; scales of face evenly distributed laterally, except for a line along the eye margin where they are more concentrated, and absent along a broad median line from the antennae to the epistoma; epistoma projecting almost as far as facial bulge. Antennae brownish, 1st segment often yellowish; segment three longer than two but subequal in length. Cheeks shining black with white scales anteriorly, and white pile posteriorly. Front aeneous, often purplish centrally; scales present. Vertex aeneous, pile blackish; ocellar triangle raised.

Thorax greenish or weakly bluish, with four broad longitudinal purplish stripes and two narrow purplish streaks between posterior calli and thoracic suture; pile short and white on scutum. Scutellum bluish on margin and shining purple elsewhere. Legs shining black, yellow on basal two tarsal segments and basal 1/4 of hind tibiae. Wings with apical crossvein clouded, connected to cloud on 2nd longitudinal vein; brown spots of variable intensity in wing cells; stigma dilute yellow. Halteres pale yellow. Squamae white with darkened margin.

Lateral margins of abdomen shining blue on first abdominal segment, purplish on remaining segments, or remaining segments more or less blue basally, with purple restricted to some portion of the apical margins. Dorsum of abdomen subopaque blue, more or less subopaque purple or bronze on apical portions of segments two, three, and four. Genitalia symmetrical; cerci longer than broad.

Female. Front narrowed above with a longitudinal depression and more or less distinctive grooves laterally; white pile present on upper angles of front in addition to the abundant white scales; vertex with white pile; stigmal cell of wing darker: lateral margins of first segment of abdomen shining black, remainder usually purple.

Lenth. Male, 4.5 mm., female 5.5.

Holotype— male from 17 mi. E. Douglas, Ariz., Cochise Co, 8August 1958, C. G. Moore, in the collection of the University of California at Davis. Allotype, female, same data.

Paratypes. ARIZONA: Bill Wms. Fork, Aug., F. H. Snow, 1 male. Canelo, 3 Aug. 1956, G. D. Butler, 1 male. Catalina Mts., Htchk. Hwy. Mil. 19, 9 July 1957, F. G. Werner, *Ceanothus*, 1 female; 18 July 1955, F. G. Werner and G. D. Butler, *Ceanothus Greggi*, 1 male. Chino Valley, 27 July 1956, Gebhardt & Butler, swept/alfalfa, 1 female. 8 mi. E. Douglas, Cochise Co., 8 August 1958, C. G. Moore, 1 male. 17 mi. E. Douglas, Cochise Co., 4 August 1958, C. G. Moore, P. Opler, D. D. Linsdale, 7 males; 8 August 1958, G. B. Pitman, R. H. James, C. G. Moore, P. D. Hurd, 1 female, 15 males. 18 mi. N. Douglas, 4500', 30 July 1946, H. A. Scullen, 1 male. Elfrida, 11 July 1955, G. D. Butler, swept/ alfalfa, 1 female. Florida Canyon, Santa Rita Mts., Pima Co., 20 July 1959, G. A. Samuelson, 1 male. Granite Dell, 11 July 1941, L. H. Banker, 1 female. Herb Martyr Dam, Cochise Co., 12 September 1958, H. V. Weems, Jr., 1 female. John Hand Park, Cochise Co., 12 September 1958, H. V. Weems, Jr., 2 males. 9 mi. E. Lochiel, 7 Sept. 1955, G. Butler-F. Werner, *Petclostemum candidum*, 1 female. Madera Canyon, Santa Rita Mts., 1 June 1961. R. H. and E. M. Painter, 1 male. Nogales, 7 June 1957, G. D. Butler, *Conium*, 1 female. Oak Creek Canon, July, 6000', F. H. Snow, 2 females, 4 males; Aug., F. H. Snow, 1 male. w. sl. Patagonia Mts., Santa Cruz Co., 7 Sept. 1955, F. G. Werner and G. D. Butler, 3 females, 4 males. Pinery Canyon, Chiricahua Mts., 6000', 9 July 1955, G. D. Butler and F. G. Werner, 1 female. 8 mi. W. Portal, cochise Co., 5400', 12 July 1956, E. Ordway, 1 male. Prescott, 27 June 1932, Timberlake, 1 female. Ramsey Canyon, Huachuca Mts., 18 July 1942, vzn Dyke, 1 male. Ruby, 16 Aug. 1961, F. Werner, 1 female. San Bernardino Ranch, Cochise Co., 3750 ft., August, F. H. Snow, 1 female. Santa Rita Mts., 17 July 1932. R. H. Beamer, 1 female, 3 males. S. Arizona, Aug. 1902, F. H. Snow, 1 male. Sunnyside Canyon, Huachuca Mts., 9 July 1940, R. H. Beamer, D. E. Hardy, L. J. Lipovsky, E. E. Kenaga, 2 females, 38 males. Tanque Verde, 19 September 1954, F. Werner, *Baccharis*, 1 female. Tucson, 10 Nov. 1955, G. D. Butler, swept/alfalfa, 1 male. CALIFORNIA: Alpine, San Diego Co., 13 Sept. 1923, E. P. Van Duzee, 1 female. Campo, 18 July 1940, R. H. Beamer and D. E. Hardy, 3 males. Coachella, 14 May 1917, E. P. Van Duzee, 1 male. Laguna Mts., 6 July 1929, R. H. Beamer, 1 male. 2 mi. N. E. Lakeside, San Diego Co., 29 March 1961, P. D. Hurd, *Salix laevigata*, 1 female. Milton, 21 Oct. 1917, J. C. Bradley, 1 male. Mission Canyon, 1 Oct. 1932. Timberlake, 1 male. Oro Grande, 26 Oct. 1951, Timberlake, 1 female, 2 males. Redlands, 1912, F. R. Cole, 1 male. Resting Springs, Inyo Co., 29-30 May 1955, Belkin et al, 1 female. Riverside, 11 March 1925, 1 female, 1 male; 13 March 1925, 1 female; 5 May 1940, 1 female; 24 May 1925, 2 males; 30 May 1925, 2 females; 29 Aug. 1926, 1 male; 22 Sept. 1929, 1 male; 29 Sept. 1928, 2 males; 8 Oct. 1939, 1 male; 24 Dec. 1934, 1 female; P. H. Timberlake. San Antonio R. S., Santa Clara Co., 27 June 1953, R. O. Schuster, 1 male. San Diego, 7 May 1913, E. P. VanDuzee, 1 male. Temecula, Riverside Co., 4 July 1950, E. G. Linsley, 2 males. Watts Valley, Fresno Co., 23 June 1956, R. O. Schuster, 2 males. NEVADA: Las Vegas, 17 Sept. 1908, J. C. Bradley, 1 female. TEXAS: Juno, Devils River, 13 June 1953, W. W. Wirth, 1 female, 1 male. Kendall Co., 22 July 1938, R. H. Beamer, 1 male. Marathon, 9 July 1938, R. H. Beamer, 1 female, 1 male. Kerrville, 22 April 1908, F. C. Pratt, 1 male. BAJA CALIFORNIA (MEXICO): Mulege, 14 May 1921, E. P. Van Duzee, 1 male. CHIAPAS (MEXICO): Ocosingo, 9 March 1953, Bechtel and Schlinger, 1 male. JALISCO (MEXICO): Chapala, 11 Sept. 1938, L. J. Lipowsky, 1 male. MORALES (MEXICO): Cuernavaca, April 1945, N. L. Krauss, 1 male. NUEVO LEON (MEXICO): 4 mi. W. El Cercado. 6 June 1951, P. D. Hurd, 1 male. OCCIDENTAL (MEXICO): Guadalajara, 1909, McConnell, 1 female, 2 males. SONORA (MEXICO): 10 mi. E. Cananea, 16 August 1959, W. L. Nutting and F. G. Werner, 1 female.

This species has a rather unique distribution amongst Syrphidae. It ranges from California and Nevada into Neotropical Mexico without any specimens yet taken in South America.

I am pleased to name this species after the late Charles Lewis Fluke.

C. (O.) nitida Wiedeman

Chrysogaster nitidus Wiedemann, 1830, Aussereurop. Zweifl. Ins. 2: 116.
Paragus aeneus Walker, 1849, List spec. dipt. ins., Brit. Mus 3: 545.
Cryptineura hieroglyphica Bigot, 1859, Rev. et Mag. de Zool., p 308.

This is only species of this group occuring in eastern North America. It has been recorded from South and Central America (Williston, 1892; Schiner, 1868) but on examination of the specimens in question, the identifications have been found to be incorrect. This species bears a close relationship with one species in western United States, *flukei*, and with a number of Central and South American species. *C.* (*O.*) *nitida*, *flukei*, and the Neotropical associates, exhibit eye markings of a more and more involved nature as well as white scales on the face and front.

It is likely that there may be some confusion about the separation of North American specimens of *flukei* and *nitida*. The wing characteristic used in the key (fig. 14), the purple scutal markings, and the male genitalia, will make clear the distinction between them.

The male genitalia in *nitida* are asymmetrical and this is the only species in the group with this characteristic (Sedman, 1959). The ejaculatory hood is twisted to the right, and the general asymmetry extends to the epandrial styli. The left style is armed with a distinct upper lope, while the right style is simple. Males of *nitida* will be easily identified without dissection of the genitalia by the projecting left style usually exposed lateral to the cerci. No such lobe exists in *flukei*, and the undersurface of the post-abdomen of the male displays only the partially concealed velvety brown cerci.

The eye markings in *nitida* (fig. 5) are quite distinctive, but this is a character with a considerable range of expression. Specimens in the same series will exhibit great variation in sinuosity of the vertical stripes, and some individuals will show differences between right and left eyes.

The median scutal stripes are simple, but the lateral pair are divided along their length (fig. 9). In *flukei*, the stripes are simple.

The males of *nitida* are often quite small and range from 4.5 to 5.5 mm., the females 5-6 mm.

The geographical distribution of this species is limited to North America. On the basis of the specimens before me, its northernmost records are in Ontario, Quebec, and its southern limits in Florida. I have seen specimens from as far west as Nebraska, Kansas, and Eastern Texas. I have not seen any evidence that this species occurs within the range of the other four Nearctic species of this group.

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Williston, S. W., 1892. Order Diptera. pp. 57-88, in Godman, F. D., and O. Salvin, Biologia Centrali-Americana. Insecta. Diptera. **3**: 1-127.

NOTES ON NORTH AMERICAN PIOPHILIDAE II.[1]
(DIPTERA)

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Work on the Piophilidae in the United States National Museum collections, which now include the A. L. Melander collection, has revealed one new species, *Piophila* (*Allopiophila*) *penicillata* (described below) the synonymy of *P.* (*A.*) *oriens* Melander and Spuler 1917 with *P.* (*A.*) *vulgaris* Fallén 1820, and the distinctness of *P.* (*A.*) *atrifrons* Melander and Spuler. Figures are given of the male terminalia of these species, as well as of the sixth sternite of *P.* (*Liopiophila*) *nigrimana* Meigen.

Piophila (Allopiophila) atrifrons Melander and Spuler
(Fig. 1)

1917. Washington Agric. Expt. Sta. Bull. 143: 66.

The types of this species were originally cited as three female specimens. Two from Oroville, Wash., without date, are females; one specimen, from Troy, Idaho, June 14, 1908, is a male and is therefore here selected as lectotype.

This species runs to *P. calceata* Duda in Hennig (1943) and is one of a group including that species, as well as *P. dudai* Frey, *P. pectiniventris* Duda, and the following new species, which are distinguishable with certainty only in the male sex, as Hennig has already remarked with regard to the Duda and Frey species.

Frey (1930; and reproduced in Hennig, 1943) gave an unsatisfactory, distorted figure of the male terminalia of *P. calceata*. *P. atrifrons* is very much like *P. calceata* in the male postabdomen and the possibility that the two forms are synonymous must still be considered; however, the shape of the parts shown by Frey differ from those of figure 1 sufficiently to permit consideration of the two forms as distinct species until such time as a comparison of European material becomes feasible.

The postabdomen of *Piophila* species is very asymmetrical and the andrium is held quite obliquely. In the figures here presented, the andrium has been separated from the protandrium (segments 6, 7, and 8) and shown in full lateral view, but the protandrium and base of the preabdomen are shown from an almost direct (a nearly directly) ventral view.

Examination of the protandrial sternites (6s, 7s) has revealed important differences between species. In *P. atrifrons*, sternite 6 is more or less simple, with a large dextral lobe; sternite 7 is somewhat bifid, with a long, digitiform anterior lobe, posterior to which is a small, blunt process.

[1] For paper I, see these Proceedings, v. 60 : 246 (1958).

The aedeagal apodeme (a_1), or phallodeme, in the three species here discussed is of the shape called *fultella* by Munro (1947) in his study of the African Tephritidae (Trypetidae) and shown by me (Steyskal, 1961) to be characteristic of the Pyrgotidae and Platystomatidae. The base of the aedeagus in *P. atrifrons* bears three short teeth and two forked gonapophyses (g), the anterior branch of the latter blunt and about half as long as other, sharply pointed branch. The hypandrium bears only one pair of processes (p), of characteristic shape.

The long hairs on the inner side of the fore tibia mentioned by Duda (1924, p. 201: "die Vorderschienen sind innen ungewöhnlich lang behaart") in a male specimen from Moscow Mt., Idaho, received from Melander, I do not find in a similar specimen in the U. S. National Museum nor in the type. Nor do I find those hairs any different in a specimen of *P. pectiniventris* Duda (Ilfeld, S.-Harz, leg. et det. Duda) and in the following new species.

Piophila (Allopiophila) penicillata Steyskal, new species
(Fig. 2)

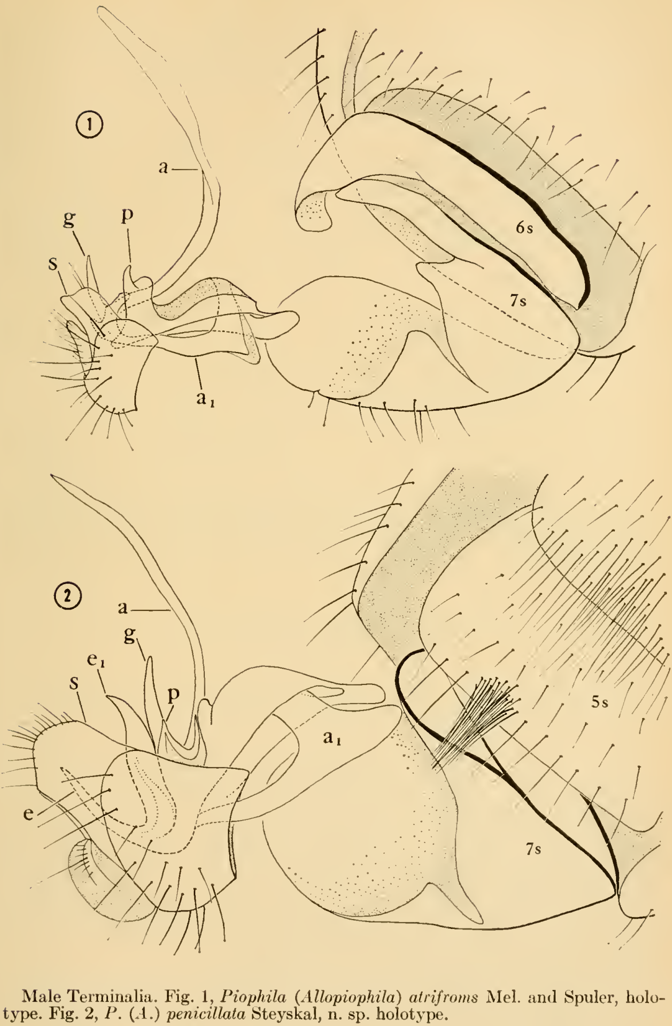
Male. Close to *P. pectiniventris* Duda and so labeled by Malloch some years ago, but differing in bristling of preabdominal sternites and details of postabdomen. Length of body, 2.15–2.86 mm.; of wing, 2.7–3.3 mm. (wings of above-mentioned specimen of *P. pectiniventris* Duda are 2.15 mm. long).

Fifth sternite (5s) mesally near its posterior margin with a tuft of stiff black bristles; those of 4th sternite in the mesal posterior part somewhat longer and more dense but not concentrated into a tuft. Sternites 6 and 7 without special projections.

Andrium differing in a number of details from that figured by Hennig (1943, pl. III, fig. 18) for *P. pectiniventris,* although of very similar structure. Epiphallus (e, e_1) tripartite, with one median posterior spine (e) and a pair of gently backwardly curved lateral spines (e_1); gonapophyses (g) long, ensiform, only gently forwardly curved; posterior process of hypandrium (p) bearing a C-shaped anterior branch lying against the small rounded anterior process; surstyli (S) broad and gently rounded apically, with fringe of hairs of moderate length; proctiger with a pair of sclerotized bands, each of which bears one long bristle and a number of small hairs.

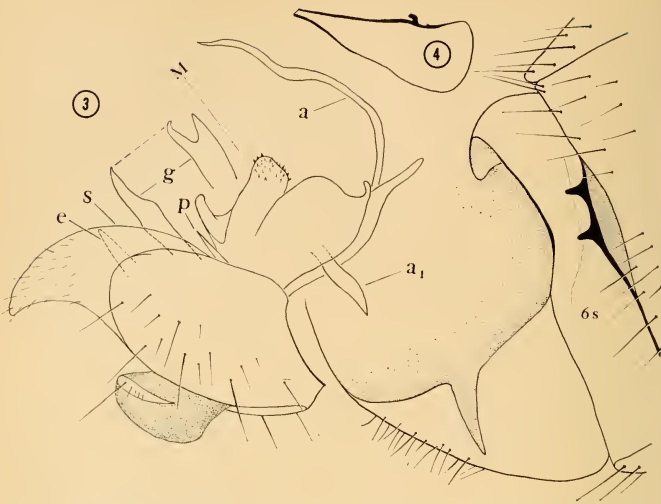
Female. Differs from related species apparently only in the somewhat larger size: Length of body, 2.33–3.22 mm.; of wing, 2.5–3.35 mm.

Holotype, male, and allotype, female, Aklavik, N. W. T., Canada, July 8, 1931; paratypes: Same locality, 9 males and 16 females, June 24 to July 18, 1931, July 18, 1932; Calgary, Alta., one male, May 31, 1924; Edmonton, Alta., one male and two females, May 20, 1924 (all Owen Bryant), Type No. 66858 in the U. S. National Museum. Two females not designated paratypes are also in the collection, one from Banff, Alta., June 13, 1928; the other from Churchill, Man., June 20, 1930 (both Owen Bryant).



Male Terminalia. Fig. 1, *Piophila* (*Allopiophila*) *atrifroms* Mel. and Spuler, holotype. Fig. 2, *P.* (*A.*) *penicillata* Steyskal, n. sp. holotype.

LEGEND: a—aedeagus; a_1—aedeagal apodeme; e, e_1—epiphallus; g—gonapophysis; M—meson; p—process of hypandrium; S—surstylus; 5s, 6s, 7s—5th, 6th.



Male Terminalia. Fig. 3. *P.* (*A.*) *vulgaris* Fallén, holotype of *P. oriens* Mel. and Spuler (syn.). Fig. 4. *P.* (*Liopiophila*) *nigrimana* Meigen, 6th sternite of specimen from Detroit, Mich.

Piophila (Allopiophila) vulgaris Fallén
(Fig. 3)

1820. Heteromyzides Sueciae: 9; (see Hennig, 1943, p. 42 for further synonymy).
1917. *Piophila oriens* Melander and Spuler, 1917. Washington Agric. Expt. Sta. Bull. 143: 63. *New synonym.*

The types of *P. oriens*, cited by Melander and Spuler as "Two males and two females. Ithaca and Geneva, New York, May; Greenfield, Massachusetts, June (Melander)", are now in the U. S. National Museum collections. The specimen labeled "type" is a male from Ithaca, N. Y., May 31, 1914 and is hereby selected as lectotype; the other Ithaca specimen, with the same date, is a female; the Geneva specimen, May 28, 1914, is a male; the Greenfield specimen, June 1, 1914, is a female. The postabdomen of the holotype was macerated and drawn as figure 3, revealing sufficient similarity to the figure given by Hennig (1943, pl. III, fig. 19) to adduce the synonymy.

Gonapophyses in anterior view (g) apically bifid, lateral branch with incurved tip, mesal branch straight. Largest, most anterad of the three processes (p) of hypandrium furnished with a number of stout denticles on mesal face.

Sternite 6 (6s) with a characteristic pair of posteriorly directed teeth midway of posterior margin.

Piophila (Liopiophila) nigrimana Meigen
(Fig. 4)

1826. Syst. Beschr. 5: 396; (see Hennig, 1943, p. 31, for further synonymy).

The sixth sternite of the male of this species, common in North America as well as in the Palaearctic region, bears a characteristic bent prong and a small tooth on its posterior margin, as shown in figure 4. A specimen from Scotland is similar.

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TROPACARUS, A NEW GENUS OF ACARIDAE
(Acarina)

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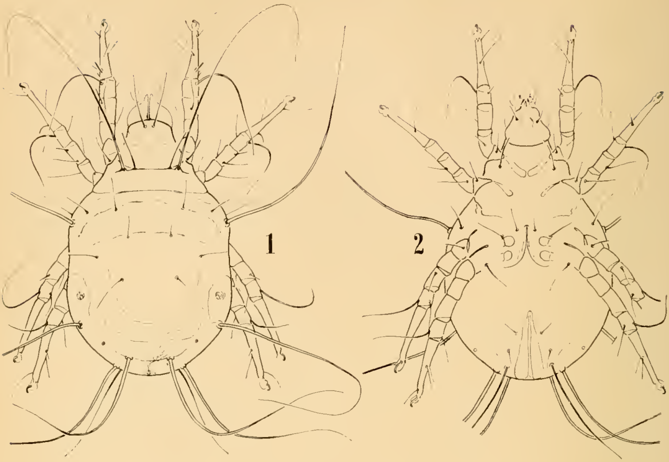
In 1955 E. W. Baker collected an undescribed acarid mite from various leaves in the Congo. These mites lived in small colonies, usually forming a circle, with their bodies oriented inward. Baker again collected this mite in Costa Rica and Nicaragua in 1959, and Fleschner found it on citrus leaves in Assam, India the same year. Muma (1961) records it as feeding on fungus on citrus leaves in Florida. He states: "This mite is usually found in clusters, including eggs, young and adults, along the midrib of the leaf or besides clumps of trash. When disturbed the mites move clumsily about until a hiding place is found or the cluster is relocated." U. S. National Museum records show that this species has also been intercepted from Brazil at U. S. Quarantine.



1. Female, dorsal view; 2. Female, ventral view.

Tropacarus, new genus

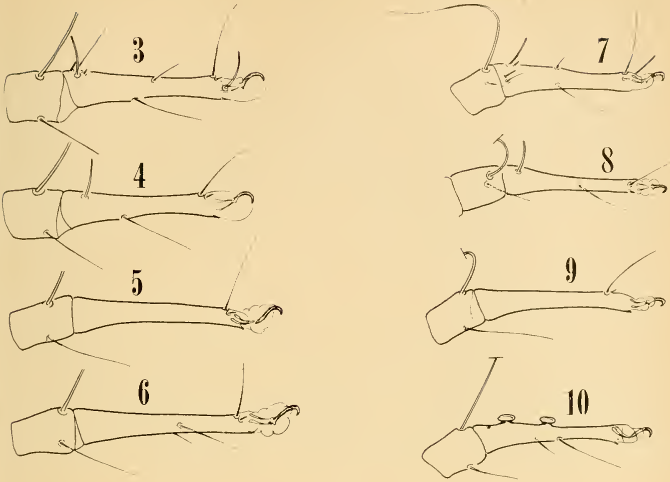
This genus is distinctive in having large genital discs, in having certain of the body setae long and whiplike, in that certain body setae are missing, in lacking most tarsal setae, and in that the male does not have anal discs.

Type. Tropacarus mumai, new species.

Tropacarus mumai, new species
(Figs. 1–10)

Female. Plump, "pale yellow to pale orange with a red-brown to black spot on each side near the back end. Frequently one or two additional dark areas occur in the middle near the back end" (Muma, 1961). Setae sce, he, 1p, d4 and sae are very long and whiplike; pa1 is about half as long as these; the other dorsal body seate are much sorter. Coxae I and III each with a seta; there are three pairs of genital setae, the posterior pair situated almost on coxae IV; there are two pairs of anal setae. The genital discs are large in relation to the body size. Leg setae are fewer in number than in other genera, especially on tarsus I and II. Body length 380 u; width 270 u.

Male. Similar to female. Tarsal IV discs are on the proximal half of the segment. There are no anal discs. Body length 320u; width 210 u.



3, Tarsus and tibia I, female; 4, Tarsus and tibia II, female; 5, Tarsus and tibia III, female; 6, Tarsus and tibia IV, female; 7, Tarsus and tibia I, male; 8, Tarsus and tibia II, male; 9, Tarsus and tibia III, male; 10, Tarsus and tibia IV, male.

The holotype female, U. S. National Museum No. 3039, twelve paratype females, and two paratype males were collected on leaves of "tree", Leopoldville, Congo, April 16, 1955, by E. W. Baker.

Other specimens were collected on *Vitex congolensis*, Stanleyville, April 18, 1955; *Berlinia* sp., same data; frangipani, same data; frangipani, Lwiro, May 17, 1955; peach, Mulunga, May 18, 1955. All were found on the ventral surfaces of the leaves, usually in colonies. The same species has been found in Florida, Costa Rica, Nicaragua, India, and Brazil (U. S. Quarantine).

Reference

Muma, M. H. 1961. Mites associated with citrus in Florida. Univ. Fla. Agr. Expt. Sta. Bull. 640: 1-39.

THREE UNCOMMON GENERA OF THE MITE FAMILY STIGMAEIDAE

(ACARINA)

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Some of the species in the mite family Stigmaeidae are rotund, almost globose types which are extensively covered with relatively thick and dimpled or reticulated plates and which have a prominent 3-pronged sensillum on the apex of the palptarsus. The majority of stigmaeids deviate from this form in various ways. Those described here differ radically from the rotund form of anatomical organization; they have slender, fusiform bodies, almost no idiosomal plating, and the palptarsus bears a single lanceolate spine or several discrete, seta-like eupathids on its apex.

The naked, spindle-shaped stigmaeids to be described are rarely found in Berlese funnel concentrates of microarthropods obtained from samples of leaf mold, humus, moss and lichen. Many hundreds of samples from numerous localities have yielded very few specimens. Consequently there are not enough geographical or ecological data to show where significant populations of these mites are likely to occur. The specimens on hand were collected over a period of about 12 years. It is for this reason that they are called rare or uncommon types.

Genus **Apostigmaeus** Grandjean

Apostigmaeus Grandjean, 1944, Arch. des Sci. phys. et nat., 5me Période, 26:105.

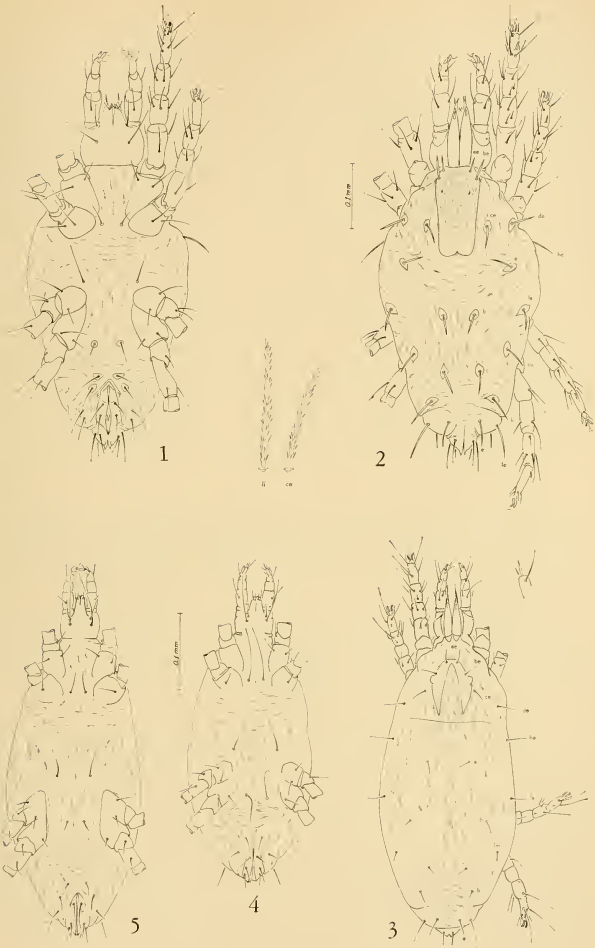
Diagnosis: Stigmaeids having unjoined or separately movable chelicerae and body plating restricted essentially to mid-dorsal section of propodosoma. Propodosomal plate narrow, elongate, bears only setae *ae* and *be*; setae *ce* and *de* not incorporated on this plate. Dorsum of metapodosoma and opisthosoma with sclerotization restricted to very small platelets, one platelet for each seta—except suranals. Dorsal setae: 13–14 pairs. No obvious eyes. Palptarsus slightly longer than tibial claw; it bears a group of minute, simple sensilla instead of an apical trident (multiple eupathid). Tarsus of each leg has a pair of small, slightly curved claws and a multibranched empodium, the shaft of which projects beyond tips of claws before subdividing to produce 3 pairs of capitate raylets.

