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PSYCHE

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No. 1

THE INTEGUMENTARY SENSE ORGANS OF THE LARVÆ OF RHIPICEPHALINÆ (ACARINA)¹

BY J. DINNIK and F. ZUMPT²

In 1938 Delpy published a short paper describing the location and morphology of the so-called spiracles or respiratory plates ("stigmates respiratoires") of various Ixodid larvæ. He examined for the purpose *Hyalomma dromedarii* Koch, *H. impressum* Koch, *Boophilus annulatus* Say, *Rhipicephalus bursa* Can. and Fanz., and *Hæmaphysalis cinnabarina punctata* Can. and Fanz. Delpy's description is brief and lacks illustrations. He thought that he saw within each "spiracle" 1 or 2 pores, sometimes reduced in size, leading into an atrium provided with two valves at the entrance. The base of the atrium he described as pierced with an opening, and Delpy considered it possible that a tracheal tube was attached at this point.

With regard to their position, Delpy distinguished coxal and abdominal spiracles. The coxal spiracles are in three pairs, placed behind each of the six coxæ. The abdominal spiracles vary greatly in number and position according to the genus. *Hæmaphysalis* is said to have four pairs, *Hyalomma* and *Rhipicephalus* only one pair, while they are entirely lacking in *Boophilus*.

Delpy was not the first, however, to describe supposed spiracles in Ixodid larvæ. Salmon and Stiles (1902) saw

¹ Preliminary Study No. 10 for a Revision of the Genus *Rhipicephalus* Koch. Nos. 1 to 8 of this series were published in the Zeitschrift für Parasitenkunde from 1939 to 1943. No. 9 is to appear in Dechiana (Festschrift f. Prof. Reichensperger).

² Now at The South African Institute for Medical Research, Johannesburg, South Africa.

them before, and they were also mentioned by Oudemans (1906), Zebrowski (1926) and Cooley (1938).

All these authors were mistaken in the interpretation of the function of the organ they had seen. The larvæ of the Ixodidæ do not possess any special respiratory organs. Only Samson (1908) correctly recognized that the so-called "larval spiracles" described by Salmon and Stiles were actually the terminal pores of integumentary sense organs. This correction was, however, overlooked up to quite recently. Even Vitzthum, in his account of the Acarina for "Bronn's Klassen und Ordnungen des Tierreichs" (1940), adopted in detail the description and views of Delpy.

K. W. Neumann (1942) and Elishewitz (1942) first re-examined these structures in an attempt to decide whether they were respiratory organs or integumentary glands. Serial sections of larvæ of *Dermacentor*, *Hæmaphysalis*, *Hyalomma* and *Ixodes* convinced Neumann that neither the Ixodinæ (Prostriata) nor the Rhipicephalinæ (Metastriata) have respiratory organs and that the structures thus far interpreted as spiracles are really integumentary glandular organs.

According to Neumann, these organs are in a direct view more or less oval in outline. "A broad ellipsoid chitinized frame at the periphery is attached to the surrounding cuticula by means of a narrow, prominent, striated edge. The lumen also is oval and contains two parallel, non-contiguous lips. Two small protuberances of the frame extend on each side into the lumen, keeping the lips from touching each other. By lowering the objective, a small circular opening may be recognized in the center between the lips."

"In a side view of the entire organ or in a section, the structure is also more or less elongate oval. The walls consist of a rather thick layer of chitin, decreasing in thickness from the base toward the surface opening. A short duct leads from the base toward the interior of the body. On either side of the mouth of this duct a tooth, anchored to the base of the organ, extends up into its lumen. Serial sections show that these teeth arise from a folding of the walls. Their length is approximately three-fourths of that of the entire organ."

“To what do these several parts correspond? The broad frame is the wall, the lips are the teeth, and the circular opening is the mouth of the short duct.” (See Pl. 1, fig. 1.)

“The organ is securely anchored in the cuticula by the upper third of its length. The subjacent hypodermal cells are broader than high and surround the organ. The adjacent cells (?generative cells) are much higher than broad. Only two seem to be present, placed parallel to the margins of the lips. A large cell, considerably broader than high, lies beneath the organ, in close contact with the entire basal surface. The duct mentioned before is never long enough to pierce this basal cell, but ends with it without tapering downward. The duct is never lined with a tænidium. So far as can be detected, the plasma of this cell is slightly granular, but a prominent clear spot in the center may be interpreted as an internal vesicle. It follows from this description that the structure is an integumentary glandular organ, not a larval respiratory organ with a spiracle and a rudimentary trachea.”

So much for K. W. Neumann's account of the morphology of his integumentary sense organ. In addition he discusses the number and position of these organs in various genera and believes to be justified in stating that originally two pairs were present. According to his account, all the spiracle-like organs show essentially the same structure, though they are sometimes reduced in size, and they seem undoubtedly to be peculiar to the larvæ. He does not mention any other integumentary sense organs besides these so-called “spiracles.”

P. Schulze (1942a) published a detailed study of the integumentary sense organs of adult ticks and found, besides true sensory setæ (sensilla trichoidea), four other types of sensilla which he called *Sensilla auriformia* (ear-shaped organs), *Sensilla sagittiformia* (arrow-shaped organs), *Sensilla hastiformia* (spear-shaped organs), and *Sensilla laterniformia* (lantern-shaped organs).

Large numbers of these organs are located within the hard and soft chitinized integument of the body. On the other hand they are sparse on the legs and palps and,

strangely enough, seem to be entirely missing on the chelicerae. Characteristic for these sensilla is their connection with two glandular cells which extend partially into the sensory duct. These cells secrete into the duct a substance which emerges at the surface after passing an end organ. P. Schulze assumes that the secretion serves as a protective coating against evaporation within the sensillum and on the outer surface, and also as a chemical means of recognition between opposite sexes and individuals of one species.