Type Species: *Apostigmaeus navicella* Grandjean, 1944; monotypic.

Apostigmaeus pacificus, n. sp.

(Figs. 1-2)

Female. Basal pieces of chelicerae slender, fusiform; fixed digits membranous, clearly discernible, coextensive with shafts of movable digits (stylets). Basis capituli and upper maxillicoxal areas covered by somewhat thickened, minutely punctate integument or skeleton; this pattern may also appear on coxae I-IV. Posterior setae on basis capituli very slender, finely pointed, ultralong, at least 59 microns, or long enough to reach bases of adoral setae at apex of rostrum. Idiosoma covered mostly with striated integeument; an unpaired propodosomal plate traverses length of propodosoma, from vertical setae to field of cross-striae between dorsocentral setae



Apostigmaeus pacificus, n. sp. (figs. 1–2). Fig. 1, ventral aspect of female; fig. 2, dorsum. Structural detail of dorsal setae *li* (left) and *ce* (right) between the two upper figures. *Eryngiopus gracilis*, n. sp. (figs. 3, 5). Fig. 3., dorsal view of female; fig. 5, its ventral side. *Eryngiopus microsetus*, n. sp. Fig. 4, ventral view of female. Millimeter scale adjacent to figure 4 also applicable to figures 3 and 5.

c; this plate nearly rectangular, long sides parallel, its width slightly greater than distance separating setae of pair *be*; phase microscopy reveals a delicate recticulum thereon; a pair of dot-like apodemal marks or pits occur on its anterior third, one mark close behind each seta of pair *be*. Seta *ae* and *be* arise on front margin of propodosomal plate; all other dorsal body setae except suranals set on very small individual platelets. Suranal region bears a pair of small suranal plates, two seta on each plate, one of pair *e* and one of pair *le*. Dorsal setae plumose, each with numerous fine barbs appressed closely to shaft; 13 pairs, none conspicuously longer than others; external suranals *le* longest; preoculars *be* barely longer than those nearby; verticals *ae* and dorsocentrals *a*, *b*, *c* subequal. Lateral opisthosomal setae *lr* of *A. navicella* absent in this species. Eyes apparently absent. Intercoxal setae smooth, with very finely pointed tips; first pair between coxae II approximately equal to length of third pair between coxae IV; seta of second pair between coxae III very long (70), widely spaced; one or both setae on coxae I-IV also long, longest ones on coxae I, II. Paragenital setae (or aggenital setae) finely plumose, 4 pairs, subequal; setae of anterior two pairs originate on small individual platelets; seta of two posterior pairs planted close together, those of each side share a platelet which surmounts a faintly elevated area. Five pairs anogenital setae, 2 pairs on genital covers, 3 pairs on anal covers; middle pair slightly longer than first and third. Numbers of setae and special sensilla on legs I-IV: femora 4–4–3–3, genua 6–5–3–3, tibia 7–6–6–6, tarsi 14–9–7–7. Average measurements in microns (n = 5): length idiosoma, vertical setae to anus, 475; seta *be* 82, *a* 64, *le* 106. Males not represented in collections.

Types. Holotype: female, Indonesia (intercepted at Hawaii), Sept. 12, 1961, H. A. Woolford and B. F. Wetzel, on *Oryza sativa*; female, Philippine Islands (intercepted at Hawaii), March 24, 1961, H. A. Woolford, on *Manihot esculenta*; female, Philippine Islands (intercepted at Hawaii), April 17, 1959, H. Woolford, on *Oryza sativa*. All in collection of U. S. National Museum.

Additional Material. France (Hawaii), March 6, 1961, H. A. Woolford, on *Avena sativa*; Tahiti (Hawaii), March 19, 1961, H. A. Woodford, on *Polianthus tuberosa*; Curundu, Canal Zone, March 10, 1961, C. E. Yunker, on porcupine *Coendu rothschildi*.

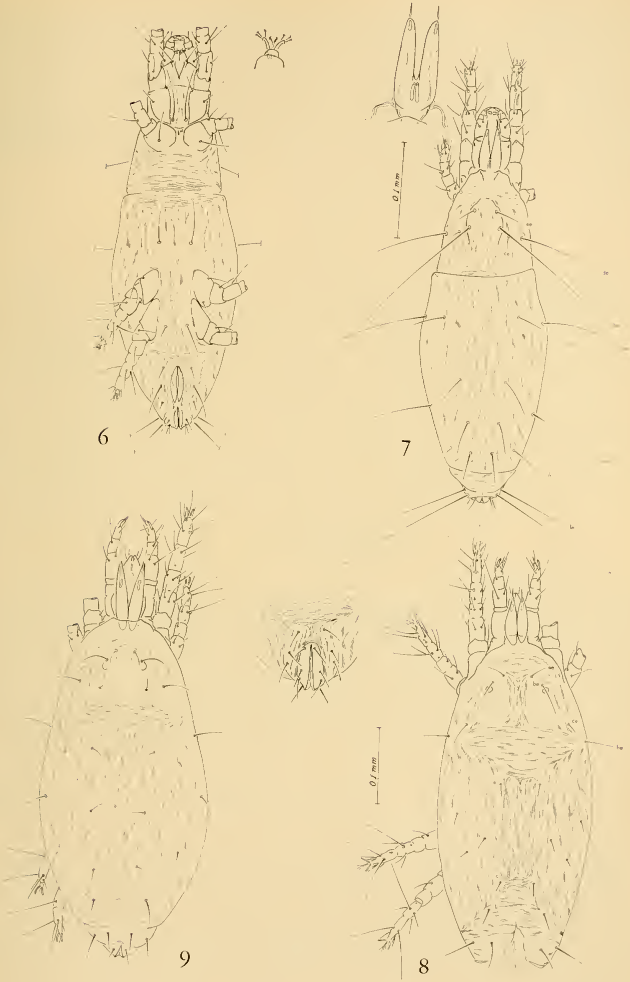
A. pacificus is distinguishable from *A. navicella* in many respects. The new species has 13 instead of 14 pairs of dorsal setae and all are plumose. The dorsal propodosomal plate is an elongate rectangle. *A. pacificus* possesses but 2 pairs of setae on the genital covers. The third pair of paragenitals is not longer than the other 3 pairs of paragenitals whereas, in *navicella*, the length of the third paragenitals much exceeds others of the group. Femur IV of *pacificus* has 3 setae instead of 2.

The occurrence of this mite on an animal, a porcupine, is probably fortuitous. This single specimen, probably brushed from low-growing vegetation, is not distinguishable from the other examples studied.

Eryngiopus, n. gen.

(Gr. eryngion, thistle; pous, foot)

Slender bodied stigmaeids with independent chelicerae. Body plating feebly developed and restricted to small raised areas on dorsum of propodosoma and to



Barbutia anguineus (figs. 6–7). Fig. 6 venter of female. Detail of pretarsus I at upper right; fig. 7, dorsum of female, with sketch of chelicerae at upper left. *Eryngiopus longurius* n. sp. Fig. 8, dorsal view of female. Detail of female genital area illustrated in insert between figures 8 and 9. *Eryngiopus vagantis*, n. sp. Fig. 9, dorsum of female.

suranal portion of opisthosoma. Idiosoma extensively covered with very finely striated integument, striae predominantly longitudinal, with few whorls or transverse bands. Terminal sensillum on palptarsus a single spikelet, not a trident or cluster of eupathids. One pair of eyes. Dorsal setae: 12–13 pairs, smooth, short, with small range of variation in lengths between different pairs. Ventral setae smooth, flagelliform, one or more pairs ultralong, especially posterior pair on maxillicoxae. Genital plate or plates absent or feebly developed around bases of posteriormost paragenital setae. Pretarsal claws plain, without accessory rays or tenent hairs. Empodium a slender shaft bearing 3 pairs capitate raylets.

Type species: *Eryngiopus gracilis* n. sp.

Key to Females of **Eryngiopus**

1. Genu II without setae; coxae 2–1–2–1 ---------------------------------- 2
   Genu II with one seta; coxae with a different formula ------------------- 3
2. Tibia IV with 4 setae; trochanter IV with one seta; 3 pairs of paragenital setae -- **gracilis** n. sp.
   Tibia IV with 6 setae; trochanter IV without seta; 2 pairs of paragenital setae -- **microsetus** n. sp.
3. Coxae 1–1–2–1; femora 5–4–3–2; propodosoma with 4 pairs of dorsal setae -- **vagantis** n. sp.
   Coxae 2–1–2–2; femora 4–4–2–2; propodosoma with 3 pairs of dorsal setae -- **longurius** n. sp.

Eryngiopus gracilis, n. sp.

(Figs. 3, 5)

Female. Propodosomal plating represented by 2 narrow strips of nude integument between protruding eyes, strips joined together in front, divergent behind, separated medially by wedge-shaped field of longitudinal striae; posterior arms of sclerotized strips attenuated, extend almost to humeral sulcus. Dorsal striae uniformly longitudinal on metapodosoma, transverse only on hinder portion of opisthosoma. Suranal section of opisthosoma delimited by an incomplete transverse fissure; suranal seta *e*, *le* share a denuded area or plate on each side of midline. Dorsal setae simple, comparatively short; humeral setae *he* 27 (all measurements in microns, holotype only), longest of dorsals; dorsolaterals *lm* 13, shortest; all others within this length range. Ventral setae equal to or longer than dorsals; posterior pair on maxillicoxae at least 70, reaches palptarsus when positioned as illustrated; first intercoxal pair 20, second pair 34, third (posterior) pair 27. Three pairs paragenital setae: first 2 pairs equal, not on plates; third pair 50% longer, each seta on an incipient genital platelet. Anogenital covers with 4 pairs setae: 1 pair on genital section, flagelliform, long enough to reach posteriormost extent of anogenital covers; anal section with 3 pairs shorter, more robust setae, subequal, each one less than half as long as setae on genital section. Setae and special sensilla on legs I-IV: coxae 2–1–2–1, femora 4–4–2–2, genua 4–0–0–0, tibiae 6–6–6–4, tarsi 14–9–7–7. Overall length of mite, palpclaw to anus, 495.

Types: Holotype ♀, 5 paratype ♀♀, American Canyon, Solano County, California, February 15, 1951, from willow bark. Holotype retained in collection at Davis, paratypes deposited in United States National Museum and British Museum (Natural History). No other specimens taken.

The possession of only four setae on tibia IV separates *E. gracilis* from its present congeners. Although none of the intercoxal setae on the podosoma is conspicuously long, their relative lengths provide an additional basis for recognizing this species, i.e., second pair > third pair > first pair.

Eryngiopus vagantis, n. sp.
(Fig. 9)

Female. Doısal plate of propodosoma integral, not invaded by longitudinal striae, covers entire elevated area bounded by eyes and setae *ae, be, ce,* its posterior margin adjoins belt of transverse striae between propodosoma and metapodosoma. A pair of small, circular apodemal marks anteriorly on propodosomal plate, one mark behind each vertical seta, both marks aligned with preocular setae. Dorsal setae fine, smooth, with several size ranges: *be* longest 41; *ae, ce, a, b, c, lm* subequal, 17–20; others of intermediate lengths. Ventral setae ultralong, flagelliform: posterior pair on maxillicoxae 75; first pair intercoxals 30, shortest of its series; second pair at least 80; third pair at least 64. Paragenital setae: 3 pairs, not on plates; first pair 24, second pair 30, third pair 40. Anogenital covers with 4 pairs setae; anteriormost pair flagelliform, approx. 1.5 times longer than each of 3 pairs which follow in succession. Coxae 1–1–2–1, femora 5–4–3–2, genua 4–1–0–0, tibiae 6–6–6–6, tarsi 14–9–8–8. Overall length, palpclaw to anus, 560.

Types: Two co-type ♀♀, 2 paratype ♀♀, 2 nymphs, Napa, Napa County, California, December 22, 1959 (S. F. Bailey and R. O. Schuster), from prune orchard. One co-type deposited in United States National Museum; one paratype in British Museum (Natural History); others filed in mite collection, University of California, Davis.

E. vagantis has several unique features: coxa I has only 1 seta; femur I has 5 and femur III has 3 setae; the dorsal propodosomal plate is not partitioned by median longitudinal striae. The middle (second) intercoxal seta is ultralong; second pair > third pair > first pair.

Eryngiopus microsetus, n. sp.
(Fig. 4)

Female: Body dimensions noticeably smaller but otherwise much like *gracilis* in respect to patterns of striae and relative lengths of dorsal setae. Propodosomal plating feebly developed, represented by a pair of nude areas confined to region of eyes and first 2 pairs of setae, possibly not joined together between bases of vertical setae. Ventral setae all longer than dorsals; posterior pair on maxillicoxae 54 (microns), extends forward to distal ends of palpgenua; first intercoxals ultralong, 72; second intercoxals at least 40; third intercoxals about 45. Only 2 pairs of paragenital setae, none originate on plates. Trochanter IV with seta absent. Coxae 2–1–2–1, femora 4–4–2–2, genua 4–0–0–0, tribiae 6–6–6–6; tarsi 14–10–8–8. Overall length, palpclaw to anus, 410.

Holotype: Female, Moss Beach, San Mateo County, California, no date recorded (W. H. Lange and E. I. Schlinger), from leaf mold under Monterey Cypress. Only example, filed in mite collection, University of California, Davis.

E. microsetus has at least two characters not shared by the other known species: There are only 2 pairs of paragenital setae and trochanter IV bears no seta. First intercoxal seta is ultralong; first > third > second.

Eryngiopus longurius, n. sp.
(Fig. 8)

Female. Plated area of propodosoma completely bisected in midline by a wide band of longitudinal striae; each half of plate triangular in outline, with setae *ae* on or adjacent to its vertex, its base adjoins broad belt of transverse striae on front of metapodosoma; areas referred to as plates also bear extremely faint longitudinal striae. A thinly sclerotized suranal plate arches over hinderpart of opisthosoma. Integumental striae with microtubercles or lobules at widely spaced intervals. Patterns of dorsal striae peculiar to species: extensive bands of striae cross front and rear ends of hysterosoma; longitudinal rows whorl between dorsocentral setae *a* and *b* to create an elongate rectangular figure on middorsum of metapodosoma. Dorsal setae smooth, 12 pairs only—presumably postoculars *ce* absent on propodosoma; *be* = *le*, longest of dorsal setae, 40; *la* 15, *lm* 12, shortest in the dorsal group. Only one pair of ventral setae ultralong: posterior setae on maxillicoxae at least 68; all coxals and intercoxals relatively short, subequal: first intercoxals 24, second 24, third 20. Chaetotaxy of ventral opisthosoma not distinguishable from *vagantis*. Coxae 2–1–2–2, femora 4–4–2–2, genua 4–1–0–0, tibiae 6–6–6–6, tarsi 14–10–8–7. Numerous setae uppermost on appendages unusually long, flagelliform, e.g.: dorsal seta on tibia III 50, on tibia IV 68; dorsal setae on tarsus IV at least 64. Overall length, palpclaw to anus, 550.

Male. Somewhat smaller than female, 480 overall, but recognizable according to qualitative characters ascribed to podosoma of opposite sex. Opisthosoma with most structural features common to other stigmaeid males. Dorsal striae whorl between setae *a* and *c* to form rectangular figure.

Types. Holotype ♀, allotype ♂, Nortonville, Contra Costa County, California, Oct. 15, 1952 (W. C. Bentinck), from saltgrass (*Distichlis* sp); Paratype ♀, 7 mi. west of Parker Dam, San Bernardino County, California, Feb. 24, 1951 (C. D. McNeill) from soil in shrub thicket. Holotype in U. S. National Museum, others retained in collection at Davis.

Microtuberculate striae and the whorling of striae middorsally between setae of pairs *a* and *c* are useful spot characters for *E. longurius*. There are only 12 pairs of dorsal setae whereas 13 pairs is the common number. Also unique is the presence of 2 setae on coxae IV. The intercoxal setae on the podosoma are comparatively short and subequal.

Barbutia Oudemans 1927

Small, emphatically fusiform species, with humeral sulcus clearly a line of body flexion. Chelicerae fused together along basal halves to form a U-shaped stylophore. Short peritremata on dorsomedian surface of stylophore. Idiosoma without obvious plates; a broad, ovoid elevation with 2 pairs setae occurs on propodosoma, between eyes; integument covering elevation striated and possibly more rigid than integument elsewhere. Thirteen pairs dorsal setae, some ultralong. One pair of eyes. Genital and anal apertures of female proximate but not sharing common covers; genital covers without setae; 3 pairs paragenital setae. Pretarsi sessile; claws diminutive, each claw with 2 pairs tenent hairs; these very short, capitate. Minute empodium with possibly 2 pairs capitate raylets.

Type Species: *Stigmaeus anguineus* Berlese, 1910. Monotypic.

Barbutia anguineus (Berlese)
(Figs. 6–7)

Stigmaeus anguineus Berlese, 1910, Redia 6:204.

Stigmaeus (*Macrostigmaeus*) *anguineus*, Berlese, 1910, Redia 6:208.

Macrostigmaeus anguineus, Oudemans, 1923, Ent. Ber. Nederland. Ent. Ver. 6:146.

Barbutia anguineus, Oudemans, 1927, Ent. Ber. Nederland, Ent. Ver. 7:260.

Female. Chelicerae with short, anteriorly directed stylets; proximal segments fused together near basal ends to form a deeply cleft, U-shaped stylophore. Peritremata located on dorsomedian surface of stylophore; these comprise a pair of juxtaposed tubes, or grooves, which extend straight backwards a short distance from points of origin in apex of cheliceral notch. Palpi with tibial claws opposable, tending to meet slightly in front of cheliceral stylets; each claw large in relation to segment which bears it, and equipped with a sharp spine, or tooth, on its concave edge. Palptarsi noticeably club-like, swollen at distal ends. Rostrum truncate anteriorly, lateral lips flared, with 2 pairs inconspicuous adoral setae. Propodosoma with smaller girth than hysterosoma, humeral sulcus appears to allow telescoping of these body sections; dorsomedian surface of propodosoma surmounted by a broad, oval elevation. One pair of eyes. Integument of dorsum entirely striated, striae faint, predominantly longitudinal and with small granules disposed at widely spaced intervals along or between them. Striae of venter without granular ornamentation; a wide belt of transverse striae occupies sternal area behind coxae II; those in vicinity of propodosomal-hysterosomal junction assume form of broader, interdigitating rugae. Sclerotized plates not evident. Thirteen pairs completely smooth dorsal setae, all flagelliform, most so finely pointed that total lengths cannot be precisely determined; setae classed in 4 size ranges with approximate lengths and presumed homologies with corresponding setae of other stigmaeids as follows: ultralong—*be* 156, *e* 144; long—*de* 82, *he* 86, *lm* 86, *le* 94; intermediate—*a* 51, *b* 39, *c* 31, *li* 39; ultrashort—*ce* 12. Ventral setae of intercoxal areas: first pair 55, reaching from base of coxa I to palptrochanter; second pair 39; third pair 27. Three pairs paragenital setae, middle pair longest: first 12, second 31, third 8. No setae on genital covers; 3 pairs on anal covers, short, subequal. Inclusive counts of setae on leg segments: coxae 2–1–2–0, femora 4–3–2–2, genua 6–0–0–0, tibiae 6–5–3–3, tarsi 12–8–8–8. Sensillum *k* on genu I solenidiform, not spine-like. Tarsi abruptly rounded distally, without tapered peduncles; claws very small, each with 2 pairs capitate raylets arising near its distal end. Empodium with one pair, or possibly 2 pairs, capitate raylets. Length of mite when positioned as illustrated, palpclaw to anus, 418.

Male. Closely resembles female in respect to prosoma and legs I-II; extra (male) solenidion does not appear on tarsi I-II; solenidion on tarsi III-IV noticeably larger and dorsal setae on hysterosoma much shorter than described for female. Opisthosoma conical, with 1 pair paragenital setae below. Aedeagus a slender, straight shaft, upcurved near tip.

Distribution. One collection, 5 specimens, Pigeon Point, San Mateo County, California, July 12, 1958, D. W. Price, from mulch in shrub thicket.

Berlese's original illustration of *B. anguineus* is complete enough to allow probable identification of the species without reference to type specimens. He did not, however, give sufficient information about peritremes, claws and general chaetotoxy to reveal its distant affinities with species in other stigmaeid genera. Oudemans (1927) separated *Macrostigmaeus serpentinus* Berl. and M. *anguineus* Berl. by creating a new genus, *Barbutia*, for the latter. In 1931, he assigned both genera to his new family, the Stigmaeidae.

Although other genera of this family contain small fusiform species having almost no plate-like armature, *Barbutia* is unique in several respects: the palpi appear to function as opposable, pincer-like appendages; the stylophore bears dorsal peritremes, as in caligonellids; and the claws have raylets or tenent hairs, as in tetranychoids. Also the genital and anal pores are independently covered and the chaetotaxy of the legs deviates considerably from stigmaeid patterns. Since *Barbutia* cannot be properly referred to any other family in the presently constituted superfamily Raphignathoidea, it is expedient to maintain the *status quo* until the systematics of this group of families is better understood.

Grandjean's nomenclature of dorsal setae is applied to *B. anguineus* without certainty of the true homologies. The humeral setae *he* and the first lateral hysterosomals *la* are the key setae in question. If the writer's assumption happens not to be the correct one of several possibilities, then the labels applied to at least seven of the hysterosomal setae (fig. 7) would be improper.

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THE ALTERNATE GENERATION OF CALLIRHYTIS AGRIFOLIAE (ASHMEAD)
(HYMENOPTERA: CYNIPOIDEA)

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The gall produced by the cynipid wasp *Callirhytis agrifoliae* (Ashm.) on the oaks *Quercus agrifolia* Nee and *Quercus Wislizenii* A. DC. in California is one of the most abundant galls in this area. The gall is a beautifully mottled, spherical, monothalamous (one-chambered) growth that develops in the axils of the leaves during the summer and early fall, grows rapidly for several months and then drops to the ground where it remains until the adult insects emerge during the early months of the following year. (Figure 1 A, B). Mature galls are 4.8-5.4 mm. in diameter and contain a thick layer of nutritive tissue around the central larval cell. It is upon this material that the tiny larva feeds and grows until it pupates in the late months of the year. Mature agamic or unisexual females emerge from the galls in late January and in February; earlier in some areas.

The species was originally described by H. F. Bassett (1881:53) however the first valid name was used by William Ashmead (1885:294). *Andricus wisliceni* (Ashmead) and *Callirhytis clarimontis* Kieffer are considered to be synonyms (Weld, 1951:647). Until the present time the species has been known only from descriptions of the agamic females which have been reared in large numbers. Specimens are exceedingly easy to obtain and to rear for the galls are often so numerous that they literally cover the ground and when gathered in December or January will nearly always yield adults. No males have been described.

Recent investigations in California have shown heterogony or alternating unisexual and bisexual generations occur as a regular part of the life cycle in several genera of the phytophagous Cynipidae on the Pacific Slope. Such alternate generations have been demonstrated in the genera *Andricus* (Doutt, 1960) *Callirhytis* (Lyon, 1959) *Dryocosmus* (Doutt, 1959) and *Heteroecus* (Lyon, MS in press). Circumstantial evidence indicates the existence of heterogony in the genera *Antron* and *Loxaulus*. With these facts in mind, it is surprising that the alternate generation has not been worked out for a species as abundant and as easy to rear as *C. agrifoliae* (Ashm.).

During the second week of February 1963 a number of agamic females emerged from galls in rearing cages and were placed on young oaks growing in five-gallon containers. The insects were at first allowed to move freely on the young trees in order to ascertain that portion of the plant in which they would oviposit. The females immediately began to oviposit in the tightly packed leaf buds and spent 20 to 30 minutes on the first leaf buds that they encountered. As they moved from bud to bud, oviposition time decreased until only 5 to 10 minutes were spent on each bud. The temperature was 60 to 64° F., but as it gradually became warmer the insects began to fly off the plants. Later in the day the females were confined to individual cloth bags placed over the twigs. The insects did not appear to be highly selective in their choice of buds and readily accepted buds that had already been visited by other females. All sites of oviposition were carefully marked.

The new leaves began to unfold on March 1st and by the time the leaves were fully expanded, tiny red blister galls were visible on the leaf veins. Agamic females continued to emerge throughout March and early April and were placed on the plants shortly after emergence. Oviposition again took place but fewer galls developed from these late females and many that did develop, failed to mature properly. The percentage of gall failure was quite high even when oviposition took place earlier in the year. Oviposition in the leaf causes it to buckle at the point where the egg is placed whether or not a gall develops. When the gall fails to develop, the spot where the egg was laid turns brown and later a tiny hole develops. Gall development was very rapid with the galls attaining full size by the time the leaves were fully developed. The insects were in the pupal stage by late March and adults of both sexes began to emerge on April 5th. Emergence continued until April 15. On experimental trees, 48 days elapsed between the time of oviposition and the emergence of the bisexual generation from the mature galls. The males were very active and immediately began to fly about in search of females. The latter move rather slowly and when disturbed will drop from the leaf rather than fly. It is interesting to note that agamic females were still emerging in the rearing cages when specimens of the bisexual generation had matured and were emerging from their galls.

Description of the Gall (Figure 1C, D, E, F). The adults of the bisexual generation produce galls of several different types. The most common type is a small, one-celled blister, 2 mm. long, that develops in the central or lateral veins of the new leaves. New galls are green, tinged with red and as they develop, the color deepens. At maturity they are tan, microscopically pubescent and very thin-walled. The exit hole made by the adult gall wasp may be on either the upper or lower surface of the leaf. Another type of gall develops as an almost imepr-ceptible swelling in the petiole of an apparently normal leaf. Sometimes the leaf aborts, but the petiole remains in the form of a tiny gall. Still another type develops at the terminal end of the shoot or in the axils of the leaves at the base of a tiny aborted bud. Galls are surprisingly difficult to locate on the native trees in spite of the fact that the agamic females are numerous. One can only speculate as to the reasons for this and in all probability their scarcity is the result of a combination of factors. In the first place they are exceedingly small, inconspicuous and are easily overlooked. Secondly, on experimental trees many failed to develop into mature galls. Finally, as is usually the case with leaf galls, a high percentage was parasitized by chalcids.

BISEXUAL GENERATION

Female: Rather strikingly different from the agamic females primarily because of size and color. The head and body are black, legs amber, yellow in some specimens, except the base of the front and middle coxae

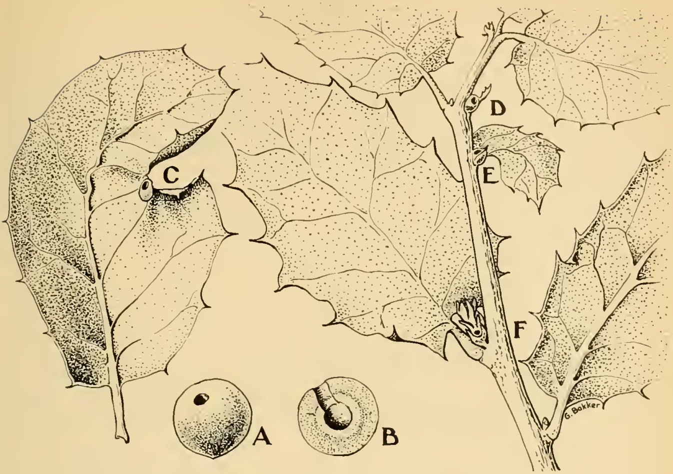

Figure 1. A, Spherical, monothalamous gall produced by the agamic generation of *Callirhytis agrifoliae* (Ashm.); B, A single gall of the same showing position of the larval cell; C, Leaf gall of the bisexual generation showing the typical bent appearance of the leaf; D, Petiole gall of the same showing aborted leaf; E, Petiole gall in normal, small leaf; F, Gall of bisexual generation developed in an aborted bud.

which are smoky; hind coxae entirely dark; distal tarsal segments as well as the terminal antennal segments also darkened; eyes black, ocelli amber. Head: granular in texture similar to the agamic females, however there are prominent fan-striae on the face and in the malar space. These are inconspicuous in the agamic females. Malar space nearly one-half the length of the eye. The interocular area is two and one-half times as wide as high. In the agamic females this area is three and one-half times as wide as high. The head is scarcely broadened behind the eyes whereas the head bulges conspicuously behind the eyes in the agamic females. The antennae are 14-segmented with the terminal segments distinctly fluted. Mesoscutum: anterior parallel lines not readily visible; lateral lines not impressed and represented by smooth bands. These lines are conspicuous in agamic females. Scutellum: disk entirely rugose; agamic females rugose except center which is pebbled. Ventral spine very short, twice as long as broad. Agamic females with longer ventral spine, 7X as long as broad. Wings in the bisexual generation are pubescent and ciliate with very dark veins. Agamic females also have pubescent and ciliate wings but the amber veins and cilia give them a much lighter appearance. Range in length of 25 specimens

1.3—1.8 mm. Average length 1.7 mm. Agamic females range from 3.1—3.8 mm. in length.

Male: Average size slightly smaller than female. Antennae with 15 segments; eyes very large with interocular space only twice as wide as high; malar space very narrow and only one-sixth the length of the eye; abdomen very thin-walled often collapsed in pinned specimens. Tergites II and III are usually the only tergites visible along the dorsal curvature of the abdomen. Range in length of 24 specimens 1.3—1.7 mm. Average length 1.6 mm.

Types: The types and ten paratypes are in the collection of the U. S. National Museum. Other paratypes are in the collections of the California Academy of Sciences, University of California at Los Angeles and the Los Angeles County Museum.

Host: *Quercus agrifolia* Nee.

Habitat: The types were reared from galls produced on potted oaks in La Crescenta, California. Additional specimens were reared from galls collected on the native oaks in the Los Angeles area.

Acknowledgment: The writer wishes to express his appreciation to Mr. Gerhard Bakker of Los Angeles City College for the illustrations in this paper and to Mr. Lewis Weld[1] of Arlington, Virginia, for review of the manuscript.

Summary: An alternate, bisexual generation occurs in the gall wasp *Callirhytis agrifoliae* (Ashm.) previously known from agamic emales only. Heterogony has not been previously demonstrated in this species. The gall, produced by the alternate generation is a tiny, single-celled gall that develops in the veins of the leaves, in the petiole, or in the base of auxillary buds on *Quercus agrifolia* Nee and *Quercus Wislizenii* A. DC. during the months of March and April.

[1] Now deceased.

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HENRY SHEPARD FULLER
1917-1964

Henry S. Fuller, M.D., internationally known medical entomologist and microbiologist, died of a sudden heart attack at Camp Zama, Japan, on February 3, 1964.

Shep, as he was called by his family and associates at Plummers Island to distinguish him from his father, Henry C., or Hank, as he was called by friends in other circles, was born June 17, 1917 in Washington, D. C. There he received his early education in the public schools. In 1937, he was awarded a B.S. degree in chemistry from Worcester Polytechnic Institute in Massachusetts. The following academic year he enrolled in Harvard Medical School, from which he received the degree M.D. *cum laude studiorum peculiarium causa* in 1941.

Following a year of internship at the Massachusetts General Hospital in Boston he was commissioned a first lieutenant in the Medical Corps of the U. S. Army. He was promoted to captain during the war and received a terminal leave promotion to major.

After his military service Harvard awarded him a Moseley traveling fellowship which enabled him to continue postgraduate studies at the London School of Hygiene and Tropical Medicine during the academic year 1946-47. There he was awarded the William Simpson prize and the Lalcaca medal for the high quality of his academic work. During the following year he was appointed assistant professor of preventive medicine at the Bowman Gray School of Medicine at Wake Forest College in North Carolina, and served concurrently as a medical officer in the Tropical Disease Clinic of the Veterans Administration Regional Office in Winston Salem. Thereafter, he returned to the Harvard School of Public Health for the period 1949-53 where he was first a research associate in medical entomology and then an assistant professor of microbiology. He received the degree of Master of Public Health *magna cum laude* from Harvard in 1951.

In 1953, he returned to government service, this time as a civilian scientist with the Department of the Army, an association which lasted until his untimely death this year. Working at the Walter Reed Army Institute of Research, he was assistant chief and later chief of the Department of Entomology. In 1956, he became chief of the Department of Rickettsial Diseases. He held this position until the summer of 1963 when he accepted an assignment for what was to have been a 2-year tour of duty as chief of the Department of Virus and Rickettsial Diseases at the 406th Army Medical General Laboratory at Camp Zama, Japan.

Shep was a brilliant scholar with a wide range of interests. His father, although a chemist, had a deep interest in natural history and was a long-term member (1910-42) and former president of the Washington Biologists' Field Club. Some of Shep's earliest recollections were of many trips he made with his parents and sisters up the Potomac River to Plummers Island, the home of that Club. Many distinguished naturalists—H. S. Barber, E. A. Schwarz, A. K. Fisher, A. Wetmore, W. L.

McAtee, S. F. Blake, H. H. T. Jackson and F. C. Lincoln—were fellow members with the elder Fuller during those years. Their specialized interests included entomology, ornithology, mammalogy and botany. From them young Fuller got a broad acquaintance with the diverse forms of life and developed a love of nature which remained at the very core of his being for the rest of his life. Plummers Island and its associations were an intimate part of his life during his boyhood years, and again during his last 15 years after he himself was elected to membership in 1949.

Because of his deep love of nature, Shep was very fond of Thoreau and was inspired by his writings. At Plummers Island he experienced the tranquil solitude of one of earth's lovely spots. It was to this retreat that he went with increasing frequency during the unhappy later years of his second marriage. For him Plummers Island was an earthly "green pasture" in the true sense of the psalmist.

He was a very witty person with an irrepressible tendency to pun and a love for playing with words. For example, he would take a word like somersault, scramble the letters, and come up with a number of plausible-sounding nouns for which he would formulate appropriate definitions. I now recall only two—"molestraus" and "moustrels;" he defined the latter as "wee, furry minstrels." For years our (HSF and KVK) standard greeting was the silly phrase, "Dr. Stomcock, I presume," a play on the name of the eminent pioneer entomologist, J. H. Comstock.

He was impatient with pompous, long-winded people who suffered from "diarrhoea of the vocal cords." When the occasion warranted, he had a sharp tongue; his inelegant, though highly appropriate term for these individuals was "foldy old marts."

During the period 1958-62, he was the perennial chairman of the House and Grounds Committee at Plummers Island, a group which he fondly and facetiously called the "Grouse and Hounds" Committee. He performed this assignment with great devotion, and at times with a degree of personal inconvenience. On one lovely spring day Fuller, armed with elbow length, heavy rubber veterinarian gloves, assumed the uninviting task of emptying the well-rotted contents of the box latrine into heavy grocery sacks, which were then carted downhill by Krombein. This exploit prompted a cryptic notation by Fuller in the Club register to the effect that we "removed certain formed objects as well as grossly amorphous material from the smaller of the two buildings on the property."

Shep was a firm believer in the purity and potability of the water accumulated in a rain barrel from the cabin roof at the Island. Each spring this water went through a fermentation cycle caused by percolation through the oak catkins in the gutters. The end product had a foul taste, but, confident that the periodic checks at Walter Reed showed the water to be at least bacteriologically safe, he drank it in preference to the "citified," chlorinated product that others of us lugged up to the Island. I can recall my consternation at one of our spring shad bakes when this water, used as a mixer, turned whiskey

Henry S. Fuller, Plummers Island, May 1961

green. Shep looked upon this as evidence that the whiskey could not have been very good.

As a result of boyhood contacts with his father's colleagues in the Washington Biologists' Field Club at Plummers Island, principally H. S. Barber the noted coleopterist, he developed an interest in Coleoptera. But even during these early years he was attracted to medical entomology, and at the age of 12 he received an award from the Gorgas Memorial Institute for an essay on malaria. The prize was presented to him by President Hoover. Perhaps this early interest in medical entomology was stimulated by another of his father's colleagues at Plummers Island, A. K. Fisher, a medically trained naturalist. Some years later Fisher, in co-sponsoring Shep for membership in the Cosmos Club, wrote: "Maybe I had some little influence in developing his interest in medical-biological research, as among other things the subject of insects as disease carriers often entered our conversation, and I led him to have deeper interest in the study of mosquitoes and fleas." During his years in the Harvard Medical School, and under the guidance of J. C. Bequaert, Fuller extended his knowledge of arthropods of medical importance. His first scientific papers, written during this period, were principally on fleas and their taxonomy.

Shep was one of the rare medical officers to be commissioned in World War II with a background of medical entomology. In spite of his unique background, the vagaries of the Army classification system led to a routine assignment as a laboratory officer in a field hospital. He could have stagnated in an area of relative entomological sterility like England or France. Fortunately for him (and more so for the Army), this hospital was sent to the China-Burma-India theater where arthropod-borne diseases were a tremendous problem. On his own initiative, and during time off from laboratory duties, Fuller soon undertook field studies in Burma and Assam on the ecology of scrub typhus and the bionomics and taxonomy of the vector chigger *Leptotrombidium deliensis.* The quality and importance of these investigations led to his subsequent assignment in October 1944 to the U. S. Typhus Commission in the CBI theater for the duration of the war. He was awarded a Bronze Star Medal by the Army for his meritorious achievements over and above the call of duty in the ecological study of scrub typhus. He was also awarded the medal of the U. S. Typhus Commission.

His interest in rickettsial diseases and their arthropod vectors continued after the completion of his military service during World War II. Important contributions to an understanding of the ecology of rickettsialpox and of the life cycle of the mite vector, *Allodermanyssus sanguineus*, were made during his tenure at the Harvard School of Public Health. While at Walter Reed Army Institute of Research, he was sent overseas once again as a member of a team to study Far Eastern Hemorrhagic Fever. In Korea, he undertook entomological investigations of the mites thought to be associated with the transmission of the disease. After his return to Washington he carried out extensive studies of the human body louse and its infection with agents of epidemic typhus and trench fever. In collaboration with an investigator at the Harvard School of Public Health, studies on trench fever led to the successful cultivation of the etiologic agent on artificial media. Shep experimentally inoculated himself with material from infected lice, contracted a clinical case of trench fever, and provided the blood from which the microorganism was first grown. More recently he directed a coordinated field and laboratory investigation into the ecology of Rocky Mountain spotted fever, in collaboration with the Virginia State Department of Health. For the first time in North America it was demonstrated that several species of native wild mammals harbor *Rickettsia rickettsii* incriminating them as possible vertebrate reservoirs. In recognition for his outstanding and distinguished performance of duty at Walter Reed Army Institute of Research he was awarded a Certificate of Achievement in July 1963.

During the few remaining months of his life in Japan he returned to a subject of earlier interest, the ecology of tsutsugamushi disease. In my (KVK) last letter from him (mid-November, 1963) he mentioned that he had just been on field maneuvers for 8 days with the U. S. Marines on the slopes of Mt. Fuji. There he collected "wee furry beasts with chiggers" and took blood samples from 575 Marines. During the week prior to his death he was again in the field with the Marines. Upon his return he was greeted by a large sign in the Marine Officers' Mess, "Welcome home, Hank," and with the announcement that they had ordered a uniform for him and were going to make him an honorary Marine. Just 2 days later he suffered a fatal heart attack.

Fuller was fully aware of the importance of systematics in relation to his investigations on arthropod-borne diseases of man. While in Europe he had the opportunity to study the chiggers in the Oudemans' collection in Leiden; this resulted in the publication of a fundamental study on the taxonomy of these species in 1952. The same year, in collaboration with G. W. Wharton, he published a manual of chiggers. The latter work, especially, provided the necessary foundation for the systematic study of the chiggers of the world. He was a valued invitational lecturer on the relations of Acarina to rickettsial diseases at the Institute of Acarology during the summers it was held at the University of Maryland. He was an invitational lecturer on this subject at the Johns Hopkins School of Hygiene and Public Health also. In 1961 he was tendered, but declined, a professorship at Johns Hopkins.

The historical development of medical entomology was a collateral interest to which Fuller devoted much of his limited leisure time. In 1959 he received a grant from the American Philosophical Society to aid in the preparation of a critical history of medical entomology. Considerable progress was made on this project during 1960. He reported in the 1961 yearbook of that Society that he had completed: "A critical, annotated translation of correspondence during 1724 between Vallisnieri and Gherli concerning lice and the so-called *morbus pedicularis*; a bibliography of the lice of man (approximately 3,600 titles); and medical entomology in the eighteenth century." It is to be hoped that one or more of these fragments are complete enough to permit publication as separate essays or bibliography. It is a pity that Fuller could not have lived to complete this critical history, for his lucid style of discursive writing would have made it a highly readable one. His broad biological background and highly developed critical sense would have made it an invaluable analysis of the historical development in this important field of entomology.

He was a member of many scientific societies including the Biological Society of Washington, Entomological Society of Washington, Entomological Society of America, Washington Academy of Sciences, American Society of Microbiology, American Academy of Microbiology, American Association of Immunologists, American Society of Parasitologists, American Association for the Advancement of Science, American Society of Tropical Medicine and Hygiene, Royal Society of Tropical Medicine and Hygiene, and Sigma Xi National Honorary Research Fraternity. He was also a member of the Commission on Rickettsial Diseases of the Armed Forces Epidemiology Board.

His social clubs were the Cosmos Club and the Washington Biologists' Field Club. He cherished his memberships in these and made many enduring friends among his fellow members. In his characteristically precocious way he was elected to the Cosmos Club before he was 29, very few men having been admitted so young. However, the Washington Biologists' Field Club and its home at Plummers Island were a vital part of his life from his earliest memories. In discussing our memberships in various societies and clubs we (HSF and KVK) opined that if some malign fate restricted us to a single organization, both of us would elect to remain in the Field Club, that unique band of congenial naturalists.

An excellent administrator and teacher, Fuller was respected for these abilities both by his superiors and by the specialists, technicians and enlisted personnel working under his direction. Because he did not tolerate incompetence or mediocrity, he was able to build an efficient, productive department. He was very solicitous of the welfare of his staff, and worked hard and effectively to insure that their achievements were recognized and properly honored.

He is survived by his third wife, Mrs. Nell Benton Fuller, by his mother, Mrs. Henry C. Fuller, by two sisters, Mrs. Josepha F. Hege and Mrs. Katherine F. Watson, and by one niece and five nephews. His ashes were interred with those of his beloved father in Rock Creek cemetery.

With Shep's untimely death medical science lost a distinguished and original investigator who had accomplished much but who would have produced much more had he been favored with a normal life span. His trenchant wit, warmhearted interest and general spirit of camaraderie made him the dearly cherished and sought-after companion of his intimate friends. Our lives have been enriched by our associations with him.

Karl V. Krombein, Chairman[1]
and Edward W. Baker

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[1] We are indebted to Dr. Bennett L. Elisberg and Colonel Robert Traub for furnishing some information on Fuller's contributions to medical science and certain details of his Army career. A generous contribution from the Pinellas Foundation has made it possible to distribute reprints of this biographical sketch to Fuller's friends and associates.

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SOCIETY MEETINGS

724th Regular Meeting, March 5, 1964.

The 724th meeting of the Society was called to order by the President, Dr. Ross H. Arnett, Jr., on March 5, 1964, at 8:00 p.m. in Room 43, U.S. National Museum. Thirty-six members and seventeen guests were in attendence. The minutes of the previous meeting were accepted with one change.

Phillip A. Hubert, Jr. and *Robert M. Altman* were accepted for membership. One candidate for membership was announced: *Setsuya Momoi* of the Museum of Zoology, University of Michigan, Ann Arbor.

There were no committee reports.

The first speaker for the evening, Mr. F. P. Weber, discussed and illustrated a new aerial photographic method for estimating damage by the spruce budworm. The second speaker, Dr. R. T. Yamamoto, reported on control mechanisms in the reproduction of American cockroaches. The third speaker, Dr. R. J. Barker, discussed the use of photoflashes as a potential new tool for the control of insect populations.

President Arnett announced that the Program Committee Chairman, Dr. R. J. Barker, was leaving the area and extended the Society's best wishes to him in his new location. L. G. Davis was appointed temporary Chairman of the Program Committee.

President Arnett invited the Society to hold the May meeting at Catholic University and a motion was made, seconded, and passed to accept.

The possibility of conducting a field trip to Dismal Swamp for members and their families was discussed and those interested were urged to remain after the meeting to formulate plans.

Dr. R. J. Barker exhibited vials containing white-eyed roaches and flies and asked the members to determine whether or not they were blind.

Mr. C. W. Sabrosky reported the first record of the face fly in Montana. The specimens originated from a housewife who refused to accept her county agent's determination of the material as the common house fly.

President Arnett called the member's attention to the new blue cover on the March issue of the Proceedings and the included article on the Society's official seal.

After the introduction of visitors, the meeting was adjourned at 9:50 p.m. W. DONALD DUCKWORTH, *Recording Secretary.*

PUBLICATION DATE

The date of publication of Vol. 66, No. 2 was July 6, 1964. The date of publication of Vol. 66, No. 3 will be found in Vol. 66, No. 4.

BOOK REVIEW

Insect Pathology, An Advanced Treatise. Volume 2. Edward A. Steinhaus, editor. Academic Press. New York and London, 689 pp. Published June 13, 1963. $23.00.

Insect Pathology, Volume 2, completes the two volume series "An Advanced Treatise" on Insect Pathology. The volume contains 17 chapters, as did volume 1. The first 12 chapters of volume 2 deal with the diseases caused by a rather complete array of causal organisms.

The first chapter is on the taxonomy of entomogenous bacteria. This is a good leading chapter as it lays out the history of the taxonomy of the entomogenous bacteria and then goes into a discussion of the criteria used in such a taxonomy, the recent state of the taxonomy and the future of the taxonomy of entomogenous organisms. The next three chapters are devoted to bacterial diseases. In the second chapter, which is a discussion of the diseases caused by spore forming bacteria, the authors devote a large portion to *Bacillus thuringiensis*. The next chapter which is on milky diseases, of course, devoted a large portion to *Bacillus popilliae* and related Bacilli which causes milky diseases in larvae other than *Popillia japonica*. The fourth chapter is on nonsporilating bacterial pathogens. Such a pathogen is the causal agent of European foulbrood in honeybees.

The succeeding four chapters discuss various diseases caused by fungi. These include Coelomomyces infections, Entomophthorales infections, diseases caused by Hyphomocycetous fungi and Cordyceps infections. These are two chapters on infections caused by protozoa, one discussing the Sporozoa and one dealing with Protozoa other than Sporozoa. Other animals causing disorders in insects are nematodes and insect parasites which are subjects of chapters 11 and 12.

Epizootiology of infectious diseases, microbial control, commercial production of insect pathogens, diagnosis of insect diseases and techniques in insect pathology are the subjects discussed in the last five chapters. Of special interest is the chapter just mentioned on the diagnosis of insect diseases. It brings to the reader a new collection of facts which is interesting and of value.

Both volumes are comprehensive treatises on insect pathology and give an accurate picture of the current work in insect pathology. Every chapter is a wealth of information, meticulously written and accurately presented. An examination of the list of contributors whose writings comprise the second volume bears out the claim that the various chapters were written by workers in the field, may, no doubt, whose authority is unequaled. Most of the seventeen chapters are composed of some original material as well as work cited from other authors. A look at the lists of references cited will give some indication of the comprehensiveness of the book.

Floyd P. Harrison, *Department of Entomology, University of Maryland, College Park.*

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THE
ENTOMOLOGICAL SOCIETY
OF WASHINGTON

ORGANIZED MARCH 12, 1884

OFFICERS FOR 1964

MEETINGS

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

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Members shall be persons who have demonstrated interest in the science of entomology. Annual dues for members are $5.00; initiation fee is $1.00 (U. S. currency).

PROCEEDINGS

Published quarterly beginning with March by the Society at Washington, D. C. Members in good standing are entitled to the *Proceedings* free of charge. Non-member subscriptions are $6.00 per year, both domestic and foreign (U. S. currency), payable in advance. All remittances should be made payable to *The Entomological Society of Washington*.

The Society does not exchange its publications for those of other societies.

All manuscripts intended for publication should be addressed to the Editor. Acceptable papers submitted by members only will be published in the order received. Immediate publication may be obtained at a cost to the author of about $15.00 per printed page, plus cost of *all* engraving. Titles of papers should be concise but comprehensive and should indicate the systematic position of the subject insect. By-lines should indicate present mailing address of the author and his organizational affiliation, if possible. Citations in the text of papers longer than one printed page should be by author and date and should refer to a list of concluding references in which author, year, title, name of publication, volume and page are given in that order. In shorter articles, references to literature should be included in parentheses in the text.

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PROCEEDINGS OF THE

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PARASITISM OF EUMENINAE BY CUCKOO WASPS IN TRAP-NESTS IN WISCONSIN

(HYMENOPTERA: CHRYSIDIDAE)[1]

JOHN T. MEDLER, *Dept. of Entomology, University of Wisconsin, Madison.*

Several species of eumenine wasps are parasitized by cuckoo wasps in trap-nests in Wisconsin. This is a report on the data obtained on hosts and parasites during 1952-1962, and is, in part, supplementary to earlier reports on *Ancistrocerus antilope* (Panzer) by Medler and Fye (1956), and *Rygchium foraminatum* (Saussure) by Medler (1964).

Methods and Results—

Trap-nests, each made by boring a hole in an 8-inch length of sumac stem, were placed in various habitats throughout Wisconsin during early spring. Periodic inspections were made during the summer, and those stems utilized for nesting were brought to the laboratory and split open. Each nest was given a code letter and diagrammed on a standardized data sheet. The cells were numbered in sequence and the cell contents reared singly in small glass vials. The letter and number system allowed accurate association of host and parasite specimens obtained by the rearings.

About 25 per cent of the eumenid nests were parasitized by chrysidids. The data (Table I) showed that more nests of *R. foraminatum* were parasitized than nests of *A. antilope*: 29 per cent versus 21 per cent. Only *Chrysis coerulans* Fab. and *C. nitidula* Fab. were reared, and it is probable that the same two species also were responsible for the 49 parasitized nests from which adults of the parasites were not obtained for identification. The data suggested that *A. antilope* was preferred by *C. nitidula*, and *R. foraminatum* by *C. coerulans*. This may be an ecological as well as a biological preference, as Koerber and Medler (1958) found that the eumenid hosts have different preferences

[1] This work was supported in part by the Research Committee of the Graduate School of the University of Wisconsin from funds supplied by the Wisconsin Alumni Research Foundation. The writer gratefully acknowledges the help of K. V. Krombein, Entomology Research Division, U. S. Department of Agriculture, who identified the wasps and the parasites.

for open areas or woodland locations in Wisconsin. Both species of *Chrysis* attacked *A. catskill* (Saussure) and *A. tigris* (Saussure), but only *C. coerulans* was found in nests of *R. leucomelas* (Saussure).

An analysis of nineteen nests of *R. foraminatum* parasitized by *C. coerulans* (Table 2) showed that the location of the parasite in the nest had no consistent pattern. In most nests it appeared that the parasite successfully attacked cells at random. However, nests 11 and 17 had a relatively long linear series of cells each of which contained a parasite. The sex of the parasite was predominantly female. A few males were reared (nests 12, 15, 18), but none of the nests contained both male and female *Chrysis*. There seemed to be no association between the sex of the host and sex of the parasite.

Chrysidids were established successfully in 110 of the 260 cells constructed in 54 plugged (completed) nests of *R. foraminatum*. The frequency distribution of parasitized cells (Table 3) showed that although a majority of nests (28) contained one parasite, it was not uncommon to obtain nests with 2 or 3 parasites. All cells were parasitized in at least one of those nests containing 2-5 and 7 cells. The number of parasites in nests declined as the number of cells increased, and the nests with 10 or 11 cells each had only one parasite. The mean number of cells in the 54 parasitized nests was 4.8 ± 2.24. The mean number of cells in non-parasitized nests of *R. foraminatum* was 4.45 ± 2.38 for the summer generation and 4.76 ± 3.23 for the overwintering generation (Medler, 1964). Therefore, the cell-building habits of the host wasp were not significantly changed in parasitized nests.

The cell location and sex of *A. antilope* and *C. nitidula* in eleven plugged nests showed a random pattern of parasitism (Table 4). There

Table 1. Number of nests of eumenid wasps parasitized by chrysidids during 1952-1962.

Host Species	Total Nests	Nests With Chrysis	Species of Chrysis	Percent of Cells Parasitized*
Ancistrocerus antilope (Panzer)	314	67	*coerulans* (9)	45
			nitidula (25)	43
			sp. ? (33)	67
Ancistrocerus sp., prob. *antilope*	124	24	*coerulans* (15)	95
			nitidula (9)	64
Ancistrocerus catskill (Saussure)	17	6	*coerulans* (4)	36
			nitidula (2)	31
Ancistrocerus tigris (Saussure)	9	3	*coerulans* (1)	20
			nitidula (2)	21
Rygchium foraminatum (Saussure)	201	60	*coerulans* (41)	45
			nitidula (3)	21
			sp. ? (16)	37
Rygchium leucomelas (Saussure)	6	1	*coerulans* (1)	20

* In parasitized nests: Total parasitized cells/total provisioned cells.

Table 2. Number of cells and sex of *Rygchium foraminatum* or *Chrysis coerulans* reared from nineteen nests, each with an orifice plug.

	Cell Number								
Nest No.	1	2	3	4	5	6	7	8	9
1	♀ C								
2	♀ R	♀ C							
3	♀ C	♀ R							
4	♀ R	♀ C	♀ R						
5	♀ R	♀ C	♂ R						
6	♀ C	♀ R	† R	♂ R					
7	♀ C	♀ C	♂ R	♂ R					
8	♀ R	♀ R	*	♂ R	♀ C				
9	♂ R	♂ R	♀ C	♀ C	♀ C				
10	♀ C	*	♂ R	♀ C	♂ R				
11	♀ C	♀ C	♀ C	♀ C	♀ C				
12	♀ R	♀ R	♂ R	♂ R	♂ R	♂ C			
13	♀ C	♀ C	♀ C	♀ C	♂ R	♂ R			
14	♀ R	† C	♀ R	♀ R	♀ C	♀ C	♀ C		
15	♀ R	♀ R	♀ R	♀ R	♂ C	♂ R	♂ R		
16	♂ R	♂ R	† ?	♀ C	† ?	♂ R	♂ R		
17	♀ C	♀ C	♀ C	♀ C	† C	♀ C	♀ C		
18	♀ R	♀ R	♀ R	† R	♀ R	♀ R	♂ C	† ?	
19	♀ R	♀ R	♀ R	♀ R	♀ C	♂ R	♀ C	† ?	♀ C

R = *R. foraminatum*; C = *C. coerulans*; † = adult not reared; * = spoiled provisions.

Table 3. Frequency distribution of the number of cells with chrysidid parasites in 54 completed nests of *R. foraminatum*.

	Number of cells in nest										
No. of Cells Parasitized	1	2	3	4	5	6	7	8	9	10	11
1	3	4	4	4	5	3	3			1	1
2		1	3	1	1		2		1		
3			1	2	4	1	1		1		
4				1	2	1					
5					1			1			
6											
7							1				

Table 4. Number of cells and sex of *Ancistrocerus antilope* or *Chrysis nitidula* reared from eleven nests, each with an orifice plug.

Nest No.	1	2	3	4	5	6	7	8	9
20	♂ N	♀ A							
21	♀ N	♂ A							
22	♀ N	♀ N							
23	♀ N	♀ A	♂ A						
24	♂ A	♂ A	♂ A	? N					
25	♀ N	†	♂ A	♂ A					
26	♀ A	♀ A	♀ N	♀ A					
27	♀ N	♀ N	*	♀ N	♂ A				
28	♀ A	*	? N	♂ A	♂ A				
29	♀ A	♀ A	♀ N	♂ N	♂ N				
30	♂ A	♂ A	♀ N	†	♀ N	♂ A	♂ A	♂ A	♂ A

A = *A. antilope*; N = *C. nitidula*; † = adult not reared; * = unprovisioned cell.

Table 5. Frequency distribution of the number of cells with chrysdid parasites in 62 completed nests of *A. antilope*.

No. of cells Parasitized	Number of cells in nest 1	2	3	4	5	6	7	8	9
1	16	13	3	8					
2		10	1	1	2				1
3			2	2		1			
4				1		1			

was no correlation between sex of host and sex of parasite, as demonstrated particularly in nest 30, where a female parasite was reared from a nest in which the host larvae were all males. Most of the parasites were female, but a male was present in nest 20, and 2 males and one female were reared from nest 29.

The frequency distribution of parasites in nests (Table 5) showed that 40 nests had one parasite, 15 had two, five had three, and only two nests had four parasites. The nest with 9 cells had two parasites. The parasitized nests contained 2.56 ± .9 cells, which is not significantly different from the 2.7 cells in an average nest in Wisconsin, reported by Medler and Fye (1956). These data indicate that the foundress did not react to parasitism by altering her normal building pattern.

The pattern of provisioning was carried out normally in parasitized nests, when the size of reared wasps was a criterion. In parasitized nests of *A. antilope* the mean head width of 13 females was 3.35 ± .31

mm; of 24 males 2.79 ± .29 mm. In non-parasitized nests, 205 females had a mean head width of 3.42 ± .28 mm; while 113 males had 2.81 ± .24 mm. Similarly, in parasitized nests of *R. foraminatum*, 49 females had a mean head width of 3.19 ± .21 mm; 35 males had 2.58 ± .26mm. The mean head width of 331 females from non-parasitized nests was 3.14 ± .28 mm; 224 males were 2.59 ± .29 mm, according to Medler (1964).

The above information on nest architecture and size of progeny suggests strongly that the eumenid wasp either does not detect the chrysidid parasite; or, does not alter her normal nest-building pattern if the parasite is detected.

Most of the trap-nests contained late-instar larvae or cocoons when opened. Life history data on *Chrysis* species was therefore limited. However, observations from a few nests obtained in early stages of construction indicated that the chrysidid deposited an egg in the eumenid cell at the time it was being provisioned. It was not determined whether the parent chrysidid or its larva destroyed the eumenid egg or larva at a very early stage, but two eggs or two larvae were never found in a single cell. As the parasite larva is very similar to the host larva, many of the rearings were made under casual observation without at first suspecting that a parasite was present.

The parasite larva, after devouring the host and provisions, responded to the texture and geometry of the cell partition to orient head-wise toward the nest exit. This response was just as precise as that found in larvae of the host (Cooper, 1957 p. 504). The mature parasite larva spun a tough, brown-opaque, oval cocoon marked with a prominent opaque white patch on the dorsal-lateral aspect. The cocoon was attached loosely to the walls of the cell by a few strands of silk. The adult chrysidid emerged from the rearing vials at the same time as the eumenids taken from the other cells.

The males are generally smaller than females, but females were reared that were smaller than the largest males. The mean head width of 66 females of *C. coerulans* was 2.56 ± .23 mm. range 2.0 – 3.0 mm.; of 9 males, 2.33 ± .21 mm, range 2.0 – 2.6 mm. The mean head width of 32 females of *C. nitidula* was 2.72 ± .25 mm., range 2.1 – 3.2 mm.; the mean head width of 4 males was 2.63 ± .17 mm.; range 2.4 – 2.8 mm.

The life cycles of the eumenids and chrysidids appeared to be synchronous. A summer and an overwintering generation were obtained for both host and paras te. Those nests opened in July or early August usually produced *Chrysis* adults after a short period in rearing vials, whereas the nests opened in late August or September contained fully developed larvae in cocoons in diapause. The diapause was normally broken by 4-5 weeks of cold treatment followed by a period of warm incubation.

Interesting evidence was obtained on the existence of chrysidids in diapause during the summer generation. Eleven nests which contained chrysidids in cocoons were opened July 5-22. Following transfer to rearing vials there was no emergence of adults during the next three months. Starting in October, the cocoons were given 1-6 weeks of cold treatment, after which, during warm incubation, the adults of *C. coerulans* and *C. nitidula* emerged. Four of the nests each had a single parasitized cell. Six of the nests had two cells, with both cells parasitized in three nests, and one cell parasitized in the other three. The eleventh nest contained six cells, but all were empty when the nest was opened on July 22, except the first-made cell which had a chrysidid cocoon. The phenomenon of summer diapause was not associated with parasite attack on one-or-two-celled nests, as several other such nests containing parasites produced the chrysidid adults during the summer without a diapause. A host wasp was not obtained from any of the above nests, but the structure of the nests was typical of *A. antilope* and probably were made by that species.

Discussion

The various theories of *Chrysis* parasitism, proposed by Westwood, St. Fargeau, Brulle, Chevrier, Smith and Packard, were summarized by Walsh (1869, p. 162). These writers variously suggested that the parasite larva fed upon the supply of food or upon the nearly fully grown host larva. It is obvious that various species differ in their habits, as Chapman (1896) observed *C. ignita* (L.) feeding upon caterpillars in a cell of *Odynerus parietum*, whereas *C. bidentata* oviposited during, or immediately after, the time a cocoon was spun by the full grown larva of *O. spinipes*. Although six to ten eggs were dropped in a host cocoon by *C. bidentata*, there was no evidence of more than one egg hatching in a cell.

Krombein (1958) proposed the following pattern for six species of cuckoo wasps in North Carolina; "The chrysidid egg is deposited in the cell while the host wasp is provisioning it; the chrysidid larva, a highly modified form with strongly chitinized head and heavy mandibles, usually hatches earlier than the host larva, and immediately seeks out the host egg or newly hatched larva and devours it; then it molts to the normal form of wasp larva and begins to feed on the prey stored for the host; it reaches maturity before using all the prey unless the host wasp has stored less than the normal amount."

The observations on *C. coerulans* and *C. nitidula* show that they also belong to the group of species that destroy the egg or perhaps the very young larva of the host, and then proceed to consume the caterpillar provisions.

Although it was not possible to obtain direct observations on *Chrysis* in the act of ovipositing in the trap-nests, it seems plausible to hypothesize that the parasite lays a single egg in a cell as it is being provisioned or prior to the closure of the cell by a partition. This act is probably undetected by the wasp building the cells. The detrimental effect to the species is the mortality in those cells successfully attacked by the parasite. This mortality varies considerably from nest to nest, and in those nests with parasites it is only rarely that all cells are destroyed. There is no evidence that the characteristic double partitions in a *Rygchium* nest provide greater protection from the parasite, in comparison with the single partitions found in *Ancistrocerus* nests.

C. coerulans is now known to parasitize wasps in three genera of Eumeninae. In addition to *Ancistrocerus* and *Rygchium* reported above, the parasite (as *bella* Cresson) was associated with *Eumenes fraternus* Say by Walsh (1869, p. 135). The specimens were obtained from two small cells which had been constructed in a single large cell of a mud-dauber nest. The observation by Walsh may help to explain the apparently anomolous records by Ashmead (1896) and Harrington (1896) who both reported *coerulans* from cells of the common mud-dauber *Sceliphron caementarium* (Drury). It is a well known habit of certain eumenids to appropriate the cells made by different bees and wasps, and a favorite locality is old mud-dauber cells.

C. nitidula apparently is restricted to *Ancistrocerus* and *Rygchium*. Harrington (1896) reared this species from *Odynerus catskillensis* Saussure (= *Ancistrocerus*). Cooper (1953, p. 32) reared *nitidula* from nests of *Ancistrocerus antilope* in New York.

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THE SYSTEMATIC POSITION OF THE GENUS LINSLEYA

(Coleoptera: Meloidae)

In a recent and valuable review of the insect enemies of Acridoidea, Greathead (1963, Trans. Roy. Ent. Soc. London 114:493) cites two references in which the blister beetle "*Lytta sphaericollis* Say" is reported as a predator of grasshoppers in Canada. These reports have an important bearing on the question of the systematic position of this meloid and related species, and since they appear to have been missed by specialists in Meloidae, I feel that special attention should now be called to them. Unfortunately, neither reference indicates the species of grasshopper involved or the extent of the predation. In one, Criddle (1931, Canada Dept. Agr. Bull. No. 143 (n.s.): 12) lists "the small blister beetle (*Lytta sphaericollis* Say)" as one of several "enemies" of grasshoppers in Canada "east of the Rocky Mountains." In the other, Romanow (1954, Proc. Ent. Soc. Manitoba 9:15) states that "three species of blister beetles, *Macrobasis* [=*Epicauta*] *fabricii* (Lec.), *Macrobasis subglabra* Fall. [*sic*], and *Lytta sphaericollis* Say, have been found to be predacious on grasshoppers eggs in Manitoba."

Sphaericollis Say (=*infidelis* Fall), *compressicornis* Horn, *convexa* LeConte, and *suavissima* Wellman were removed from the genus *Lytta* and placed in a new genus, *Linsleya*, by MacSwain in 1951 (Pan-Pacific Ent. 27:58). Subsequently, *Linsleya* was revised with the addition of a new species (*californica*), by Selander (1955, Amer. Mus. Novitates No. 1730, 30 pp.), and the triungulin larvae of two of the species were described by MacSwain (1956, Univ. California Publ. Ent. 12:38–39). On the basis of anatomical characters of the larval phase MacSwain treated the genus as an epicautine. This interpretation has been generally accepted in this country (*e.g.*, Selander, *op. cit.;* Arnett, 1960, The beetles of the United States, Fasc. 69:5), but Kaszab (1963, Acta Zool. Acad. Sci. Hungaricae 5:83, fig. 96) regards *Linsleya* as a lyttine more or less closely related to *Lytta*.

The dispute over the relationships of *Linsleya* arises from the fact that while the triungulin larvae of the genus are clearly epicautine structurally, the adults lack the diagnostic anatomical characteristic of all other epicautines (an excavated, sericeous-pubescent area on the fore femur that serves as an antennal cleaner). This dispute might have been averted had the reports of Criddle and Romanow come to light earlier since it has long been accepted that the subtribes Epicautina and Lyttina (tribes of most authors) are quite distinct bionomically. Thus all undoubted epicautines whose larval ontogeny has been studied (numerous species of *Epicauta*) have proven to be predaceous on grasshopper eggs, while all lyttines investigated (species of *Lytta* and *Trichomeloe*) are larval parasitoids in the nests of bees. Consequently, the reported association of *Linsleya sphaericollis* with grasshopper eggs provides strong, if not decisive, support for MacSwain's interpretation of the relationships of the genus *Linsleya*.—Richard B. Selander, Department of Entomology, University of Illinois, Urbana.

NEW FLOWER BREEDING SPECIES OF DROSOPHILA [1]
(Diptera: Drosophilidae)

Sarah Bedichek Pipkin, The Gorgas Memorial Laboratory, Panama, R. of P.

In studies designed to learn something of the ecology of the Drosophilidae of Panama, twelve new flower-breeding species of the genus *Drosophila* have been discovered. Excepting the last, these belong to the subgenus *Drosophila.* The species occupy a facies distinct from that of the ground-feeders, with one exception, never being taken by net-sweeping over fallen fruits or blossoms or in traps baited with cultivated fruits. The flies may be collected by aspiration from the flowers of various forest plants or may be "bred out" of the latter. The ecological relationships among certain o these species wil be discussed elsewhere. The purpose of the present paper is to present descriptions of the species.

Colors and measurements given in the descriptions were determined using live specimens. Terminalia preparations were made, also with fresh material, following the method of Fairchild and Hertig (1948). Chromosomes of larval ganglion cells of two species have been prepared using the method o Lewis and Riles (1960). The eye index and that of the horn of the puparium were measured according to Frota-Pessoa (1954). "Outer" and "inner" coi s of the testis are considered to represent the testis proper and vas deferens, respectively, following Throckmorton (1962).

Types of the new species will be deposited in the U. S. National Museum, Washington, D. C.; Drosophila Type and Reference Collection of the Genetics Foundation, The University of Texas, Austin, Texas; California Academy of Sciences, San Francisco, California; and The Gorgas Memorial Laboratory, Republic of Panama. Pressed specimens of certain plant hosts of the new species of *Drosophila* will be placed in the National Herbarium, Washington, D. C.

Description of the Species

Drosophila nigrasplendens, new species
(Figures 1 A–D)

External characters of imagines.

♂, ♀, Arista with 5 dorsal and 2 ventral branches in addition to the terminal fork. Antenna dark brown, third joint covered with pale pile. Frontal triangle dull black; ocellar triangle and orbits dark brown and semi-shining; ocelli yellowish. Frontal hairs few or absent; orbital hairs, 5 on each side. Proclinate orbital bristle 3/4 the posterior reclinate; anterior reclinate very small, less than 1/3 the proclinate.

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Anterior ocellars slightly divergent, the length equal to that of the inner verticals. Post verticals well developed, crossed. Face dark brown; carina high, flat-topped, not sulcate, slightly longer than third joint of the antenna. Cheeks dark brown; 2 oral bristles of about equal length. Distance from the border of the eye to the base of the first oral 1/10 greatest diameter of the eye. Eyes wine red with thick yellowish pile. Eye index 1.7. Palpi yellowish with one prominent subapical bristle, another on the antero-lateral border in addition to many small hairs. Proboscis dark brown; head somewhat depressed.

Acrostichals in 6 rows; no prescutellars; anterior scutellars almost straight. Distance from anterior to posterior dorsocentrals one-half the distance between the two anterior dorsocentrals. Two humeral bristles. Pleura dull lead-colored with pale pollinosity; halteres dull yellowish. Anterior sternopleural bristle 5/7 the posterior; midsternopleural thin and 3/7 the posterior. Femora black, tibiae dark brown; tarsi dirty yellowish; many recurved hairs on first tibiae and tarsi. About 6 stout bristles on the lateral flexor border of anterior femora. Apical bristles on first and second tibae; preapicals on all three.

Wings unicolorous tan with yellowish veins; posterior cross-vein and tip of III slightly darker. Costal index about 2.9; 4th vein index about 1.6; 4c index about 0.8; 5x index about 1.1. Third section of costal vein with heavy hairs on the basal half. One bristle at the apex of the first costal section.

Abdominal tergites all black except for anterior medial portions of tergites 2, 3, and 4 which are brownish to yellowish; semi-shining with some pollinosity visible.

Body length (etherized), ♂, 1.75 mm.; ♀, 1.75 mm.

Wing length, ♂, 1.15 mm.; ♀, 1.15 mm.

Internal characters of imagines and genitalia.

Anterior Malpighian tubule single for more than 3 times the width of the intestine; two branches free and turned back a little. Posterior Malpighian tubule single for a little less than 3 times the width of the intestine; two branches free apically, each looped about a spermatheca. Each testis with 6 pale yellow larger proximal coils (the vas deferens) and 8 to 9 deeper yellow thin concentrically arranged distal coils (testis proper). Sperm pump with 2 short diverticula, each the length of the pump. Apodeme of the penis rod-shaped; penis simple, slightly expanded apically. Forceps with 9 to 10 primary teeth, each separated by a short distance from the other, in a sigmoid curve; 7 to 8 thick marginal bristles (fig. 1 D). Hypandrium with one pair of long bristles; a pair of gonapophyses, each with two short bristles; bow of hypandrium with well developed horn; genital arch with about 4 bristles on the lower part near the junction with the forceps; toe not well developed (fig. 1 A,D). Anal plates separate from genital arch. Spermathecae brown, club-shaped; inner duct expanded apically. Ventral receptacle loosely coiled; stretches longer than the fly itself. Ovipositor plates boat-shaped; reddish, with about 20 teeth, those near the apex especially broad and sharp-tipped; apex of ovipositor plates acuminate (fig. 1 B).

Other characteristics, relationship, and ecology.

Eggs. With 2 short filaments, each about 1/20 the length of the egg (fig. 1C).

Relationship. Although this species possesses several characters typical of the subgenus *Sophophora* (two egg filaments, ventral receptacle only loosely coiled, posterior Malpighian tubules free, bands of abdominal tergite not broken in the midline), nevertheless it is placed in the subgenus *Drosophila* because of the structure of the male terminalia: simple head of penis, well developed horn of the bow of the hypandrium, uncomplicated forceps.

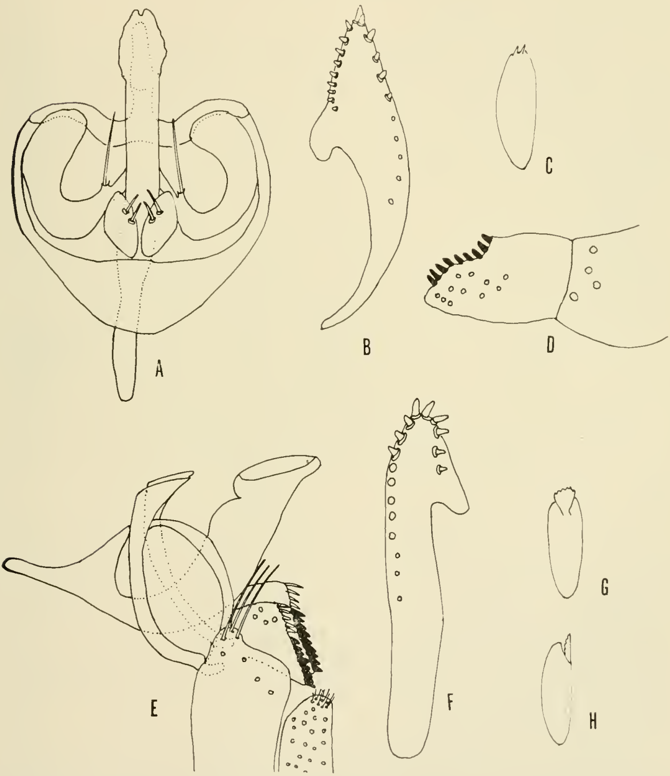

Figure 1, *D. nigrasplendens*. A, ventral view hypandrium, penis and its apodeme; B, ovipositor plate; C, egg; D, forceps and lower part of genital arch. *D. leoni*. E, lateral view of hypandrium, penis and its apodeme, forcipes, lower part of genital arch and of anal plate; F, ovipositor plate; G, H, egg.

Ecology. Aspirated July, 1960; May, July, 1961; Sept., 1962, March, 1963, from flowers of *Heliconia subulata* R. and P. (Family Musaceae); bred from these flowers Sept., 1962, Cerro Campana, Republic of Panama, 2500 feet; bred from the flowers of an unidentified closely related *Heliconia* sp., March, 1963; Ft. Sherman Reservation, Canal Zone.

Drosophila alani, new species
(Figure 3 G–L, Figure 8)

External characters of imagines.

♂, ♀. Arista with 5 or 6 dorsal and 3 ventral branches in addition to the terminal fork. Antenna yellowish brown; third joint lead-colored with short pale hairs; not as long as the carina. Front dull lead posterior to the level of the proclinate orbital bristle, becoming brownish anteriorly. Frontal triangle well defined; 3 conspicuous frontal hairs on each side near the apex; 6 orbital hairs; ocelli pink. Proclinate orbital 3/5 the posterior reclinate; anterior reclinate less than 1/3 the proclinate. Anterior ocellars straight and about equal to the inner verticals; post verticals crossed; not unusually small. Face yellowish brown above, darker below; carina flat, not sulcate, broader below. Cheeks yellowish brown; distance from eye margin to base of first oral 1/11 the greatest diameter of the eye. One pair prominent oral bristles, the second less than half the first. Eyes large, dull purplish red with pale pile; eye index 1.1. Palpi yellowish brown with one long subapical bristle, a shorter bristle below it on the lateral margin, in addition to smaller hairs; proboscis yellowish.

Acrostichal hairs in 6 rows; no prescutellars. Anterior scutellars widely divergent. Two humeral bristles. Distance from anterior to posterior dorsocentrals about 3/7 the distance between the two anterior dorsocentrals. Mesonotum and scutellum shining dark brown; pleura shining lead color; halteres dirty yellow. Anterior sternopleural 4/7 the posterior and thinner than the latter; mid-sternopleural only 2/7 the posterior. Legs unicolorous dirty yellowish; a few recurved hairs on the first tarsi. Anterior femora with 3 bristles along the lateral-extensor surface; two, along the lateral-flexor surface. Apicals on the first and second tibiae; preapicals on all three.

Wings unicolorous tan; posterior crossvein distinctly convex. Two prominent bristles at the apex of the first costal section, the ventral one thinner, followed in the male, by 13 costal bristles of length equal to that of the dorsal bristle at the apex of the first costal section, held at an angle of 30 degrees to the plane of the wing, each longer bristle being separated from the next longer bristle by a number of costal hairs of the usual size; two such longer bristles being located distal to the tip of II (fig. 8). The longer costal bristles are evident on close inspection in the female wing, but these are much shorter than in the male wing. Third section of the costal vein with heavy hairs on the basal 4/9. Costal index about 3.6; fourth vein index about 1.2; 4c index about 0.53; 5x index about 0.8.

Abdomen, ♂, ♀, shiny greenish gray with black apical bands extending more than half the width of the tergite; these fading at the lateral bend; bands of tergites, 3,4 and 5 slightly thickened medially. In ♀, seventh tergite is triangular, incomplete dorsally; eighth tergite, a broad trapezoidal plate. Sternites of both sexes lead color.

Body length (etherized), ♂, 2.75 mm.; ♀, 2.75 mm.

Wing length, ♂, 2.45 mm.; ♀, 2.45 mm.

Internal characters of imagines and genitalia.

Anterior and posterior Malpighian tubules golden yellow, branching at a distance of about 4 times the width of the intestine; anterior tubules free; posterior tubules apposed but no continuous lumen. Each testis a flat rosette of about 10 gyres, the

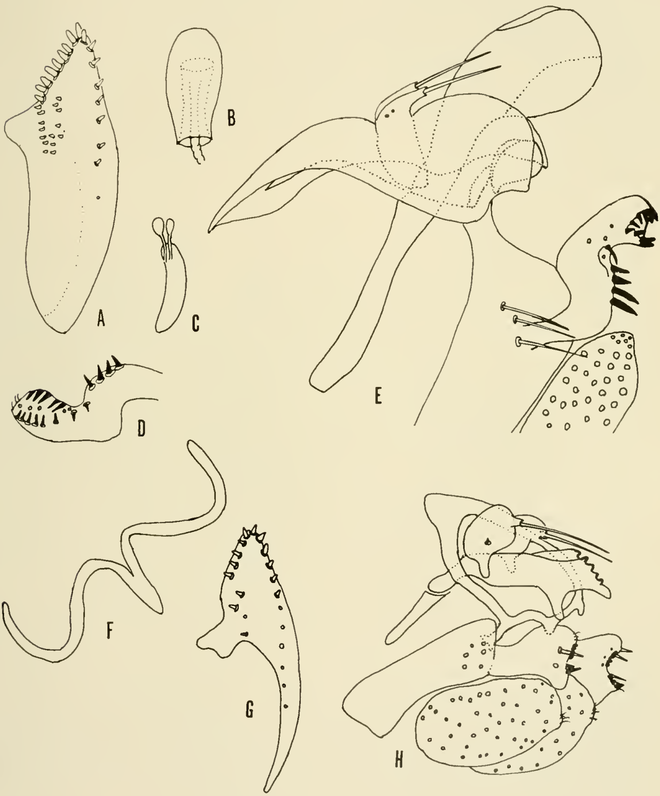

Figure 2, *D. hansoni*. A, ovipositor plate; B, seminal receptacle; C, egg; D, ventral surface of forceps; E, lateral view of hypandrium, penis and its apodeme; lower part of genital arch and anal plate; forceps; F, bow of hypandrium. *D. leukorrhyna*. G, ovipositor plate; H, lateral view of hypandrium, penis, apodeme of penis; forceps; genital arch and anal plates.

diameter of the testis becoming gradually larger distally; almost transparent; whitish. Sperm pump with two diverticula, each about 1 and 1/2 times the length of the pump. Apodeme of the penis rod-like, making an angle of about 120° with the penis; penis shaped like the torso of a sheep in lateral view (fig. 3 L); head of penis with 4 to 6 heavily chitinized teeth; dorsal surface of head of penis T-shaped (fig. 3 J). A pair of gonapophyses, each with a long bristle; bow of hypandrium with short horn (fig. 3 G). Hypandrium joined broadly to conchae. Forceps with 4,5 or 6 very short primary teeth, no secondary teeth; large rounded medial ventral prolongation and smaller dorsal prolongation on each forceps (fig. 3 K). About 5 long marginal bristles and a number of shorter bristles on the medial surface of each forceps. About 4 prominent bristles on the lower part of each genital arch near the junction with the forceps; no bristles on the toe; anal plates separate from genital arch. Spermatheceae dark brown, globular; inner duct with wide apical expansion (fig. 3 I). Ventral receptacle a long tube with from 114 to 120 tight coils. Ovipositor plates golden brown with about 13 marginal teeth and 8 smaller spines posteriorly medial to the dorsal edge (fig. 3 H).

Other characteristics, relationship, and ecology.

Puparia. Dull brown; anterior spiracles each with 10 long and 5 very short filaments; posterior spiracles white, apart. Horn index 2.

Relationship. Shows relationship to *D. leukorrhyna* new species, in the shape of the penis and presence of heavily chitinized teeth on the head of the latter; in the large eighth tergite of the female of both species, and in the enlargement of certain bristles of the costal vein, though this is not readily seen in *D. leukorrhyna.* The wing of *D. alani*, with certain elongated costal hairs, somewhat resembles that of *D. acanthoptera* Wheeler 1949, subgenus *Sordophila*, although the wing of the latter species is similar in both sexes. Further, costal indices in the two species differ markedly, and the two bristles at the apex of the first costal section are shorter in *D. alani* than in *D. acanthoptera.* Anterior scutellar bristles are widely divergent in *D. alani* but convergent in *D. acanthoptera.* Structure of testis coils differs in the two species, and there are no secondary bristles in the forcipes of *D. alani*, although these are present in the forcipes of *D. acanthoptera* ((Hsu, 1949).

Ecology. Bred from flowers of *Heliconia curtispatha* Peters found in the forest near the Cinco Millas Railroad Station, Almirante, Bocas del Toro, Republic of Panama, April, 1962. Specimens collected from and also bred from flowers of the same species in a gallery forest near El Real, Darien, Republic of Panama, Nov., 1962. The specimens from Darien differ from the type material of *D. alani* as follows: eyes bright red; abdominal tergites lighter (yellowish, with apical bands only half the width of the tergites); pleura lighter (straw-colored); apodeme of the penis in an almost straight line; head of the penis with 3 more teeth than are found in *D. alani,* from Almirante, Panama. It is not known if the El Real specimens represent an undescribed sibling species or merely a geographical variation of *D. alani.*

Dedication. The species is named in honor of Alan C. Pipkin, Jr., who first collected it, in appreciation of the extensive help I have received from him in collecting tropical Drosophilidae.

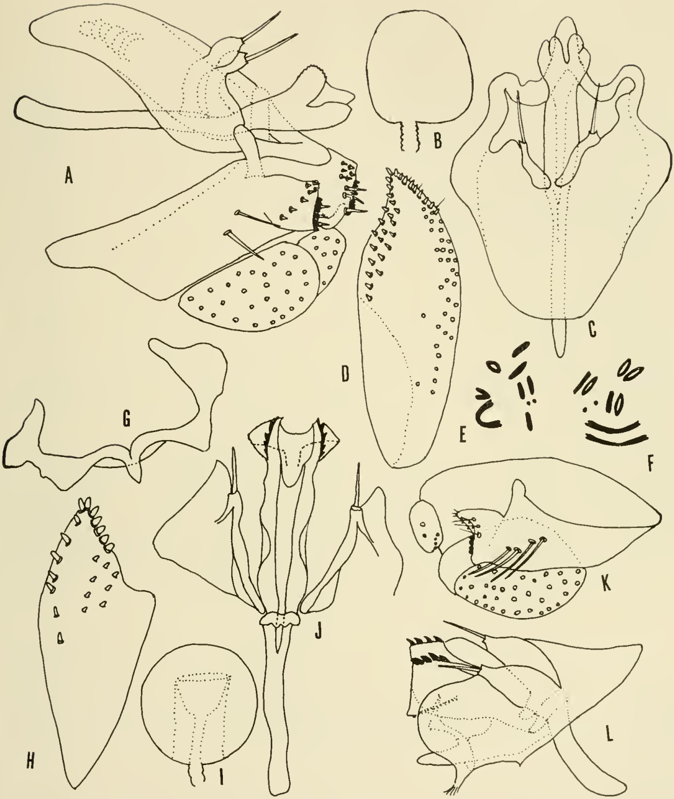

Figure 3, *D. mcclintockae*. A, lateral view of hypandrium, penis, apodeme of penis, genital arch and anal plates, forcipes; B, seminal receptacle; C, ventral view of hypandrium, penis and its apodeme; E, F, chromosomes of larval brain ganglion cells, male and female. *D. alani*. G, bow of the hypandrium; H, ovipositor plate; I, seminal receptacle; J, ventral view of penis and its apodeme, gonapophyses and conchae (rest of hypandrium removed); K, lateral view of forceps, genital arch, and anal plates; L, lateral view of hypandrium, penis and its apodeme.

Drosophila leukorrhyna, new species
(Figure 2 G–H)

External characters of imagines.

♂, ♀. Arista with 5 dorsal and 3 ventral (or 6 dorsal and 2 ventral) branches in addition to the terminal fork. Antenna dark brown, third joint slightly longer than the carina and covered with short pale hairs. Front dark brown with a pale pollinosity when viewed at an angle; orbits and ocellar triangle darker; ocelli pinkish. Six inconspicuous frontal hairs on each side near the apex of the frontal triangle. Proclinate orbital bristle 4/5 the posterior reclinate; anterior reclinate very thin, about 1/8 the posterior reclinate. Orbital hairs, 6 on each side. Anterior ocellars almost parallel; about equal to the inner verticals. Post verticals well formed, crossed. Face dusky brown; carina white, broad, bulbous, not sulcate, slightly longer than third joint of antenna; clypeus lead colored; oral cavity ventral to clypeus whitish. Cheeks brownish from eye margin to base of oral; paler posteriorly and ventrally. One pair strong oral bristles; second pair thinner and less than half the first; distance from eye margin to base of oral bristle 1/10 the greatest diameter of the eye. Eyes dark red, not darker above, with pale pile; eye index 1.1. Palpi dusky brown with one strong apical bristle, two subapical bristles, and many fine hairs. Proboscis dark brown, shining at tip.

Acrostichals in 6 rows; no prescutellars. Anterior scutellars widely divergent; two humeral bristles. Distance from anterior to posterior dorsocentrals half the distance between the two anterior dorsocentrals. Mesonotum and pleura shining dark brown; halteres lead colored at tip; dirty yellowish at base. Anterior sternopleurals half the posterior sternopleurals; mid-sternopleurals thin and 1/4 the posterior. Legs unicolorous brownish-yellow; 5 prominent bristles on the lateral extensor surface and 4 such bristles on the lateral flexor surface of the anterior femora; a few recurved hairs on the first tibiae and tarsi. Apicals on first and second tibiae; preapicals, on all three.

Wings unicolorous tan; posterior crossvein darkened; two prominent bristles at the apex of the first costal section; third section of the costal vein with heavy hairs on the basal half. Both sexes have about 13 heavy hairs of the costal vein slightly longer than other hairs, a longer hair occurring about every seventh hair; seen when the wing is viewed from an angle, since longer hairs project at a slight angle from wing surface. Costal index about 3.1; fourth vein index, about 1.5; 4c index about 0.8; 5x index about 1.0.

Abdomen, male, with shining black apical bands, filling the width of tergites 5,6; dark brown with slight medial indentation in tergites 2,3,4; tergites of female similar but dark brown; eighth tergite large, forming a dorsal trapezoidal plate anterior to the anal plates.

Body length (etherized), ♂, 2.5 mm.; ♀, 3 mm.

Wing length, ♂, 2.25 mm.; ♀, 2.35 mm.

Internal characters of imagines and genitalia.

Anterior Malpighian tubules free; posterior Malpighian tubules apposed but without a continuous lumen. Each testis whitish, with 4 thicker proximal coils (the vas deferens) and 10 thinner distal coils (the testis proper). Sperm pump with two diverticula slightly more than one-half the length of the pump. Apodeme of the penis a bent rod; head of penis expanded, the apical ventral end with serrate edges (fig. 2 H), a finger-like projection dorsally; bow of hypandrium with well developed horn; a pair of gonapophyses, each with one prominent bristle and a second inconspicuous one. Forceps with 3 or 4 short black teeth ventrally, followed after a space of one or two teeth by 3 larger primary teeth dorsally, the whole arranged in a curve which turns abruptly with the larger dorsal teeth; forcipes joined medially by a narrow plate. Two large bristles on the lateral surface of the forceps; 5 to 6 prominent bristles on the lower part of the genital arch near the junction with the forceps. Genital arch separate from anal plates.

Spermatheceae light brown, pear-shaped, twice as long as wide; diameter of inner duct uniform. Ventral receptacle very long and thin, with about 4 large loose coils at the base and 104 small tight coils distally. Ovipositor plates golden, not unusually acuminate, with about 24 teeth (fig. 2 G).

Other characteristics, relationship, and ecology.

Eggs. With 4 slender filaments, the proximal ones slightly less than the longer diamteter of the egg.

Relationship. Related to *D. alani* n. sp., which it resembles in the general shape of the penis and apodeme, in the chitinized spines on the tip of the penis, the presence of a large eighth tergite in the female, and the presence of certain elongated hairs of the costal vein.

Ecology. Develops in the flowers of *Heliconia mariae* Hook (Family, Musaceae). Bred from these flowers collected in Madden Forest, Canal Zone, January, 1961; in Ft. Sherman Reservation, Canal Zone; March, Oct., 1962; in Yape, Darien, Republic of Panama, Nov., 1962.

Drosophila leoni, new species
(Figure 1 E–H)

External characters of imagines.

♂, ♀. Arista with 3 dorsal and 2 ventral branches in addition to the terminal fork. Antenna dark lead color; third joint covered with pale short hairs. Front dull black; orbits and ocellar triangle slightly raised and semi-shining; frontal triangle covered with pale pollinosity. Ocelli whitish; 3 to 4 inconspicuous frontal hairs on each side near the apex of the frontal triangle. Proclinate orbital bristle of equal length as the posterior reclinate; anterior reclinate 2/3 the proclinate; 6 orbital hairs on each side. Anterior ocellar bristles divergent and equal to the inner verticals. Post verticals well formed and crossed. Face dark lead color on carina, paler on sides; carina prominent, broad, sulcate. Cheeks dark brown, not missing below; distance from eye margin to base of oral bristle 1/20 greatest diameter of the eye. One pair of prominent oral bristles, the second one-third the first. Eyes red with short black pile; eye index 1.25. Palpi dark gray, with one prominent subapical bristle and several shorter bristles below on the lateral margin, together with smaller hairs. Proboscis dark gray.

Acrostichal hairs in 8 rows; one pair of weak prescutellars; anterior scutellars convergent; two humeral bristles. Distance from anterior to posterior dorsocentrals 1/3 the distance between the two anterior dorsocentrals. Mesonotum, scutellum, and pleura dull black. Halteres pale yellow. Anterior sternopleural 5/7 the posterior; mid-sternopleural thin, 1/7 the posterior.

Legs unicolorous yellow; some recurved hairs on first tarsi; anterior femur with about 4 to 5 prominent bristles on the lateral-extensor surface and 3 to 4 such bristles on the lateral-flexor surface. Apicals on first and second tibiae; preapicals on all three.

Wings unicolorous pale yellow; veins the same color. Two prominent bristles at the apex of the first costal section. Third section of the costal vein with heavy hairs on the basal half. Costal index about 2.0; fourth veing index 2.1; 4c index, 1.4; 5x index, 1.7.

Abdomen of both sexes pale yellow with narrow light brown apical bands fading at the lateral bend of the tergites, each medially interrupted.

Body length (etherized), ♂, 2.5 mm.; ♀, 3 mm.

Wing length, ♂, 2.2 mm.; ♀, 2.25 mm.

Internal characteristics of imagines and genitalia.

Anterior and posterior Malpighian tubules branching at a distance about equal to the width of the intestine; the anterior branches free, turned back along the intestine; posterior branches apposed with continuous lumen. Each testis with 6 thicker lemon yellow distal coils (the testis proper) wrapped posteriorly about 5 pale yellow proximal coils (the vas deferens). Sperm pump with 2 diverticula at least 1 and ½ times the length of the pump. Apodeme of the penis divided into 2 fish-tail shaped plates; head of penis horn shaped with subapical ventral constriction (fig. 1 E). Hypandrium without a bow; no gonapophyses. Forceps with 9 to 11 primary teeth in a slightly curved line; no secondary teeth; about 6 marginal bristles; a prominent ventral prolongation; forcipes broadly joined in a straight line. About 4 to 6 prominent bristles on the lower part of the genital arch near the junction with the forceps; toe with 3 prominent bristles. Anal plates separate from genital arch.

Spermathecae small, globular; grayish, about 1/3 the size of a parovarium; ventral receptacle, a long thin tube loosely coiled near the base, with 13 tight apical coils. Ovipositor plates black, rounded apically, with 16 to 18 marginal spines; the lining membrane between the 2 ovipositor plates covered with overlapping spines, giving scaly appearance (fig. 1 F).

Other characteristics, relationship, and ecology.

Eggs. With a short shield-shaped white plate replacing filaments; larvae seen moving within several fresh laid eggs; hence flies are presumed to be viviparous (fig. 1 G, H).

Puparia. Golden brown with pale posterior spiracles, held apart. Horn index, 2.6; anterior spiracles amber, with 58 branches of varying lengths.

Ecology. Develops within the flowers of *Dimerocostus uniflorus* Poepp (Family, Zingiberacea). Bred from these flowers collected May, July, 1960; Jan., 1961.

Relationship. Not related to any species here described.

Dedication. The species is named in honor of Dr. Jorge León, Instituto Interamericano de Sciencias Agricolas de la Organizacion de las Republicas Americanas in appreciation of the identification of plants in which *Drosophila* are found breeding.

Drosophila hansoni, new species
(Figure 2 A–F)

External characters of imagines.

♂, ♀. Arista with 4 dorsal and 2 ventral branches in addition to the terminal fork. Antenna yellowish tan; third joint covered with short pale hairs. Ocellar triangle and orbits semi-shining yellowish; ocelli pink; frontal triangle dull yellow; frontal hairs 4 on each side at apex of frontal triangle. Proclinate orbital bristle about the length of the posterior reclinate; anterior reclinate 1/3 the other two, minute; 5 orbital hairs. Anterior ocellars straight and approximately equal to the inner verticals; post verticals well formed and crossed. Face straw-colored; carina narrow above, widening below, flattened. Cheeks yellowish; one pair prominent oral bristles, the second pair one half the first; distance from eye margin to base of first oral less than 1/8 the greatest diameter of the eye. Eyes bright red with yellow pile; eye index 1.2. Palpi straw-colored with one strong subapical bristle, 2 shorter bristles, and additional hairs; proboscis yellowish, darker distally.

Acrostichals in 6 rows; no prescutellars. Anterior scutellars widely divergent. Distance from anterior to posterior dorsocentral bristles 7/10 the distance between the two anterior dorsocentrals. Mesonotum and scutellum shining yellowish tan; pleura, straw; halteres yellowish. Anterior sternopleural 2/3 the posterior; mid-sternopleural thin, 1/3 the posterior.

Legs unicolorous yellowish; many recurved hairs on first tarsi. First femora with 4 bristles along lateral-extensor surface and 4 longer bristles along lateral-flexor surface. Apicals on first and second tibiae; preapicals, on all three.

Wings unicolorous tan. Posterior crossvein darkened but unclouded. Costal index about 3.3; fourth vein index, 1.5; 4c index, about 0.7; 5x index, about 1.0. Third section of costal vein with heavy hairs on the basal half. One prominent bristle at the apex of the first costal section.

Abdominal tergites of male yellowish with black apical bands, widely interrupted medially on tergites 2,3, and 4, fading at the lateral bend of tergites; tergite 5 with a large black triangular mark, the apex of the triangle notched; tergite 6 with a large trapezoidal black mark, the medial marks extending the width of the tergite; sternites straw-colored. Female with widely interrupted black apical bands on tergites 2,3,4, and 5; tergite 6 with a small black oval or triangular mark; tergite 7 yellow.

Body length (etherized), ♂, 2.33 mm.; ♀, 2.33 mm.

Wing length, ♂, 1 mm.; ♀, 1.05 mm.

Internal characters of imagines and genitalia.

Malpighian tubules branched at a distance of about 3 times the width of the intestine; anterior branches free; posterior branches apposed but without continuous lumen. Each testis with 4 proximal thicker straw colored coils (the vas deferens) and 9 yellow thinner distal coils (the testis proper), looped concentrically about the core of the inner coils, forming a flat bouquet, the most distal two coils wrapped back upon the inner coils. Sperm pump with 2 diverticula each the length of the pump. Apodeme of the penis a straight rod; penis simple; expanded subapically; appears in profile like the bowl of a pipe (fig. 2 E). Bow of hypandrium with prominent horn fitting into a medial groove on the plate joining the forcipes (fig. 2 F). A pair of gonapophyses, each with a long bristle and a pair of small bristles (fig. 2 E). Each forceps with a proximal lip bearing four teeth, spaced apart, and a distal lip bearing 5 or 6 teeth in line with those of the proximal lip and 8 teeth along the medial lateral edge of the forceps (fig. 2 D). Genital arch with 3 prominent bristles on the lower part near the junction with the forceps; no well developed toe. Anal plates separate from the genital arch. Spermatheceae elongate, brownish; inner duct becoming only slightly greater in diameter apically (fig. 2 B). Ventral receptacle long and tightly coiled with 69 gyres. Ovipositor plates golden brown, with about 19 primary teeth and 15 smaller teeth, proximally situated on and medial to the dorsal edge (fig. 2 A).

Other characteristics, relationship, and ecology.

Eggs. With two filaments, each 5/9 the length of the egg, the filaments expanded apically like an oar on a slender stalk (fig. 2 C).

Relationship. Shows relationship to the *tripunctata* species group in the characteristic body color and abdominal markings, high costal index; rod-shaped apodeme of the penis, simple head of penis; pronounced horn on the bow of the hypandrium; differs from this group in the lower number of branches of the arista, presence of two filaments only on the egg; shape of the forceps.

Ecology. Develops in flowers of *Heliconia vellerigera* Poepp. (Family, Musaceae), collected at Cerro Campana, Republic of Panama, 2500 feet, July, 1960; April, May, July, 1961; bred from these flowers Oct., Nov., 1962.

Dedication. The species is named in honor of Dr. W. J. Hanson, Department of Zoology, The University of Utah, who first collected it, in appreciation of his generous help in collecting tropical Drosophilidae during the years 1959 and 1960.

Drosophila mcclintockae, new species

(Figure 3 A–F)

External characters of imagines.

♂, ♀. Arista with 7 dorsal and 3 ventral branches in addition to the terminal fork; antenna yellowish brown, third joint covered with short pale hairs. Front yellowish brown, pollinose, with pale golden sheen when viewed from an angle; ocellar triangle darker; ocelli, amber; 3 frontal hairs on each side the apex of frontal triangle; 6 orbital hairs. Proclinate orbital bristle the same length as the posterior reclinate; anterior reclinate thin, 1/6 the proclinate. Anterior ocellar bristles divergent and equal to the inner verticals; post verticals well formed and crossed. Two prominent oral bristles of nearly equal length. Face and cheeks yellowish tan; distance between eye margin and upper oral bristle 1/12 the greatest diameter of the eye. Carina broad, flat, not sulcate. Palpi yellowish tan; one prominent subapical bristle and three shorter bristles along the lateral margin of the palpi in addition to smaller hairs. Proboscis yellowish tan. Eyes bright red, scarcely darker dorsally, with yellow pile. Eye index 1.3.

Acrostichal hairs in 8 rows, sometimes irregular; no prescutellars. Mesonotum, scutellum, pleura and bases of legs orange-brown, semi-shining. Halteres golden. Two humeral bristles. Anterior scutellar bristles divergent. Anterior sternopleural 7/9 the posterior sternopleural; mid-sternopleural thin and 5/7 the anterior. First femora with 4–5 long bristles on the lateral exterior surface and 5 long bristles on the lateral flexor surface; 3 black bristles at the base of the hind metatarsus. Some recurved hairs on the foretarsi and tibiae. Apical bristles on the first and second tibiae; preapicals on all three.

Wings lead color; posterior crossvein clouded. Costal index about 4.1; 4th vein index about 1.2; 5x index, 1.1; 4c index, 0.5. Heavy hairs on the basal 2/3 of the 3rd costal section; one prominent bristle and one weaker bristle at the apex of the first costal section.

Abdomen, ♂, orange-brown with narrow black apical bands fading at the lateral bend of the tergite, with widely separated medial interruptions on tergites 3,4, and 5. Tergite 6 with narrow black bands on both the anterior and posterior border, these connected by a black bridge, varying in width; genital arch and anal plates black. Genitalia invaginated within a genital cavity, over which the last sternite projects; the latter lined with prominent black hairs. Abdomen, ♀, orange-brown with narrow black apical bands, medially interrupted, fading at the lateral bend of tergites 2,3,4. Tergite 5 with narrow dark apical bland, not interrupted medially. Tergite 6 with dark apical band thickened medially in a narrow stripe extending the with of the tergite; tergite 7 brownish. Sternites yellowish, the most posterior one slightly darkened apically.

Body length (etherized), ♂, 3.5 mm.; ♀, 4 mm.
Wing length, ♂, 3.4 mm.; ♀, 3.4 mm.

Internal characters of imagines and gentalia.

Anterior and posterior Malpighian tubules branch at a distance of a little more than the width of the intestine; ends of both free. Testes pale yellow; 6 gyres, all of the same diameter. Sperm pump with two thin diverticula about 6 times the greater diameter of the pump. Apodeme of the penis an almost straight rod; head of penis simple, expanded, with four lobes at tip; bow of hypandrium with a pronounced horn; a pair of gonapophyses each with a long bristle (fig. 3 A, C). Forceps with 9 to 10 primary teeth in a straight row, no secondary teeth, 3 to 4 marginal bristles, about 7 small bristles on the lateral face of the forceps; the two forcipes joined by a widely grooved chitinous plate (fig. 3 A). Two bristles on the genital arch near the point of junction with the forceps; toe rounded, with one bristle. Genital arch separate from anal plates; the latter without a noticeable tuft of hair on the ventral margin. Spermatheceae chitinized, brown, almost globular; inner duct with constriction at base, expanded apically (fig. 3 B). Ventral receptacle tightly coiled with about 68 gyres. Ovipositor plates golden brown, acuminate apically but broad subapically, with about 64 teeth, these occurring in more than single file except at the tips of the plates (fig. 3 D).

Other characteristics, relationship, and distribution.

Eggs. Longer and more slender than is usual in *Drosophila* eggs, with 2 distal and one proximal filaments, slightly more than twice the length of the egg.

Puparia. Burnt orange in color; anterior spiracle with 26 filaments, silvery distally, yellowish proximally, with a black ring at the base of the filaments; posterior spiracles whitish becoming yellowish at the base and at the tip; parallel. Horn index 2.3.

Chromosomes. Larval brain ganglion cells of males with 3 pairs rod-shaped and a pair of dot-shaped autosomes, a large V-shaped X chromosome and a rod-shaped Y chromosome; of females, with the same autosomes but two V-shaped X chromosomes (fig. 3 E, F). Salivary gland cells with one very long arm, one long arm, 3 medium arms, and one short arm, a clearly staining nucleolus, and scant chromocenter.

Relationship. Shows relationship to the *tripunctata* group in the abdominal markings; high costal index; clouded posterior crossvein; male terminalia which possess a simple head of penis, bow of hypandrium with pronounced horn; no secondary bristles on the forceps, presence of a genital cavity formed by an overhanging last sternite. Resembles *D. argentifrons* Wheeler in the heavy pollinosity of the front and long hairs lining the genital cavity; differs from the latter by lacking secondary teeth on the forceps, in body color and markings.

Ecology. Eggs laid in growing tip and also sides of floral spikes of *Aphelandra micans* Moritz, Family Acanthaceae, Cerro Campana, Republic of Panama, 2500 feet. Collected from these plants and bred from them, October, November, December, 1960, 1961, 1962. Also bred from another *Aphelandra* sp. at El Real, Darien, Panama. The Darien specimens do not differ from those collected at Cerro Campana.

Dedication. The species is named in honor of Dr. Barbara McClintock, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, New York.

Drosophila xanthopallescens, new species
(Figure 4 A–C)

External characters of imagines.

♂, ♀. Arista with 4 (sometimes 3) dorsal and 2 (sometimes 3) ventral branches in addition to the terminal fork. Antenna dull yellow; third joint covered with short pale hairs, slightly longer than the carina. Front dull golden yellow; ocelli amber; 4 to 5 frontal hairs on each side near the apex of the frontal triangle. Proclinate orbital bristle approximately the same length as the posterior reclinate; anterior reclinate, half the proclinate; 7 to 8 orbital hairs. Anterior ocellar bristles divergent and equal to the inner verticals; post verticals well formed, crossed. Face pale straw on carina, yellowish laterally; carina high, narrow, not sulcate, flat-topped ventrally. Cheeks straw colored; wide ventrally, distance from eye margin to base of oral bristle about 1/8 the greatest diameter of the eye. One pair of prominent oral bristles, the second about one third the first. Eyes br'ght red, not darker above, with yellow pile; eye index 1.2. Palpi straw colored with one subapical bristle, 2 lateral short bristles below it, in addition to smaller hairs. Proboscis yellow.

Acrostichals in 8 rows, those of the last row slightly elongated; no prescutellars; anterior scutellar bristles convergent; 2 humeral bristles. Distance from anterior to posterior dorsocentrals 4/9 the distance between the two anterior dorsocentrals. Mesonotum and scutellum unicolorous dull yellow, with some pollinosity when viewed at an angle; bristles black; halteres yellow. Pleura semi-shining yellow; area between bases of fore coxae, whitish. Anterior sternopleural 5/6 the posterior; mid-sternopleural thin, 1/3 the posterior.

Legs unicolorous yellowish; few recurved hairs on first tarsi; 4,5 prominent bristles on lateral flexor surface of first femora, longer than the 4,5 prominent bristles on the lateral extensor surface of the same. Apicals on first and second tibiae; preapicals, on all three.

Wings unicolorous tan, brownish in old flies; 2 prominent bristles at apex of first costal section, ventral one weaker. Posterior crossvein dark but not clouded. Third section of costal vein with heavy hairs on the basal half; II bends slightly to the costa at its tip. Costal index about 2.3; 4th vein index 1.4; 4c index, 0.9; 5x index, 1.1.

Abdomen yellow with thin brown medially interrupted apical bands extending to the lateral bend of the tergite on tergites 2,3,4. Tergites 5,6 (and in female, tergite 7), bare.

Body length (etherized), ♂, 2.5 mm.; ♀, 3.3 mm.

Wing length, ♂, 2.35 mm.; ♀, 2.70 mm.

Internal characteristics of imagines and genitalia.

Anterior Malpighian tubule branches at a distance of twice the width of the intestine. Ends of anterior tubules free and turned back; posterior Malpighian tubules apposed, but no continuous lumen. Each testis with 9 thicker lemon yellow distal coils (the testis proper) and 9 thin inner coils (the vas deferens), with diameter about that of a Malpighian tubule. Sperm pump with 2 diverticula the length of the sperm pump; ends of diverticula bent back. Apodeme of the penis a short rod; penis bulbous; head of penis with slight subapical dorsal invagination; a pair of small gonapophyses; forceps with 12 to 13 primary teeth in a wide curve; no secondary teeth; 11 bristles on the lateral face of forceps, 4,5 marginal bristles hypandrium without bow; 3 bristles on lower genital arch near junction with forceps; 4 prominent bristles on the upper part of the genital arch (fig. 4 A). Genital arch fused medially with the anal plates; toe of genital arch well formed, with three prominent bristles. Spermatheceae amber at base, whitish above, slightly elongate, with basal lip; inner duct of uniform diameter (fig. 4 C). Ventral receptacle a thin tightly coiled tube of about 151 gyres. Ovipositor plates yellow, rounded at tip, each with about 18 spines (fig. 4 B).

Other characteristics, relationship, and ecology.

Eggs. With 4 slender filaments each slightly longer than the greater diameter of the egg.

Relationship. Closely related to the following species from which it differs in body and bristle color and in the tip of the penis.

Ecology. Collected from the surface of bracts and from flowers of *Calathea insignis* Peters (Family Marantaceae), and bred from floral spikes of the same plant July, 1960; Oct., Nov., 1962, Cerro Campana, Republic of Panama, 2500 feet; also bred from flowers of *Heliconia elongata* Griggs (Family Musaceae), Jan., 1961, Ft. Sherman Reservation, Canal Zone.

Drosophila aureopallescens, new species
(Figure 4 D–E)

External characters of imagines.

♂, ♀. Arista with 4 dorsal and two ventral branches in addition to the terminal fork. Antenna straw colored; third joint with short pale hairs, slightly longer than the carina. Front dull straw, orbits raised; 4 frontal hairs on each side near apex of frontal triangle. Proclinate orbital bristle about the same length as the posterior reclinate; anterior reclinate about half the proclinate; 7 orbital hairs on each side. Anterior ocellar bristles divergent, about equal to the inner verticals; post verticals well formed, crossed. Face straw colored, with pale yellow pollinosity; carina high, flat on top, not sulcate. Cheeks wide below, lead colored in area between eye margin and base of first oral which is 1/10 the greatest diameter of the eye; cheeks straw-colored behind. One pair of prominent oral bristles; the second, less than half the first. Eyes bright vermilion red, with pale pile; eye index 1.1. Palpi with a strong subapical bristle and 2 other bristles below it on the lateral margin, in addition to smaller hairs. Proboscis straw colored with golden hairs.

Acrostichals in 8 rows, those of the last row slightly elongated; no prescutellars. Anterior scutellars convergent; 2 humerals. Distance between anterior and posterior dorsocentral bristles half the distance between the two anterior dorsocentral bristles.

Mesonotum, scutellum, and pleura unicolorous dull yellow with strong orange pollinosity and yellow bristles; halteres yellow. Anterior sternopleural about 13/16 the posterior; mid-sternopleural thin and about 1/4 the posterior. Legs unicolorous yellow; some recurved hairs on the first tarsi; first femora with 3 long bristles on the lateral extensor surface; 4, on the lateral flexor surface. Apicals on the first and second tibiae; preapicals, on all three.

Wings unicolorous yellow, with yellow veins, no clouding. Two prominent bristles at the apex of the first costal section, the ventral one weaker. Third section of costal vein with dark heavy hairs on the basal 4/11; II bends slightly to the costa at its tip Costal index about 2.4; 4th vein index, 1.6; 4c index, 1; 5x index, 1.3.

Abdomen yellow with golden pollinosity; no bands.

Body length (etherized), ♂, 2.75 mm.; ♀, 3 mm.

Wing length, ♂, 2.4 mm.; ♀, 2.7 mm.

Internal characteristics of imagines and genitalia.

Anterior Malpighian tubule branches at a distance of six times the width of the intestine; anterior branches short, free at ends which are turned back. Posterior Malpighian tubule branches at distance of about the width of the intestine; ends apposed, but no continuous lumen. Each testis with about 11 lemon-yellow coils wrapped posteriorly about a coiled vas deferens, the diameter of the vas deferens being no greater than that of the vas deferens near the sperm pump; vas deferens uncoiled is longer than the abdomen of the fly. Sperm pump with two short diverticula less than the greater diameter of the pump.

Apodeme of the penis a short curved rod; penis bulbous, head of penis with a short dorsally directed hook on each side of aperture; a pair of small gonapophyses each with a small bristle; forceps with 10 to 12 primary teeth in a slightly curved row; no secondary teeth; about 7 marginal bristles; about 9 bristles on the lateral surface of the forceps; hypandrium without a bow; 3 prominent bristles on the lower genital arch near junction with the forceps; 4 such bristles on the upper genital arch (fig. 4 E).

Genital arch fused medially with the anal plates; toe well formed with 3 bristles. Spermatheceae light brown; slightly elongate, with basal lip. Ventral receptacle a thin tightly coiled tube of about 151 tyres. Ovipositor plates pale yellow, rounded at tip, with about 21 spines (fig. 4 D).

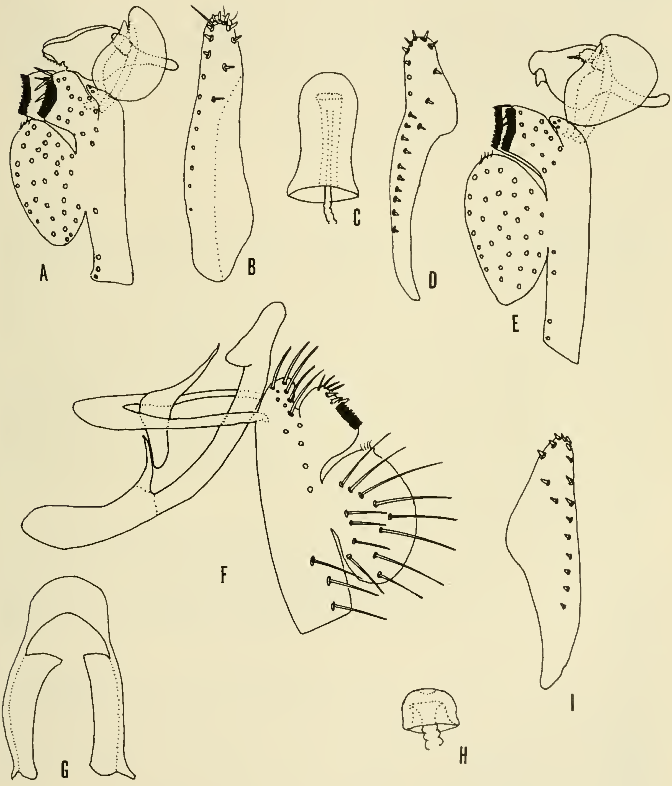

Figure 4, *D. xanthopallescens*. A, lateral view of penis and its apodeme, genital arch and anal plate, forcipes; B, ovipositor plate; C, seminal receptacle. *D. aureopallescens*. D, ovipositor plate; E, lateral view of hypandrium, penis and its apodeme, forcipes, genital arch and anal plate. *D. othoni*. F, lateral view of hypandrium, penis and its apodeme, forceps, genital arch and anal plate; G, hypandrium and conchae; H, seminal receptacle; I, ovipositor plate.

Relationship and ecology.

Relationship. Close to *D. xanthopallescens*, new species, from which it differs in the more golden color and in the yellow bristles of *D. aureopallescens*, the head of the penis, and slight variations in certain internal characters.

Ecology. Bred from an unidentified *Calathea* sp., closely related but more golden than *Calathea insignis* Peters in forest near El Volán, Chiriqui, Republic of Panama, June, 1962; 4,500 feet. Also aspirated from and bred from inflorescences of *Calathea lutea* (aubl.) Meyer, April, 1963; Ft. Sherman Reservation, Canal Zone, sea level.

Drosophila alexanderae, new species
(Figure 5 A–F)

External characters of imagines.

♂, ♀. Arista with 4 dorsal and 2 ventral branches in addition to the terminal fork. Antenna yellowish; 3rd joint reaching beyond end of the carina, yellowish medially, brownish laterally, with short pale hairs. Front dull yellowish brown, slightly browner posterior to the level of the posterior reclinate bristle; lunula straw colored. Ocellar triangle dark brown; ocelli pink; 7 frontal hairs on each side near the apex of the frontal triangle. Proclinate orbital bristle 4/5 the posterior reclinate; anterior reclinate 1/4 the proclinate; 7 orbital hairs. Anterior ocellar bristles slightly divergent, about 1.7 times as long as the inner verticals. Post verticals well developed, crossed. Face pale straw; carina high, narrow, not sulcate. Cheeks yellowish; distance from eye margin to base of the oral bristle 1/8 the greatest diameter of the eye. One pair of oral bristles, the second thin and less than half the first. Eyes bright red, with yellow pile; eye index, 1.2. Palpi yellowish, with one subapical bristle and 2 other strong bristles below it on the lateral margin, together with smaller hairs. Proboscis yellowish with yellow hairs apically.

Acrostichal hairs in 8 rows; no prescutellars; anterior scutellars convergent; 2 humeral bristles. Distance from anterior to posterior dorsocentrals one half the distance between the two anterior dorsocentrals. Mesonotum and scutellum dull yellowish with no stripes in life; pinned specimens show mesonotum with a narrow median pale streak and two indistinct lateral streaks. Pleura straw colored; halteres yellowish. Anterior sternopleural 6/7 the posterior sternopleural; mid-sternopleural thin and 2/7 the posterior.

Legs unicolorous yellowish; a few recurved hairs on first tarsi. Anterior femora with 5 prominent bristles on the lateral extensor surface and 4 such bristles on the lateral flexor surface. Apicals on first and second tibiae; preapicals on all three.

Wings unicolorous tan; anterior and posterior crossveins dark, the latter lightly clouded. Two bristles at the apex of the first costal section. Third section of costal vein with heavy hairs on approximately the basal 7/12. Costal index about 2.3; fourth vein index about 1.6; 4c index about 0.9; 5x index about 1.2.

Abdominal tergites of male yellowish with thin brown apical bands fading at the lateral bend of the tergites; tergites 2 and 3 not interrupted medially; tergites 4,5,6 briefly interrupted medially. Abdomen of female similar but apical bands not interrupted medially. Sternites of ♂, ♀, straw colored.

Body length (etherized), ♂, 2.75 mm.; ♀, 3 mm.

Wing length, ♂, 2.45 mm.; ♀, 2.85 mm.

Internal characters of imagines and genitalia.

Anterior Malpighian tubules free; posterior Malpighian tubules apposed with small constricted protoplasmic bridge at junction. Each testis with 8 thick lemon yellow outer coils (the testis proper), wrapped posteriorly about a thread-like proximal tube (the vas deferens), with a diameter about that of a Malpighian tubule. Sperm pump with two diverticula each about the length of the greater diameter of the pump.

Apodeme of the penis a slender rod, almost straight; penis bowl shaped with small ventral indentation apically; hypandrium without bow (fig. 5 C); a pair of small gonapophyses, each with a short bristle (fig. 5 A, B). Forceps with about 11 short primary teeth, an interruption the width of one or two teeth occurring between two groups of teeth, those situated proximally being more ventral than those situated distally; no secondary teeth; 11 marginal bristles; two bristles on the lateral surface of the forceps; the forcipes joined in a broad curved plate (fig. 5 F). About 12 prominent bristles on the lower genital arch near ths junction with the forceps; four such bristles on the upper part of the genital arch; no bristles on the rounded toe. Anal plates fused medially with the genital arch. Spermatheceae tan, elongated; inner duct of uniform diameter (fig. 5 E); ventral receptacle a thin tube; greatly

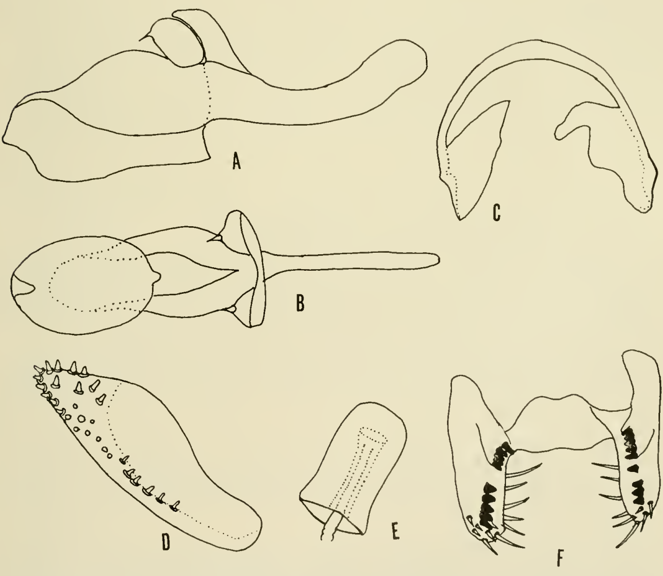

Figure 5, *D. alexanderae*. A, lateral view of penis, its apodeme, and gonapophysis; B, ventral view of penis and gonapophyses; C, hypandrium and conchae; D, ovipositor plate; E, seminal receptacle; F, forcipes.

coiled, with 92 gyres. Ovipositor plates yellow, acuminate, with about 22 spines marginally and seven more internal to these apically (fig. 5 D).

Relationship and ecology.

Relationship. Shows relationship with *D. xanthopallescens*, *D. aureopallescens*, and *D. othoni*, all of this paper. See discussion in description of *D. othoni*.

Ecology. Bred from the flowers of *Heliconia elongata* Griggs (Family Musaceae), collected April, 1962 in forest near Almirante, Bocas del Toro, Republic of Panama.

Dedication. The species is named in honor of Dr. Mary L. Alexander, The Genetics Foundation, The University of Texas, Austin, Texas.

Drosophila othoni, new species
(Figure 4 F–I)

External characters of imagines.

♂, ♀. Arista with 4 dorsal and three ventral branches in addition to the terminal fork. Antenna yellowish, third joint extending slightly beyond the end of the carina, darker laterally and covered with short pale hairs. Front dull yellowish, pollinose; ocellar triangle slightly darker; ocelli pinkish; 12 frontal hairs irregularly distributed near the apex of the frontal triangle. Proclinate orbital bristle of length equal to that of the posterior reclinate; anterior reclinate 2/5 the proclinate; 6 orbital hairs. Anterior ocellar bristles slightly divergent and equal to the inner verticals; post verticals well formed, crossed. Face pale straw colored; carina broad, bulbous, not sulcate. Cheeks straw colored; distance from eye margin to the base of the oral bristle 1/6 the greatest diameter of the eye. One pair of oral bristles; the second minute. Eye color red as in *D. melanogaster*, not darker above, with yellowish pile; eye index 1.3. Palpi pale straw, with one subapical bristle, 3 others below it on the lateral margin in addition to smaller hairs. Proboscis pale straw.

Acrostichal hairs in 6 rows, the last row slightly elongated; no prescutellars; anterior scutellars convergent. Distance from anterior to posterior dorsocentrals 3/7 the distance between the 2 anterior dorsocentrals; 2 humerals. Mesonotum and scutellum dull yellowish; pleura and halteres pale straw. Anterior sternopleural approximately 5/6 the posterior sternopleural; mid-sternopleural minute. Fly appears more long and slender than is usual in the subgenus *Drosophila*.

Legs unicolorous pale straw; with some recurved hairs on first tarsi. Anterior femora with 4 bristles on the lateral flexor surface, stronger than the 5 bristles on the lateral extensor suface. Apicals on the first and second tibiae; preapicals on all three.

Wings unicolorous tan, with brown veins; the crossveins unclouded; one prominent bristle at the apex of the first costal section. Third section of costal vein with heavy hairs on the basal 5/11. Costal index about 2.6; fourth vein index, about 1.8; 4c index, about 0.9; 5x index, 1.3.

Abdomen of male dull straw with narrow black apical bands, medially interrupted, fading at the lateral bend, on tergites 2 and 3. Tergites 4,5, and 6, bare. Abdomen of female dull straw, with black apical bands extending the entire width of the tergite, fading at the lateral bend, with only slight medial interruptions, on tergites 2,3,4, and 5, the apical band of tergite 5 fading before the lateral bend. Sternites, ♂, ♀ pale, last sternite of female bifurcated posteriorly; last sternite of male projects over a genital cavity.

Body length (etherized), ♂, 3 mm.; ♀, 3.75 mm.

Wing length, ♂, 2.4 mm.; ♀, 2.6 mm.

Internal characters of imagines and genitalia.

Anterior Malpighian tubule branches at a distance of 3 times the width of the intestine; branches free at ends. Posterior Malpighian tubule branches at a distance of about the width of the intestine; branches apposed but no continuous lumen. Each testis pale straw, a flat bouquet of 8 gyres (the testis proper) the diameter of the testis small proximally, increasing distally. Vas deferens a long thin colorless tube, with diameter about that of a Malpighian tubule. Sperm pump with 2 diverticula each about 1 and 1/2 times the length of the pump. Apodeme of the penis a short thick rod; bifurcated distally, the dorsal branch joining the penis, a rod more slender than its apodeme, expanded apically, with a pronounced ventral hook. The ventral branch of the apodeme of the penis joins paired gonapophysis-like structures, roughly triangular in lateral view, or the shape of a skewed normal distribution. Hypandrium without a bow (fig. 4 G). Forceps with 9 to 10 primary teeth, no secondary teeth, about 7 to 8 marginal bristles. Toe rounded, large, with about 8 strong bristles; genital arch with about 13 evenly spaced large bristles extending from the dorsal extremity to the point of junction with the forceps. Distinct tuft of small bristles on the ventral edge of anal plates which are joined medially with the genital arch (fig. 4 F). Spermathecae gray, broad, with basal lip, inner duct of uniform diameter, with shallow apical indentation (fig. 4 H). Ventral receptacle a thin tube with about 140 tight small coils. Ovipositor plates yellow with about 17 spines; tips of plates rounded (fig. 4 I).

Relationship and ecology.

Relationship. Shows relationship to *D. xanthopallescens*, *D. aureopallescens*, and *D. alexanderae* of this paper. These four species form a natural species group within the subgenus *Drosophila*, designated the *xanthopallescens* species group, sharing the following characteristics: pale yellowish, dull species with costal index near 2.4, one prominent oral bristle, arista formula 4/2 or 3, defined according to Wheeler, et al., (1962), cheeks wide, bow of hypandrium lacking, anal plates joined medially with genital arch; testes with extremely thin vas deferens component; high number of coils of the ventral receptacle (more than 90).

Ecology. Bred from *Calathea lutea* (Aubl.) Meyer; aspirated from *Heliconia mariae* Hook; collected in traps baited with cultivated fruits, Nov., 1962, in gallery forest near El Real, Darien, Panama. Also netted from *Heliconia mariae* March, 1963, Ft. Sherman Reservation, Canal Zone.

Dedication. The species is named in honor of Sr. Pablo Othon, El Real, Darien, Republic of Panama, in appreciation of his generous hospitality to scientists for the past thirty years. The present author is indebted to him and to his son, Sr. Enrique Othon.

Drosophila flexipilosa, new species
(Figure 6 A–H)

External characters of imagines.

♂, ♀. Arista with 6 dorsal and 3 ventral branches in addition to the terminal fork. Antenna yellowish, third joint tan with short pale hairs. Front dull yellowish brown; area about bases of orbital bristles paler. Ocellar triangle brown; ocelli pinkish; about 5 frontal hairs placed irregularly near the apex of the frontal triangle. Proclinate orbital bristle 4/5 the posterior reclinate; anterior reclinate half the proclinate; 6 orbital hairs. Anterior ocellar bristles divergent and equal to the inner verticals. Post verticals well developed, equal to proclinate orbital bristle. Face including carina straw colored, the latter broad below, not sulcate. Cheeks straw colored; distance from eye margin to base of upper oral about 1/6 the greatest diameter of the eye. Two prominent oral bristles. Eyes red as in *D. melangomaster*, with yellow pile; eye index 1.2. Proboscis and palpi straw colored, the latter with a prominent subapical bristle, 4 shorter bristles below it on the lateral margin in addition to smaller hairs.

Acrostichal hairs in 8 rows, the last slightly elongated; no prescutellars; both anterior and posterior scutellars convergent; 2 humerals. Distance from anterior to posterior dorsocentrals 2/5 the distance between the two anterior dorsocentrals. Mesonotum and scutellum dull tan, pollinose; pleura straw colored; halteres yellowish. Anterior sternopleural 3/5 the posterior; mid-sternopleural 2/5 the posterior.

Legs unicolorous tan; many recurved hairs on first tarsi; 11 short spines in a row on the distal medial flexor surface of the first femur (fig 6 D); 2 bristles on the distal extensor extremity of first femur; 5 prominent bristles on the lateral extensor surface and 6 such bristles on the lateral flexor surface of the first femur; 2 black bristles at the base of the hind metatarsus; apicals on the first and second tibiae; preapicals, on all three.

Wings unicolorous brown; tips of II, III darkened, more so in the female where the area of the wing bordering the darkened II and III tips is also lightly clouded; posterior crossvein dark and lightly clouded; II bends slightly to costa at tip. One prominent bristle at the apex of the first costal section; heavy hairs on the basal 2/7 Costal index about 4.0; 4th vein index 1.1; 4c index, about 0.53; 5x index, 0.83.

Abdomen of male dull yellowish tan with black apical bands on tergites 2,3, and 4, fading at the lateral bend of the tergites, with wide medial interruptions; tergite 5 with paramedian blunt triangular black marks, tergite 6 with a broad black trapezoid mark, the anterior borders of the trapezoid rounded, a narrow pale median streak extending from the anterior border of the trapezoid to a distance half the width of the tergite. Sternites pale; last sternite does not project over a "genital cavity." Genital arch black dorsally; tan, ventrally; anal plates tan. Abdomen of female dull yellowish tan with tergites 2,3,4, and 6 marked as in the male. Tergite 5, with a black apical band, wide medially and bearing a short medial indentation; tergite 7 triangular, yellowish; tergite 8, visible dorsally, black; last sternite bifurcated posteriorly.

Body length (etherized), ♂, 3.75 mm.; ♀, 4 mm.

Wing length, ♂, 3.2 mm.; ♀, 3.5 mm.

Internal characters of imagines and genitalia.

Anterior and posterior Malpighian tubules whitish, branching at a distance of about the width of the intestine; anterior branches free; posterior branches with ends apposed, the lumen being continuous. Each testis composed of 1 and 1/2 proximal

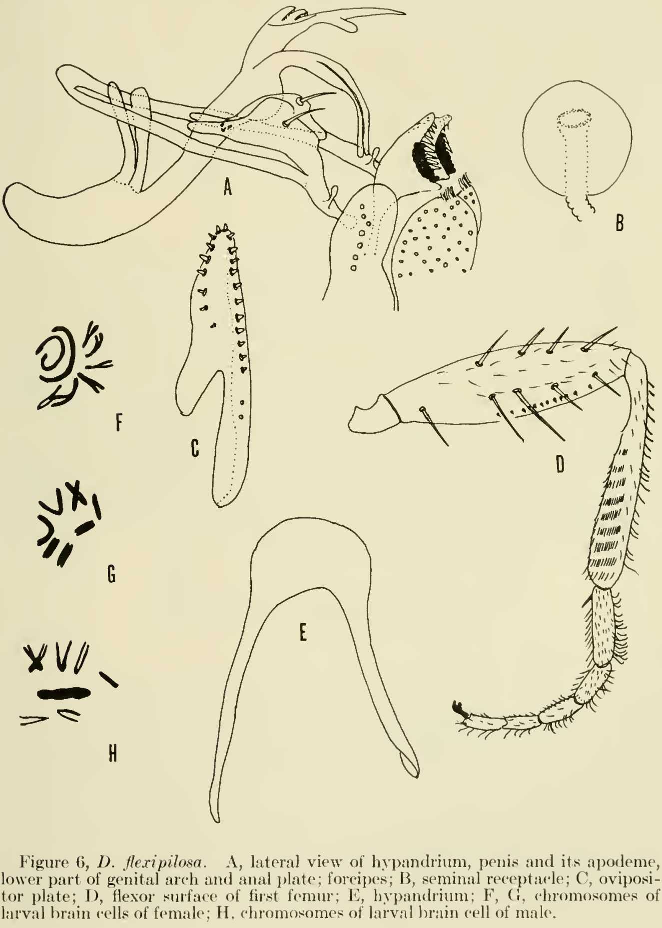

Figure 6, *D. flexipilosa*. A, lateral view of hypandrium, penis and its apodeme, lower part of genital arch and anal plate; forcipes; B, seminal receptacle; C, ovipositor plate; D, flexor surface of first femur; E, hypandrium; F, G, chromosomes of larval brain cells of female; H, chromosomes of larval brain cell of male.

coils (the vas deferens) and 3 distal coils about the same diameter (the testis proper), the whole being yellow medially and whitish both proximally and distally. Sperm pump large, opaque, with two diverticula each twice the greater diameter of the pump.

Apodeme of the penis a thick curved rod; penis slender, slightly expanded apically, the head of the penis with a long deeply bifurcated dorsal branch and a four lobed ventral branch. Hypandrium (fig. 6 E) without a bow, joined narrowly with the posterior gonapophyses, each with a prominent bristle; anterior gonapophyses rod-like, located at the base of the penis (fig. 6 A). Forceps with 9 primary teeth, no secondary teeth, prominent extenuated ventral prolongation; about 7 marginal bristles; the forcipes joined by a narrow bridge. Anal plates with prominent tuft of bristles on the ventral margin, separate from the genital arch. Pronounced toe with 7 prominent bristles; no other bristles on the genital arch. Spermatheceae almost globular, golden brown; inner duct slightly expanded apically, heavily chitinized apically (fig. 6 B); ventral receptacle with about 15 coils. Ovipositor plates golden, with about 22 spines, blunt apically (fig. 6 C).

Other characteristics, relationship and ecology.

Eggs. With 4 slender filaments, each about the length of the egg.

Puparia. Golden brown; anterior spiracles with about 19 golden branches; horn index 1.7; posterior spiracles black, apposed.

Chromosomes. Larval brain ganglion cells of males with a large V-shaped X chromosome, rod-shaped Y, and three pairs of rod-shaped autosomes (fig. 6 F, G, H,). Dot-like autosomes were not seen although salivary chromosome configuration indicates their presence. Salivary gland cells with one long arm, 4 medium arms, and one short arm.

Relationship. Not related to any species here described.

Ecology. Bred from nut-like fruit of forest tree near El Volcán, Chiriqui, Republic of Panama, 4,500 feet, June, 1962; also from blossoms of *Hedychium coronarium* Koenig (Family Zingiberaceae), collected from a house yard in the town of El Volcan, August, 1961, June, 1962. The species breeds well in laboratory medium.

Drosophila xiphiphora, new species
(Figure 7 A–G)

External characters of imagines.

♂, ♀. Arista with 5 dorsal and 2 ventral branches in addition to the terminal fork. Antenna yellow; second joint with one strong bristle directed dorsally, one weak bristle ventrally, and smaller hairs; third joint covered with short pale hairs. Front tan; orbits brown; 7 frontal hairs on each side toward the apex of the frontal triangle; ocelli whitish. Proclinate orbital bristle equal in length to the posterior reclinate; anterior reclinate approximately 3/4 the other two and placed slightly closer to the proclinate; 9 orbital hairs. Anterior ocellars divergent, slightly shorter than the inner verticals, post verticals well formed, crossed. Face broad, yellowish, carina shallow, broadening below. Cheeks lead color; one pair oral bristles; distance from eye margin to base of oral bristles 1/17 greatest diameter of the eye. Eyes very large, flattened above, ventral border a shallow V; color or eyes purple; pile scant, yellow. Eye index 1.1. Palpi small and yellow, one apical bristle 4 to 5 shorter bristles below it on the lateral margin in addition to smaller hairs; proboscis yellow, much shorter than head, bearing a number of dark hairs distally; clypeus whitish; area behind palpi white; occiput shining black.

Acrostichals in 10 rows, slightly irregular, 8 rows behind, last row slightly elongated. Two anterior dorsocentral bristles half the length of the two posterior dorsocentrals; distance from anterior to posterior dorsocentrals 1/4 the distance between the two

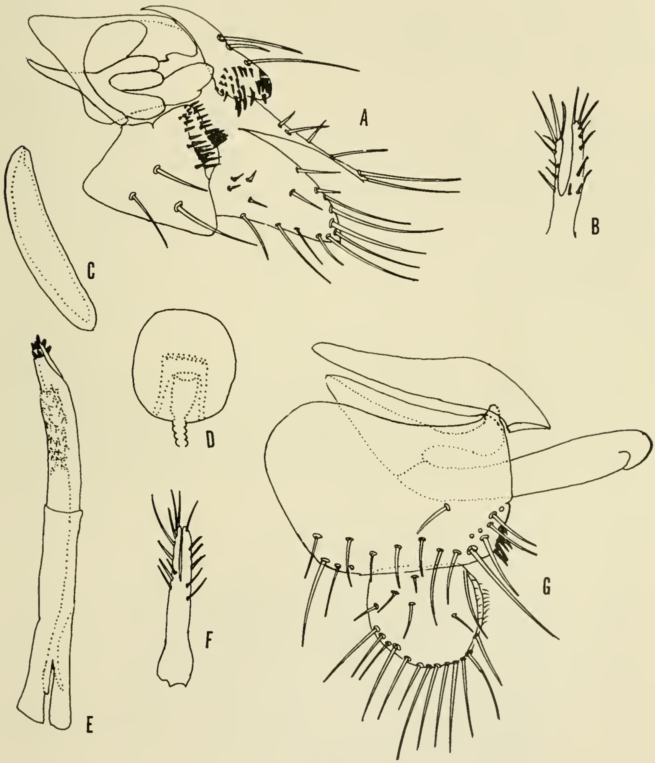

Figure 7, *D. xiphiphora.* A, latero-ventral view of hypandrium, penis and its apodeme; genital arch and anal plates; forcipes; B, anal plates of male; C, egg; D, seminal receptacle; E, ovipositor plates; F, anal plates of female; G, lateral view of hypandrium, penis and its apodeme, genital arch, forceps; genital arch and anal plate.

anterior dorsocentral bristles. Mesonotum and scutellum semi-shining orange-yellow; some pollinosity when viewed at an angle; greatest width of mesonotum approximately equal to greatest width of head; two humeral bristles. Pleura bare, shining orange; halteres yellow. Only two sternopleural bristles, the anterior one thin and 2/9 the posterior. Legs yellowish; 6 prominent bristles on the ventral border of first femur. Length of first tibia equal to combined length of first tarsi. Apical and preapical bristles fairly strong on second pair of legs; weak on first pair; a weak preapical only on third pair. Recurved hairs on foretarsi.

Wing unicolorous tan, no clouding; with rudimentary auxillary vein; no warts on underside of wing; costal index 2.0; fourth vein index, 1.4; 4c index, 0.87; 5x index, 1.1. Third costal section with heavy hairs on approximately the basal half. One weak bristle at the apex of the first costal section.

Abdomen, ♂, semi-shining orange-yellow, tergites with black apical bands less than the width of the tergite and fading at the lateral bend, thickened medially, the bands of tergites 2 and 3 with shallow medial indentation. Anal plates yellow, compressed laterally, on a stalk, with long hairs distally; genital arch yellow. Abdomen of ♀, similar but apical band of tergite 6 thinner than that of others; tergite 7 much enlarged, bent at right angles to preceding, shining black, bearing a groove on its dorsal surface in which lie the elongated, yellow anal plates, possessing a tuft of bristles distally. Sternites 2,3,4,5 yellowish; sternite 6 black, elongate, without bristles.

Body length (etherized), ♂, 3.25 mm.; ♀, 3.5 mm.

Wing length, ♂, 3 mm.; ♀, 3 mm.

Internal characters of imagines and genitalia.

Anterior Malpighian tubule branched basally near gut, the two branches short, free distally, turned back at ends. Posterior Malpighian tubule also branched basally near gut; two long branches apposed, with continuous lumen. Malpighian tubules pale yellow. Each testis deep lemon yellow with one thick inner coil (the vas deferens) and 6 thinner outer coils plus an uncoiled portion equal in length to about two gyres. Sperm pump with prominent brown sclerite, no diverticulum. A pair of conspicuous yellow globular rectal glands arising at the extreme dorsal posterior end of the gut on stalks about one and a half times the length of a ripe egg; present in both sexes.

Apodeme of the penis short, expanded, shaped like the dorsal fin of a fish bearing a posteriorly directed branch which joins the hypandrium ventrally. Penis slender, rod-like, with subapical dorsal invagination. Hypandrium (fig. 7 A, G) lacking a bow, with short arms, within the posterior end of which a tubercle of the genital arch is imbedded; forceps shallow, broadly joined with the genital arch, each forceps with a horse-shoe shaped line of primary teeth, irregularly spaced, the 5 to 7 longer teeth being located on each of the dorsal arms of the horse-shoe, shorter teeth being located at the bend of the horse-shoe. Genital arch very wide with 17 or more bristles fairly evenly spaced along its dorsal border. Anal plates (fig. 7 B) separate from genital arch. Spermathecae (fig. 7 D) almost globular, with pale yellow chitinized center; inner duct expanded into a funnel-shaped opening distally, with slight subapical constriction. Ventral receptacle a long thin tube with 17 tight basal coils and loose tangled distal portion. Vaginal plates (fig. 7 E) enormously elongated, retracted into body when at rest, each plate with 4 black teeth at the distal end.

Other characteristics, relationship, and ecology.

Eggs. Mature egg (fig. 7 C) dissected from ovary without filaments, the length about 4 times the breadth.

Puparia. Chocolate brown; anterior spiracles with about 25 very short filaments turned back; horn index about 6.7; posterior spiracles apposed.

Ecology. Aspirated from the flowers of *Heliconia subulata* R. and P.; bred from both this species and from *Heliconia vellerigera* Poepp. (Family Musaceae), May 3, Sept. 7, Oct. 4, 1961; April 11, Sept. 7, Sept. 19, Nov. 3, 1962, Cerro Campana, Republic of Panama, 2,500 feet. Only one larva develops within a single small flower of *Heliconia subulata*.

Relationship. This species represents a different subgenus within the genus *Drosophila* from any hitherto described. Its low sterno-index, absence of egg filaments, and very short anterior spiracles of the puparium are not in agreement with Sturtevant's (1942) description of the characteristics of the subgenus *Drosophila*. The extremely shallow forceps, barely delimited from the genital arch is not seen in other members of the latter subgenus. Finally, the method of attachment of the hypandrium and genital arch by a tubercle of the *genital arch* inserted into the hypandrium rather than by a tubercle of the hypandrium inserted into the genital arch differs from the attachment of hypandrium and genital arch found in other species of the subgenus *Drosophila* lacking a bow of the hypandrium, such as *D. xanthopallescens*, *D. aureopallescens*, *D. othoni*, and *D. alexandereae*.

Of the specimens of this species observed, five, including both sexes, showed a black instead of a tan front. A specimen with a black front was bred from both *Heliconia subulata* and from *Heliconia vellerigera*. It is not known whether the specimens with a black front represent a sibling species or polymorphism within a single species.

Figure 8, Photograph of male wing of *D. alani*.

Discussion

Although widely diverse species of neotropical *Drosophila* are found breeding within flowers; e.g., *D. leoni*, *D. flexipilosa*, *D. mcclintockae*, *D. aracea* (Heed and Wheeler, 1957), and the members of the *flavopilosa* species group recently described by Wheeler, Takada, and Brncic (1962), this paper reports finding, also, related species of *Drosophila* breeding within members of the same plant genus. For example, *D. leukorrhyna* and *D. alani* were each bred from *Heliconia mariae* and *Heliconia curtispatha*, respectively; *D. alani* was also found feeding on *H. mariae* in Darien Province, R. of Panama. Further, *D. xanthopallescens* has been bred from *Calathea insignis*, whereas its closely related *D. aureopallescens* was bred from a closely similar unidentified *Calathea* species. The latter pair of *Drosophila* species show the development of protective coloration to match their respective plant hosts. Finally, the four species, *D. xanthopallescens*, *D. aureopallescens*, *D. alexanderae*, amd *D. othoni* form a natural species group within the flower breeders' niche, using both species of *Calathea* and of *Heliconia*.

Acknowledgments

It is a pleasure to acknowledge the assistance of Dr. W. J. Hanson, Utah State University, Logan, in collecting several of these species in 1960, 1961; also the help of Mr. Alan C. Pipkin, Jr., and of Mr. L. M. Powers in collections. The slides of dissected flies were prepared by Mr. Orlando Ortiz; the photograph of the wing of *D. alani* was made by Dr. Alan C. Pipkin, Sr. Plants were identified by Professor R. L. Rodriguez, The University of Costa Rica, and by Dr. Jorge León, Instituto Interamericano Ciencias Agricolas de la Organización de los Estados Americanos. To Mrs. Lillian Greer Bedichek I am indebted for choice of Latin names. The author thanks Dr. G. B. Fairchild for advice and criticism.

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TWO NEW GENERA OF DOLICHOPODIDAE FROM MEXICO (DIPTERA)

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During recent trips to Mexico, numerous undescribed species of the family Dolichopodidae were collected. Among these were representatives of the following previously undescribed genera.

The concave occiput, apical arista, lack of acrostichals and of preapical setae on the femora place both genera in the Medeterinae close to the European genus *Cyrturella* Collin. *Microcyrtura* is distinct in the generally dark setae, the broadened clypeus, the very elongate arista, and the form of the third vein of the wing. *Microchrysotus* has the clypeus narrow and the arista shorter as in *Cyrturella*, but the curved fourth vein and fuscous band of the wing and the male palpus and fore tarsus are distinctive.

Microcyrtura, gen. nov.

Small, metallic dark green or dull black, setae mostly dark. Face of the male narrow in the middle, broad above and below, without setae, covered with silvery-white pollen; first antennal segment bare above, second segment truncate apically, arista apical and very elongate; occiput strongly concave. Thorax strongly arched with the posterior slope flattened; acrostichals absent, five pairs of dorsocentrals, a pair of long scutellars, proepisternum bare above. Femora without preapicals. Second wing vein extending only twice as far as the first vein, ending far short of the tip of the third vein; third vein parallel with the fourth beyond the posterior crossvein, curving and converging with the fourth vein near the tip, more widely separated in the female; fourth vein ending at the apex of the wing; posterior crossvein shorter than the last section of the fifth vein; sixth vein lacking. Abdomen slightly tapering, mostly rather straight; hypopygium small, sessile, extending forward under the tip of the abdomen.

Type species, *Microcyrtura campsicnemoides* sp. n.

The species are found on rather dry rock surfaces. Each of the four species known from Mexico has a distinctive distribution.

1. Legs pale; male with a series of prominent anterodorsals and a very long posterodorsal on the middle tibia; hypopygium without prominent lamellae 2

Legs dark, brown or yellowish-brown; male without distinctive setae on the middle tibia; hypopygium with long rather densely pubescent apical lamellae ---------- 3

2. Fore basitarsus of the male not broader distally, posterodorsal of the middle tibia rather erect, inserted before the first of the anterodorsal series (San Luis Potosi, Hidalgo) ---------- *M. campsicnemoides*

Fore basitarsus of the male broadened distally, posterodorsal of the middle tibia nearly appressed, usually inserted by the first of the anterodorsal series (Guerrero, Chiapas) ---------- *M. metatarsalis*

3. Second joint of hind tarsus distinctly longer than the first; front bearing some rather yellowish pollen; male with prominent setae on the fore tibia and tarsus; hypopygial lamella slender, dark (Oaxaca) ---------- *M. oaxacensis*

First two joints of hind tarsus of about equal length; front with prominent silvery-white pollen; fore leg without prominent setae; hypopygial lamella broad, whitish (Puebla) ---------- *M. lamellata*

Microcyrtura campsicnemoides sp. n.

(Figs. 1, 2)

Male.—Length 1.0 mm.; wing 1.1 mm. by 0.4 mm.

Face narrow in the middle, broadened above, with a marked suture below which the clypeus is broadened; front broad with diverging sides, becoming very broad above; face and front covered with silvery-white pollen. Palpus and proboscis brown with small brownish hairs. Antenna black, basal two segments very short; second segment ringed with small black setulae; third segment conical, covered with fine pale hairs; arista short-pubescent, as long as the head and thorax combined; lower orbits with a row of fine rather pale hairs.

Thorax dark metallic green, dulled with yellowish-brown pollen on the anterior mesoscutum, with thick whitish pollen on the flattened posterior slope, grayish pollen on the pleura.

Middle and hind coxae except the tips and the base of the fore coxa infuscated; fore and middle coxae with sparse pale hairs and a few larger setae on the anterior surface, middle coxa with a large pale seta toward the outer margin, hind coxa with a smaller pale external seta. Hind femur except the extreme base, upper surface of the middle and sometimes the fore femur, hind tarsus from the tip of the first joint, and the distal joints of other tarsi brownish, remainder of legs usually including all trochanters yellow; bristles black but hairs mostly pale; rows of slender erect setae along the antero- and posteroventral margins of the fore femur, two or three erect slender anteroventral setae on the middle femur near the base; fore and hind tibiae without distinctive setae; middle tibia with an anterodorsal bristle near the basal third followed by a series of about fourteen erect brown setae, one posterodorsal near the basal fourth which is half as long as the length of the tibia, apicals small, indistinct. Lengths of the joints of the fore tarsus from the base as 7–3–2–2–3; middle tarsus as 9–4–3–2–3; hind tarsus as 5–5–3–2–3; distal joints of all tarsi slightly widened.

Wing rather elongate-oval, clear with brownish veins, anal angle rather rudimentary. Margin of the calypter, its hairs, and the knob of the halter black, stem of the halter often pale.

Abdomen about as long as the thorax, rather dull black, with only short dark hairs. Hypopygium brownish, small, extending forward under the tip of the abdomen, with an angle on the lower surface and a few short appendages at the tip, with a small flange on each side above the tip.

Female face nearly as broad in the middle as below; without evident row of erect setae on the anterodorsal surface of the middle tibia, posterodorsal of the middle tibia much shorter; anal angle of wing slightly more prominent.

Holotype male, allotype female, and six male paratypes, from limestone face near seepage above roadside spring, just north of Chapulhuacan, Hidalgo, Mexico, Aug. 5 and 13, 1962; three male and three female

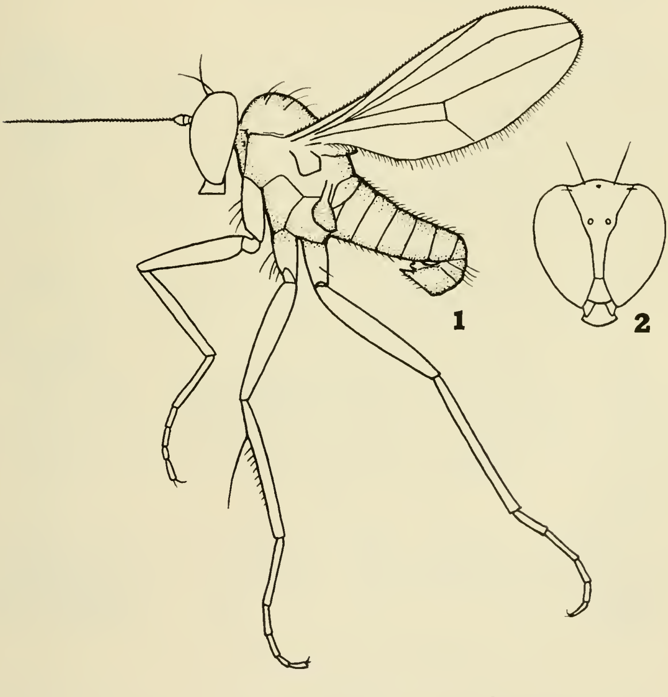

Fig. 1–2. *Microcyrtura campsicnemoides* sp. n., male, line represents 1 mm.; Fig. 2, showing anterior view of head slightly more enlarged.

paratypes, from limestone surfaces near moisture in small ravine, a few miles south of Tamazunchale, San Luis Potosi, Mexico, Aug. 4 and 5, 1962; all collected by the author. Holotype and allotype in the U. S. National Museum (USNM type no. 67060), two males and one female at the Instituto de Biologia, Ciudad Universitaria, Mexico, D. F., others in the author's collection.

The species resembles the genus *Campsicnemus* of the Campsicneminae in the shape of the face and in having a modified middle tibia.

Microcyrtura metatarsalis sp. n.
(Fig. 4)

Male.—Length 1.2 mm.; wing 1.3 mm. by 0.5 mm.
Head, thorax, and wing as in *M. campsicnemoides.*

Bases of middle and hind coxae, upper edge of hind femur, and distal joints of tarsi somewhat darkened, legs otherwise pale; setae rather pale, only largest setae dark. Middle femur with two or three slender erect anteroventrals near the base, hind femur with one or two rather prominent anteroventrals near the tip; fore and hind tibiae without distinct setae, middle tibia with a series of about seventeen erect anterodorsals from near the base to the tip, longest one near the base and usually paired with a very long nearly appressed posterodorsal. Lengths of joints of the fore tarsus from the base as 10–3–3–2–4, mostly darkened, metatarsus slightly compressed especially in the distal half and with two or three short erect dark setae posteriorly at the tip; middle tarsus as 12–5–4–3–4; hind tarsus as 8–7–5–3–4; distal joints of all tarsi slightly widened.

Hypopygium brown, short, curling forward under the tip of the abdomen, with a pair of apical prongs projecting upward toward the abdominal venter.

Female apparently indistinguishable from that of *M. campsicnemoides.*

Holotype male and one male paratype, from rather dry rock surface in shaded ravine near Tierra Colorada, Guerrero, Mexico, May 29, 1963; allotype female, six male and eight female paratypes, from rocks in shaded roadside ravine, sierra above Arriaga, Chiapas, Mexico, May 21–22, 1963. Holotype and allotype in U. S. National Museum (USNM type no. 67122), two males and two females at the Instituto de Biologia, Ciudad Universitaria, Mexico, D. F., others in the author's collection.

The species is very closely related to the preceding but differs in the form of the fore metatarsus and the hypopygium. The large posterodorsal of the middle tibia is usually distinctive also in its insertion and in being nearly appressed so as to touch the tips of the row of anterodorsals.

Microcyrtura oaxacensis sp. n.

(Fig. 5)

Male.—Length 1.3–1.5 mm.; wing 1.5 mm. by 0.6 mm.
Head and thorax very similar to *M. campsicnemoides,* but the front usually bears

partly yellowish or brownish pollen.

Legs pale brownish; setae mostly dark. Fore femur with a series of slender posterodorsals prominent near the tip, middle femur with one or two erect slender ventral setae near the base, hind femur with a row of erect fine setae along the ventral margin; fore tibia with a series of rather stout setae along the posterodorsal surface, longer setae distally, series continued on the metatarsus, middle tibia with a very small anterodorsal and posterodorsal near the basal third, hind tibia without distinctive setae. Lengths of joints of the fore tarsus from the base as 10–5–4–3–4, metatarsus with four strong posterodorsals of which the second is usually longest, series continued on second joint with shorter setae, two or three ventrals near base of the metatarsus; middle tarsus as 13–8–5–3–3; hind tarsus as 8–10–6–4–4.

Wing usually brownish tinged, shape and venation as in *M. campsicnemoides.*

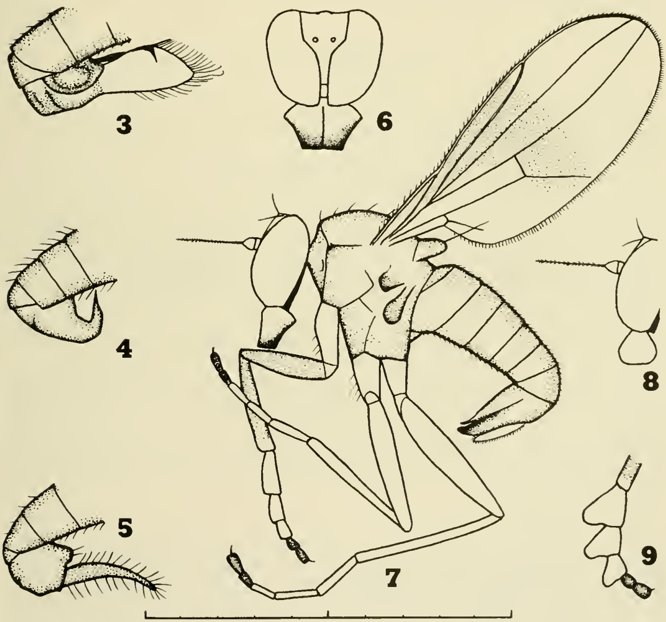

Fig. 3–9. *Microcyrtura* and *Microchrysotus,* males, line represents 1 mm.; Fig. 3. *Microcyrtura lamellata* sp. n., genitalia; 4. *M. metatarsalis* sp. n., genitalia; 5. *M. oaxacensis* sp. n., genitalia; 6–7. *Microchrysotus mirabilis* sp. n., 6. showing anterior view of head; 8–9. *M. tarsalis* sp. n., 8 head with palpus, 9. fore tarsus.

Hypopygium small, brown, rather globose with a pair of long tapering brown lamellae bearing numerous short hairs.

Female face nearly as wide in the middle as below; fore and hind legs without distinctive setae, middle tibia with the anterodorsal and posterodorsal much longer than in the male; anal angle of wing more prominent.

Holotype male, allotype female, thirteen male and eighteen female paratypes, from rock surfaces in shaded ravines and on shaded culverts, along rt. 175 on sierra above Valle Nacional, Oaxaca, Mexico, May 13–16, 1963. Holotype and allotype in U. S. National Museum (USNM type no. 67123), two males and two females in the Instituto de Biologia, Ciudad Universitaria, Mexico, D. F., others in the author's collection.

As in *M. lamellata* the hypopygial lamellae are apparently projections of the capsule and are not articulated at the base.

Microcyrtura lamellata sp. n.
(Fig. 3)

Male.—Length 1.5 mm.; wing 1.5 mm. by 0.6 mm.

Head and thorax essentially as in *M. campsicnemoides* with silvery-white pollen very prominent on the front.

Legs dark, coxae and femora with greenish tinges and dulled with slight whitish pollen, trochanters, tibiae, and basal joints of the tarsi pale brownish; setae mostly rather pale. Fore and hind femora with a series of short erect setae along the anteroventral surface, middle femur with usually three slender erect ventral setae near the base; fore and hind tibiae without distinctive setae, middle tibia with a small black antero- and posterodorsal near the basal fourth. Lengths of joints of the fore tarsus from the base as 7–4–3–2–3; middle tarsus as 9–5–3–2–3; hind tarsus as 6–6–4–3–3.

Wing mostly clear, oblong with anal angle prominent, venation as in *M. campsicnemoides*.

Hypopygium small, black, smooth near the base; lamella large, oval, whitish with pale marginal setae; inner margin indurated, black, ending in a short incurved black tooth.

Female face nearly as wide in the middle as below; femora without erect ventral setae, antero- and posterodorsal of middle tibia larger than in the male; anal angle of wing as in the male.

Holotype male, allotype female, seven male and eight female paratypes, on rocks by stream in deep shaded gorge by old road west of San Martin, Puebla, Mexico, May 27, 1963. Holotype and allotype in U. S. National Museum (USNM type no. 67124), two males and two females at the Instituto de Biologia, Ciudad Universitaria, Mexico, D.F., others in author's collection.

The species is generally larger than others of the genus and was the only one occurring in a generally arid and elevated region.

Microchrysotus, gen. nov.

Small, rather dull brownish or black ornamented with ochre and white portions; larger setae dark. Eyes nearly contiguous below in the male, approximated in the female, face dark with brownish pollen, without setae; palpi much enlarged in the male; first and second segments of the antenna short and truncate, first bare above, arista apical, slightly longer than the face; occiput strongly concave. Thorax slightly arched, not distinctly flattened posteriorly; acrostichals absent, five pairs of dorsocentrals, one pair of scutellars, procpisternum bare above. Femora without preapicals; fore tarsus mostly white, compressed in the male. Wing clear with a median fuscous band; second vein extending only two-thirds the wing length, curving forward distally and ending in a slight sinus; third and fourth veins distinctly convergent distally, fourth bending forward in the last part; posterior crossvein about half as long as the last of the fifth; sixth vein represented by a weak fold. Abdomen slightly tapering; hypopygium short, sessile, extending forward under the tip of the abdomen.

Type species, *Microchrysotus mirabilis* sp. n.

The species were found primarily on leaves. A few specimens were on adjacent moist rock.

Microchrysotus mirabilis sp. n.
(Figs. 6, 7)

Male.—Length 0.9 mm.; wing 1.0 mm. by 0.4 mm.

Face very narrow from slightly below the antennae, greenish with thick brownish-yellow pollen; front broad, only a little broader above. Palpus broadly triangular with the tip truncate, yellowish with the tip usually violet; proboscis small, brownish-yellow. Antenna yellow with the tip of the third joint slightly darkened. Lower orbit with a row of pale hairs.

Thorax dark; mesonotum metallic green mostly dulled by thick ochre pollen. A few pale hairs above the fore coxa.

Fore coxa, tip of fore tibia, first to third joints of fore tarsus whitish; femur, most of tibia, and last two tarsal joints dark; middle and hind legs pale with last two tarsal joints dark. Lengths of joints of fore tarsus from the base as 8–6–4–3–4, first three joints slightly but distinctly compressed; middle tarsus as 6–5–5–3–4; hind tarsus as 10–8–5–3–5.

Wing rather oblong-oval. Calypter dark with very short dark hairs, halter light brown.

Abdomen slightly longer than thorax, rather dull black, with only short dark hairs. Hypopygium yellowish-brown, darker toward the tip, elongate rather pale short-pubescent lamellae against the lower surface.

Female face slightly wider, clypeus prominent; palpus small, brown; mesonotum without ochraceous pollen; abdomen rather compressed and truncate.

Holotype male, allotype female, three male and six female paratypes, from foliage and moist rock in small roadside ditch, near 95 km. marker on rt. 175, Sierra Juarez above Valle Nacional, Oaxaca, Mexico, May

17, 1963. Holotype and allotype in U. S. National Museum (USNM type no. 67125), one male and one female at the Instituto de Biologia, Ciudad Universitaria, Mexico, D. F., others in the author's collection.

Both sexes were observed to hold their ornamented front legs outward and slowly wave them back and forth in a manner reminiscent of many Ephydrids.

Microchrysotus tarsalis sp. n.
(Figs. 8, 9)

Male.—Length 0.8 mm.; wing 1.0 mm. by 0.4 mm.

Very similar to *M. mirabilis*, showing only three observed differences. Palpus enlarged, rather rounded, pale yellow; mesonotum metallic green dulled with yellowish pollen, without thick ochraceous pollen; fore tarsus with first three joints strongly compressed, triangular, as wide as long.

Female apparently not distinguishable from that of *M. mirabilis*.

Holotype male, from foliage in small roadside ditch, near 95 km. marker on rt. 175, Sierra Juarez above Valle Nacional, Oaxaca, Mexico, May 17, 1963, in U. S. National Museum (USNM type no. 67126).

Lacking evident distinctions all females collected were assigned to *M. mirabilis*.

BOOK REVIEW

Practical Entomology, by R. L. E. Ford. Frederick Warne & Co., Inc., 101 Fifth Ave., New York 3, N.Y. ix – 198 pp. 1963. $4.95.

This work, one of the *Wayside and Woodland* series, presents methods and techniques for collecting, rearing, and preserving insects by the novice. Many excellent suggestions concerning specific habitats for finding various stages of British insects, especially Lepidoptera, are given. Rearing of Lepidoptera is discussed in some detail. And, means of rearing or maintaining colonies of bumblebees, wasps, and ants for observation and study are illustrated.

The author indicates that short (less than 38 mm.) insect pins are preferable to long ones. Workers over the world, with the exception of the British, use the long pins. Fortunately, specimens on short pins can be double mounted. Brass pins should never be used, contrary to the author's statement. Eventually, verdigris forms, ruining the specimen. Japanned steel or stainless steel pins should be used for all in ects.—RONALD W. HODGES, Entomology Research Division, U.S.D.A., Washington, D. C.

A NEW SPECIES OF IOSCYTUS FROM THE WESTERN UNITED STATES (Hemiptera: Saldidae)

John T. Polhemus, *3115 S. York, Englewood, Colorado*

Several years ago I acquired the Hottes Collection of Saldidae, and in that collection was a single specimen of an undescribed species of *Ioscytus* from West Texas. The specimen was poor, so a description could not properly be based on it alone, but during 1963 I was fortunate in collecting good series of this insect in Colorado and at several locations in New Mexico. With abundant material at hand, a good comparison with other species of *Ioscytus* can be made and a description of the new species is now possible.

The new species described below will bring the number of species in the genus *Ioscytus* to five, plus one subspecies. *Ioscytus beameri* Hodgden is quite unlike the other species of the genus in body shape and general appearance, but probably should remain in the genus provisionally until more material is available. This problem and others concerning the genus will be treated in another publication.

IOSCYTUS COBBENI, N. SP.

Of moderate size, slender, general color black, long haired, macropterous.

Head: Black, shining, frons rugulose; postclypeus and anteclypeus red, praeocellar spot and labrum brown; covered with short pale inconspicuous hairs and with usual three pairs of long erect hairs on frons and vertex and several additional black setae; vertex slightly carinate between eye and ocelli on each side; ocelli raised slightly; rostrum light brown, extending between hind coxae.

Thorax: Pronotum black, shining, smooth, with scattered long black hairs and inconspicuous light colored short hairs; lateral margins almost straight, narrowing moderately anteriorly; callus strongly raised, with circular deep impression in center; posterior lobe shorter than anterior lobe. Underparts black, clothed with fine silver hairs; acetabulae brown margined. Scutellum as wide as long, black, shining, faintly rugose; vestiture similar to pronotum.

Wings: Hemelytra fully developed; covered with scattered long straight black setae and a few inconspicuous short dark hairs; dull black, barely shining, with pale embolium varying in color from flavous to hyaline (fig. 1a); membrane clouded with deep black-brown, sometimes becoming sub-hyaline apically, with four cells.

Extremities: Antennal segments 1 and 2 yellowish red to red brown, stout; segments 3 and 4 somewhat incrassate, black; all segments clothed with short light hairs, and with scattered semi-short black hairs; antennal proportions (60 units = 1 mm.)

♂; segment 1, 22; segment 2, 43; segment 3, 41; segment 4, 38.

♀; segment 1, 23; segment 2, 45; segment 3, 43; segment 4, 39.

Legs, coxae testaceous; femora becoming red on apical half; clothed with short light hairs, and usual dark spines on tibia; apex of tarsus dark.

Genital Structures: Parandria, paramere, and median sclerotized structure of aedeagus (viewed from directly above) as figured (fig. 1b, c, d). Penisfilum coiled one and one half times.

Holotype (♂), length 3.7 mm., width 1.5 mm.
Allotype (♀), length 4.3 mm., width 1.8 mm.
Mean length of 10♂: 3.79 mm. (max. 4.0; min. 3.4).
Mean width of 10♂: 1.54 mm. (max. 1.6; min. 1.4).
Mean length of 10♀: 4.15 mm. (max. 4.5; min. 3.5).
Mean width of 10♀: 1.75 mm. (max. 1.9; min. 1.5).

Material: Holotype (♂), Hygiene, Colorado VIII–14–1963, J. T. Polhemus; Allotype (♀), Hygiene, Colorado, VI–2–1963, J. T. Polhemus. Paratypes as follows: 25 specimens, Hygiene, Colorado, from V–25 to VIII–14–1963, J. T. Polhemus; 3 specimens, LasVegas, New Mexico, VIII–25–1963, J. T. Polhemus; 12 specimens, Jemez Spring, New Mexico, VIII–25–1963, J. T. Polhemus; 33 specimens, Maxwell, New Mexico, VIII–25–1963, J. T. Polhemus; 4 specimens, SanYsidro, New Mexico, VIII–25–1963, J. T. Polhemus; 6 specimens, Springer, New Mexico, VIII–25–1963, J. T. Polhemus; 1 specimen, El Paso, Texas, VIII–27–1934, C. J. Drake.

The Holotype, Allotype, and paratypes are in the collection of the author. Paratypes will also be sent to the U.S. National Museum, California Academy of Science, University of Kansas, and the private collections of H. C. Chapman and R. H. Cobben.

This species is named in honor of R. H. Cobben who has made outstanding contributions to our knowledge and understanding of the family Saldidae.

Comparative Notes: Ioscytus cobbeni is most closely related to *Ioscytus politus* Uhler, but can generally be separated from the latter species by the completely black corium and the lack of golden pubescence on the clavus. However specimens of *I. politus* from California have been examined (S. Dos Palos, California, Merced Co., California, XI–30–1962, H. C. Chapman) that are almost completely black and nearly devoid of golden pubescence. Chapman reports that totally black specimens exist (personal correspondence). These specimens do not have a light embolium or light red 1st and 2nd antennal segments and are therefore easily separable from *I. cobbeni*. More than a hundred specimens of *I. politus* from the Rocky Mountain region have been studied and thus far all have been semibrachypterous, whereas *I. cobbeni* is known only in the macropterous form.

I. cobbeni can be easily separated from its most nearly related congener by external characters, however the male parameres are also good specific characters. The paramere of *I. cobbeni* is longer, more strongly curved, and has a longer processus hamatus than *I. politus*.

Habitat: Ioscytus cobbeni was the commonest Saldid found at moderate altitudes (5000–6000 ft.) in Northern New Mexico during August of 1963. It seems to prefer stable habitats such as spring fed streams or seep areas. A high mineral content in the habitat water may also be preferred, as indicated by the occurrence in numbers at a mineral water seep South of Maxwell, New Mexico, at Jemez Hot Spring, New Mexico, and at specific Sulphur Springs on the South side of Rabbit Mountain near Hygiene, Colorado. The mineral content of the water is unknown at collection locations near LasVegas, New Mexico (seep area), SanYsidro, New Mexico (seep area), and Springer, New Mexico (seep area and grassy area adjacent to small stream), however, the latter location is the only one of these where specimens were abundant.

Species found at the same locations as *I. cobbeni* were *Salda buenoi* McDunnough, *Salda lugubris* Say, *Micracanthia quadrimaculata* Champion, *Saldula comatula* Parshley, *Saldula hirsuta* Reuter, and *Saldula orbiculata* Uhler. *Ioscytus politus* Uhler apparently requires, or at least prefers, an alkaline situation, and while the two species have been taken in the same general area (within 15 miles of each other) they have not been seen together.

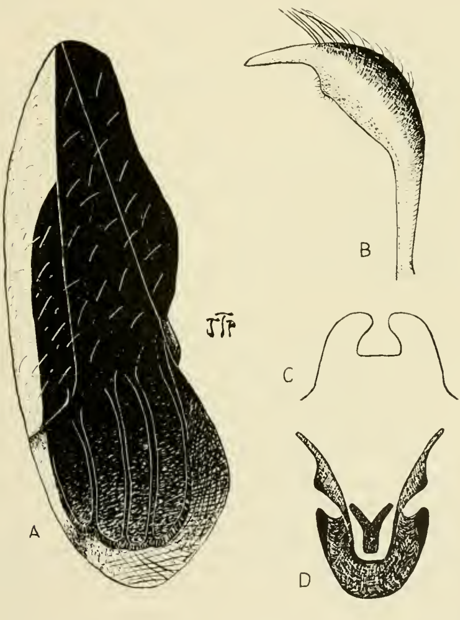

Fig. 1: *Ioscytus cobbeni*, n. sp. A. Left hemelytron of ♂. B. Left paramere. C. Parandria. D. Median sclerotized structure of aedeagus.

BOOK REVIEW

Curculionidae of America North of Mexico, A Key to the Genera, by David G. Kissinger, Taxonomic Publications, South Lancaster, Massachusetts. 1964. Pp. v + 143, + 59 figs. Price, $7.50.

The purpose of this work is to provide keys to the nearly 400 curculionid genera occurring in North America north of Mexico. The author has admirably fulfilled this purpose.

In this work 42 subfamilies are treated. Keys are provided for the subfamilies and each subfamily is provided with keys to the genera. No attempt has been made at identifications on the species level. For each subfamily and genus treated there is a general account of the group. The account of each genus includes the author, date, synonyms, principle references to the keys to the species, the habitat and habits, and the distribution (by states and provinces).

Structural features that are used in identifying genera have been used in the construction of the keys. A section on the taxonomically important adult structures is given but the treatment is not and was not intended to be a complete study of the adult curculionid morphology.

The keys represent an improvement over those of Bradley, a Manual of the Genera of Beetles of America, North of Mexico. Ithaca, New York. 1930, and Arnett, The Beetles of the United States (A Manual for Identification), Catholic University of America Press, Washington, D. C. 1960. There are a few keys with which the user is apt to have trouble. Difficult groups are still difficult. For example, in the key to the genera of subfamily 1 which contains 44 couplets, all the genera (17) from couplet 29 to the end are hard to separate.

The work is not without errors. Most of these should have been corrected in galley proof. An erratum sheet will have to be published but a few of the more obvious are pointed out below. The spelling of the specific name of the cotton boll weevil on p. 55 is *grandis,* not *grandus;* p. 5, *Magdalis,* not *Magdalus;* p. 74, *Perigastes* should be *Perigaster;* p. 130, fig. 30 and p. 37, *Cyrtepistomus* instead of *Cyrtepistomis.* There is a faulty reference on page 67–68. Under the generic name *Cryptorhynchus.* the author says to consult Sleeper (1955a) for a key to separate the species. This work contains the description of seven new species of weevils in miscellaneous genera, but there are no keys to the *Cryptorhynchus.*

Students wishing to pick a group of curculionids for study will find this work most helpful as the author has indicated in many instances which genera are in need of revision and where keys to the species are desired.

The book represents a much needed and valuable contribution to our entomological literature; it will be indispensable to anyone interested in the Curculionidae of America north of Mexico.—Rose Ella Warner, Ent. Res. Div., A.R.S., U.S.D.A., Washington, D. C.

NEW SPECIES OF TRICHOPTERA FROM CUBA

JOHN M. KINGSOLVER [1], 429 St. Lawrence Drive, Silver Spring, Maryland

The three species included in this paper were collected by Dr. M. W. Sanderson of the Illinois Natural History Survey on an expedition to the West Indies.

This paper has been supported by a research grant from the National Science Foundation.

Types of the species herein described are deposited in the collection of the Illinois Natural History Survey.

PSYCHOMYIIDAE

Polycentropus rosarius, new species.

Male.—Length 7 mm. Color cinnamon brown to yellow. Antennae light yellow with darker sutures; body brownish-yellow; wings with small hyaline areas at cross-veins r-m, m and m-cu. Wing venation and general form typical for genus. Male genitalia, fig. 1A, 1B, 1C; tenth tergite semimembranous, incised on meson, with auxiliary lobes at apex and on dorsal surface of each of the main lobes, fig. 1c; paired lateral sclerotized processes long, tapered, curved laterad, each with a stout seta on its antero-lateral face. Cerci bilobed. Claspers broad at base tapering to rounded apices in ventral view, somewhat slipper-shaped in lateral view, vertical mesal lobes triangular, platelike; slender paired rods attached to the dorsal angle of the mesal process extend anteriorly to a membranous connection at extreme base of clasper. Aedeagus clavate apically.

Female and larvae not known.

Holotype ♂—Cuba, Rancho Mundito, Sierra del Rosario, Pinar del Rio Province, June 16, 1959, M. W. Sanderson.

Paratypes—Same data, 4 ♂; Cuba, Moa, Oriente Province, November 3–16, 1947, J. Acuna, 1 ♂.

This species is in the same group with *Polycentropus dominguensis* Banks from the Dominican Republic and the closely related *nigriceps* Banks from Cuba. All three species have bilobed cerci and similarly formed claspers. *Rosarius* differs from *nigriceps* in the shorter dorsal lobe of the cercus and the larger vertical mesal lobe of the claspers, and from *dominguensis* chiefly in the less elaborate dorsal process attached to the mesal lobe of the claspers and in its smaller size (*dominguensis* is 12 mm. long).

Although the series from Pinar del Rio and the single paratype from Moa are from opposite ends of the island, the male genitalia are identical.

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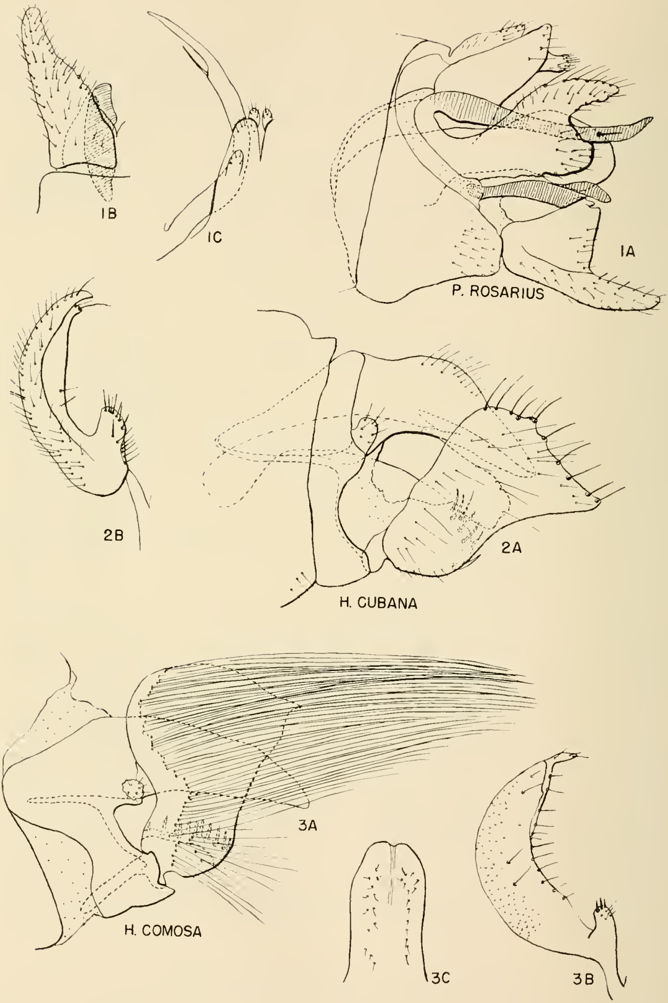
[1] Work completed while at Illinois Natural History Survey.


1B
1C
1A
P. ROSARIUS
2B
2A
H. CUBANA
3A
H. COMOSA
3C
3B

HELICOPSYCHIDAE

Helicopsyche cubana, new species

Male.—Length 6 mm. Color light brown; antennae, legs and body straw yellow; wings with hyaline streaks at fork or $R_4 + R_5$, at crossvein r-m and at fork of $M_2 + M_3$. Wing venation and body form typical for genus. Male genitalia, fig. 2A, 2B, tenth tergite hood like, slightly emarginate at apex in dorsal view; cerci short, rounded; clasper broadly triangular in lateral aspect, apex somewhat attenuated and curved mesad, antero-dorsal corner rounded, dorsal margin with several stout setae, postero-ventral margin sinuate, basal mesal lobe spinose. Aedeagus tubular.

Holotype ♂. Cuba, Moa, Oriente Province, June 5, 1959, M. W. Sanderson, at light.

Helicopsyche comosa, new species.

Male.—Length 6 mm. Color light brown, body, legs and antennae yellowish-brown. Wings with hyaline areas as in preceding species. Wing venation typical for genus. Male genitalia, fig. 3A, 3B, 3C. Tenth tergite elongated and hoodlike, apex emarginate in dorsal view. Clasper in lateral aspect panduriform, postero-dorsal angle acuminate, lateral face covered with very long, fine, blackish hair, basal mesal lobe spiniform. Fig. 3B is of a denuded right clasper of the paratype, ventral aspect.

Holotype ♂. Cuba. Aspiro-Rangel, Pinar del Rio Province, June 16, 1959, M. W. Sanderson.

Paratype. Same data, 1 ♂.

These two species of *Helicopsyche* belong to the *planata-borealis-limnella* complex with species heretofore described only from the Central North America mainland. From *planata* Ross and *borealis* (Hagen) *cubana* differs in the more prolongated apex of the clasper and from *limnella* Ross in the more rounded dorsal margin of the clasper.

The extreme hairiness of the claspers in *comosa* is not found in any other described *Helicopsyche* in the New World. The hair is long and silky and its density conceals the outline of the clasper in a lateral aspect.

The shape of the spiniform basal mesal lobe also indicates the close relationship of *comosa* with the more primitive continental species.

FLIGHT IN THE HORNED PASSALUS BEETLE, POPILIUS DISJUNCTUS (ILLIGER)

(Coleoptera: Passalidae)

The ability of the horned passalus beetle, *Popilius disjunctus* (Illiger), to fly has been raised in the literature (e.g. Gray, 1946, Amer. Mid. Nat. 35:728–46) and by entomologists in personal conversations. We have not been able to force this beetle to fly and no flight attempts have been observed in laboratory colonies during the past three years.

We have five records of this beetle having been taken in flight. A single beetle was taken in flight at late dusk near Athens, Georgia, in May, 1960. The beetle was flying over a small lake towards the woods at one edge of the lake and was captured at the shore line. In four other cases individual beetles were captured in Georgia by entomologists when the beetle flew to a porch light at night. One was taken in Atlanta by Dr. Rudolph Franklin in the spring of 1962, two in Athens by Dr. Robert Davis, one June 8, 1958, and the other June 29, 1960, and one by Mr. Marlon Nelms at a second floor window in Rome, August, 1961. In the one case where the method of flight was observed the body of the beetle was bent ventrally and the elytra, which cannot be separated, raised as a unit to allow the membranous wings to be extended for flight.

We also have records for beetles collected in light traps using U. V. lights. Dr. Edward Menhinick collected 10 beetles from a trap between June 6 and August 20, 1955, near Aiken, South Carolina. This trap, which was run all night throughout the summer, was suspended by a wire from a live tree approximately six feet above the ground. The construction and type of suspension of the trap would have prevented the beetles from crawling into the trap. A light trap was set up and run nightly by one of us (B.J.J.) specifically in an attempt to capture passalus beetles. The trap was supported by three ½ inch iron pipe legs about five feet above the ground. Construction of the trap was such as to prevent any insects from crawling up the legs into the trap. The trap was run from late July until October, 1963, in a woods near Athens, Georgia, where beetles were known to be present. A timer turned the trap light on at 6:00 p.m. and off at 6:00 a.m. One beetle was taken in this trap August 18. Although flight may not be common in this species, it probably serves as a means of dispersal of the beetle to new logs and areas and apparently occurs at night or at times of reduced light.—Preston E. Hunter and Billy J. Jump, Department of Entomology, University of Georgia, Athens.

A NEW GENUS AND SPECIES OF HALYINE PENTATOMID FROM ARGENTINA

(HETEROPTERA: PENTATOMIDAE)

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In a small collection of pentatomids recently loaned me for study by my good friend, Professor Belindo A. Torres, of the La Plata Museum, Argentina, the following interesting new genus and species appeared. It differs from the standard New World halyines in one or two minor respects but is included in the tibe Halyini due to the composition of its male genitalia and conformity to the requirements of the tribe in most other respects.

Marghita, new genus

Ovate; moderately large, 15.0 mm. long; subdepressed above, distinctly convex beneath.

Head, excluding eyes, suboval, flattish, porrect, very feebly exserted, slightly shorter than the median length of pronotum, and about three-fourths as wide between the eyes as long; anteocular margins very feebly sinuate, then gradually convergent to a moderately rounded, incised apex; juga longer than the tylus, their apices narrowly rounded and separated from one another; eyes subglobular, large, protuberant, but not pedunculate; ocelli placed in a line drawn across the posterior margins of the eyes, and more than twice as far apart as distant from the eyes. Antennal tubercles prominent and visible from above; antennae five-segmented, reaching the middle of scutellum, segment I exceeding the apex of the head by about half its segmental length; segment III longer than segment II.

Pronotum hexagonal, more than twice as wide as long, the anterior portion midly declivous; anterior margin slightly wider than the head through the eyes, and less than half the length of the transhumeral diameter, moderately excavated centrally, then truncate behind the eyes and ending laterally in an acute, oblique denticle; anterolateral margins very narrowly carinate and vaguely subreflexed, very shallowly sinuate at the middle; humeral angles rectilinear, subprominent, but not produced. Scutellum reaching the fifth abdominal tergite, about one-third longer than wide at its base, frena surpassing the middle, the post frenal lobe about five-eighths the length of the prefrenal portion, postfrenal margins gradually converging, the apex obtusely, subangularly rounded, the extreme lateral margins barely reflexed. Hemelytra reaching the apex of abdomen, corium longer than scutellum, veins of membranes simple or sometimes bifurcate. Connexivum moderately exposed, segmental apical angles rectilinear and barely produced.

Bucculae well developed, parallel, very gradually increasing in height posteriorly, and ending in line with the posterior margins of the eyes. Rostrum arising in line with the antennal tubercles, attaining the basal abdominal sternite, segment I not exceeding the bucculae, i. e. not reaching the prosternum as is common in numerous New World halyines; segment II distinctly shorter than segments III and IV combined. Mesosternum mildly convex with a percurrent, thin, low, median raised line or subcarina. Metasternum hexagonal the anterior and posterior margins a little shorter than the lateral margins, weakly impressed centrally and provided with a low, median, thin, raised line or subcarina contiguous with the one on the mesosternum. Mesocoxae and metacoxae mutually equidistant. Tibiae shallowly planosulcate; terminal segment of posterior tarsi feebly depressed above, this sometimes not very clearly defined. Abdomen quite convex, median portion of basal segment tumid but not in the form of a tubercle; trichobothria transversely paired and lying laterad of an imaginary longitudinal line joining the row of spiracles on each side; no median abdominal furrow evident. Basal margins of the terminal abdominal sternites in both sexes broadly, arcuately rounded.

Basal plates of female genitalia transversely triangular.

Pygofer large, ovate-globular, its ventral apical margins strongly reflexed, the submarginal surface of the capsule almost vertical in position. Details of the morphology of the pygofer are given under the species heading.

Type species *Marghita crepuscula*, new genus, new species.

Marghita crepuscula, new species

Ovate; moderately large, averaging 15.0 mm. long. 8.5 mm. wide across the humeri, and 9.0 mm. wide across the greatest abdominal diameter. Above matte, sordid yellowish fulvous, very densely overlain with coarser piceous, and finer ferruginous punctures, producing an overall medium brown, stippled appearance; beneath matte, much paler with more sparsely distributed fuscous and ferruginous punctures.

Head three-fourths the median length of pronotum, and about one-fourth shorter than wide through the eyes; densely nigropunctate; juga longer than the tylus by about the width of one jugum there, not connivent; eyes fuscous; ocelli light red, about two and one-half times as far apart as distant from the eyes. Antennae setose, brownish fulvous, the basal three sements lightly infuscated, the basal portion of the terminal segment sometimes narrowly pale; segmental ratios: 39/30/40/50/50, i. e. segment II equal to segment I, shorter than segment III.

Pronotum two and one-half times as wide as long medially, the surface rather evenly convex but somewhat roughish, the coarser fuscous punctures interspersed with innumerable extremely fine reddish-ferruginous ones, the fuscous ones somewhat irregularly distributed; a percurrent pale median linea evident; anterior apical denticles flavescent and directed slightly anteriorly. Scutellum vaguely transversely rugulose with a pale median linea on the basal half, contiguous with the one on the pronotum; a small median yellow spot on the basal margin; punctures of two sizes, the smaller paler ones more abundant; the lateral margins of the apex very narrowly subreflexed, piceous and glabrous. Hemelytra very evenly punctured, a small ivory discal spot present; free apical margin of the corium very vaguely sinuate, essentially straight, its external apical angle subacutely rounded and slightly produced posteriorly; membranes dull smoky yellow, veins light brown, subparallel, one or two of them sometimes bifurcate. Connexivum brownish-fulvous, very densely fuscopunctate; segmental apical angles rectilinear to subobtuse, barely produced.

Venter yellowish, much paler than dorsum, less densely punctured. Thoracic pleura with a vague, broad, cloud-like band of denser fuscous punctures extending longitudinally along each side, about midway between the lateral margins and the midline; other punctures on the pleura more loosely distributed, those on the abdomen finer and for the most part reddish-ferruginous; a median row of irregular fuscous spots on the abdominal disc; sometimes there is a single transverse row of small fuscous dots along the posterior margin of each abdominal segment. Mesosternum infuscated, punctured, the median subcarina black. Metasternum flavescent, slightly thickish, the central impressed area and the subcarina black. Legs sordid yellowish fulvous, femora and tibiae densely blotched with small reddish fulvous spots. Ostiolar peritreme, short, digitiform, almost auricular, ending abruptly within the basal third of the metapleuron. Rostrum infuscated, basal segment and portion of segment II sometimes flavescent or pale; segment ratios: 25/45/60/38, i. e. segment II three-fourths the length of segment III, less than half the length of segments III and IV combined, segment IV distinctly shorter than segment III. Spiracles piceous.

Basal plates of female genitalia subtriangular, about one-half again as wide as long, their inner margins contiguous, their apical margins very shallowly sinuate.

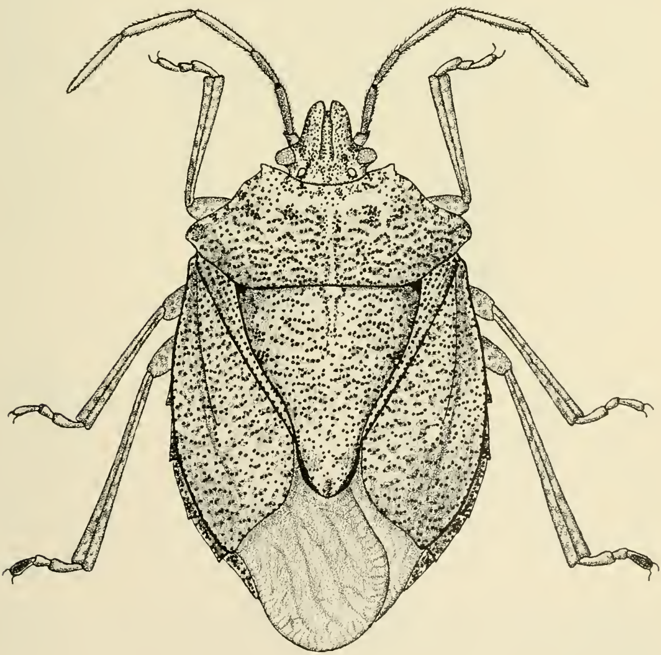
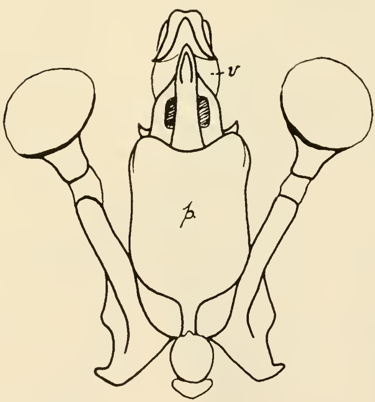


Figure 1. *Marghita crepuscula* new genus, new species; male.

their internal apical angles obtusely rounded; median plate subpentagonal; apical plates elongate oblong, subparallel, well separated, their apices not exceeding the abdominal margin.

Pygofer stout, ovate-globular, about half again as long as wide; contents of genital cup compacted; dorsal border of capsule arcuately sinuate; lateral apices of capsule stubby, obtuse, each provided with an incurved, triangular brush of long, densely matted hairs on its extreme apex, and a large, robust, slightly curved antrorsely directed acute cusp arising from its superior surface, the axes of the two cusps slightly convergent, and each cusp lies appressed to its adjacent paramere; ventral apical margin strongly reflexed, deeply truncately sinuate centrally, the submarginal face almost vertical in position, bilaterally impressed, provided with a low median carina; proctiger large, strongly declivous beyond its middle, the basal half horizontal, subquadrangular in outline, slightly convex, glabrous, and provided with a small, stubby tubercle on each side at the region of the flexure, the declivous apical portion convex, obtusely subtectiform in contour and densely clothed in long silvery hairs; paramere (fig. 3) placed vertically, appearing as if squeezed between the proctiger and lateral wall of capsule, basal disc (*basis parameri*) suborbicular, vertical arm short, stout, head compressed, longitudinally elliptical with a prominent notch on anterior margin, the lobe above the notch acutely triangular, the one below it stubby, subconical, nigropunctate and provided with long setae, posterior margin obtusely rounded, slightly thickened, dorsal margin (in lateral aspect) somewhat sigmoid; phallotheca of the aedeagus ovate cylindrical, provided with a pair of posteriorly



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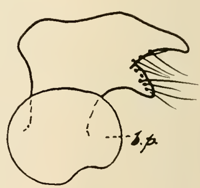

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Figure 2. *Marghita crepuscula*, aedeagus, dorsal aspect. Figure 3. *Marghita crepuscula*, right paramere, lateral aspect. **p**: phallotheca; **v**: vesica; **b.p.**: basis parameri.

directed dorsal connectives to which are appended prominent *capitate processes,* vesica complex in design as shown in figure 2, without apparent conjunctival membranes and thus not retractile into the phallotheca; treatments with potassium hydroxide and acetic acid have failed to produce any evidence of such membranes of the phallus.

Described from six specimens.

Holotype: Male: 15.0 mm. long; 8.5 mm. wide across the humeri. Aristobulo del Valle, Missiones, Argentina. December 1, 1957. M. Biraben, collector. Deposited in the La Plata Museum, Argentina.

Allotype: Female: Same data as above. Deposited in the La Plata Museum, Argentina.

Paratypes (4): Three females, one male. Same data as above. One male and one female deposited in the American Museum of Natural History. Two females deposited in the La Plata Museum.

As a new genus and new species this form has, as yet, no close affinities.

The salient halyine characters evident in this genus and species are the large oval head with protuberent globular eyes, the prominent antennal tubercles readily visible from the dorsal aspect, the first antennal segment exceeding the apex of the head, the thin rostrum which originates in line with the antennal tubercles. the pairs of abdominal trichobothria lying laterad of the spiracles (quite characteristic of New World genera, except *Brochymena*), the flattened dorsal surface of the terminal tarsal sement on the hind leg, and the robust male genital segment with its strongly reflexed apical margin and impressed submarginal surface.

The fact that the first rostral segment is confined to the length of the buccular canal and does not reach the prosternum does not necessarily exclude this genus from the tribe Halyini. *Dalpada* Amyot and Serville (an essentially Asiatic genus) shows this same character.

A NOTE ON NERTHRA PRAECIPUA TODD

(Hemiptera: Gelastocoridae)

Through the courtesy of Dr. W. E. China of the British Museum (Natural History) I have examined a female specimen from Chile that he treated (1963, Ann. & Mag. Nat. Hist., ser. 13, vol. 5, p. 722) as *Nertha n. sp.* The specimen is the second known example of *Nerthra praecipua* Todd. The type, also a female, described in 1957, Proc. Ent. Soc. Washington, vol. 59, no. 4, p. 151, fig. 9 from the Drake Collection via the Reed Collection is labeled "Chile." The specimen discussed by China was collected by G. Kuschel on October 10, 1958, at station H. C. 8 (850 ft.), Chepu, Chiloe Is., Chile. The specimen also bears a label, "Secondary Scrub." An exact locality, date and ecological habitat may enable collectors to locate more examples of this interesting species.—E. L. Todd, Falls Church, Va.

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