The sensory function of the sensilla auriformia seems to be of a proprio-receptive nature, serving to perceive changes or shifts within the chitin. It is probable that the other three types, grouped together as "tuft-shaped" sense organs or krobylophores, are vibro-chemoreceptive organs, which react at the same time to chemical as well as to seismic stimulation. They evidently play an important part in the sexual life of the ticks.

We examined the larvæ of *Rhipicephalus sanguineus* Latr., *Rh. appendiculatus* Neum., *Rh. bursa* Can. and Fanz., *Rh. evertsi* Neum., *Rh. simus* Koch, *Hyalomma dromedarii* Koch, and *Boophilus calcaratus* Birula.

The larvæ were merely mounted whole on microscopic slides in Berlese's medium, a procedure which we found to be superior for our purpose to all other methods of mounting. Owing to prevailing conditions we were unable to make sections.

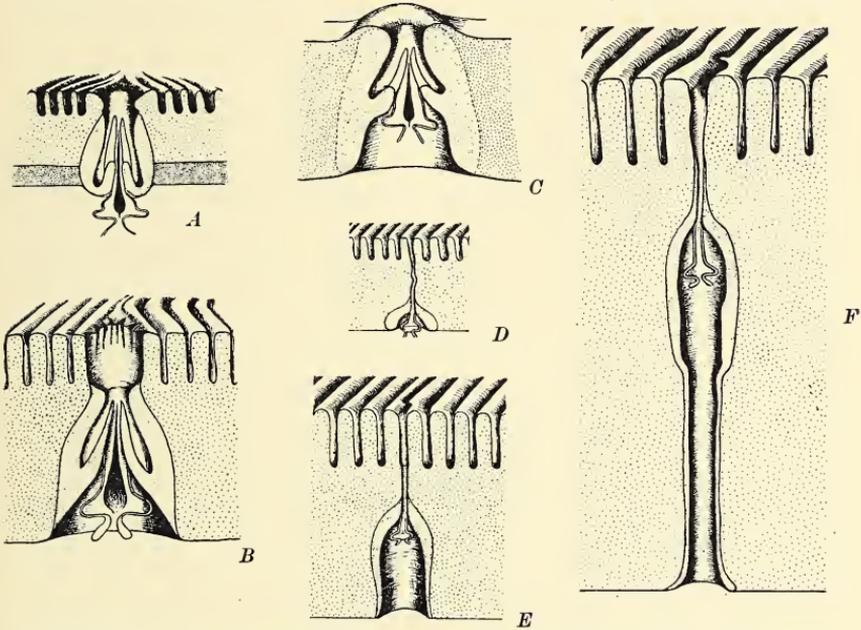
We were able to ascertain that the larvæ are not equipped with peculiar integumentary sense organs. On the contrary we found much the same organs present as in the adults and nymphs. In the larvæ, however, sensilla laterniformia seem to be lacking and the other types of sensilla are to some extent more primitive in development. The organs are distributed over the entire body in fixed numbers and in a definite arrangement.

A detailed account of the three types of sensilla mentioned above follows.

1. Sensilla sagittiformia (arrow-shaped organs)

The sensillum sagittiforme represents a new mode of sensory organ, called by P. Schulze a krobylophore sen-

sory organ, because a tuft-shaped structure is its most striking characteristic. In the adult tick he described this organ as follows in side view (Pl. 1, fig. 2): "The distal portion of the chitinized passage or lumen appears arrow-shaped. Below this lies a narrow pagoda-shaped 'tuft' chamber and farther inside a small, more or less spheroidal 'terminal chamber.' This is separated from



Text-figure 1. A, Sensillum sagittiforme of the opisthosoma of *Rhipicephalus appendiculatus* Neum. B, Same in the larva. C, Same in the nymph. D, Sensillum hastiforme of *Rhipicephalus appendiculatus* Neum. E, Same in the nymph. F, Same in the adult female.

the middle chamber by projecting ledges which leave room only for a small opening. The innermost chamber is attached to a simple duct into which the glandular cells extend, enveloping the nerve cells. The surrounding chitin is especially thick beneath the lower portion of the 'arrow points.' The nerve cells decrease in size as they enter the 'terminal chamber.' The axial fiber is attached to a strong scolopale which enlarges to

form a knot and then tapers down, becoming pointed again upon entering the 'pagoda-shaped chamber' in which the 'tuft' is located. This tuft has much the shape of a gas flame and is not chitinized but of a uniform structure, although at times it seems to be somewhat fibrillar."

The larvæ we examined all show, contrary to Delpy's description, four pairs of spiracle-like structures, three of them behind the coxæ, the fourth on the opisthosoma (Pl. 2, figs. 4 and 5). A comparison of their inner structure (Text-fig. 1A-C) with P. Schulze's description and drawings clearly shows that these so-called "larval spiracles" are in reality sensilla sagittiformia. The finer structure of the organ is best seen in the opisthosomal pair of the larvæ of *Rhipicephalus appendiculatus* and *Boophilus calcaratus*. It is pear-shaped and pierces with its conical end the integument on the dorsal face of the fourth festoon. The walls are of thick chitin, the chitinous capsule being 0.012 to 0.016 mm. long and 0.011 to 0.014 mm. broad. A funnel-shaped fold is visible within the capsule. The narrow ends of this capsule, pointing toward the opening, are less strongly chitinized and look in direct view like a pair of lips lying within the capsule (compare Pl. 1, fig. 1). Within these lips lies the tuft-like structure, surrounded by a fine pagoda-like contour.

The sensilla sagittiformia behind the second and third coxæ are very similar in structure to the opisthosomal pair described above. On the other hand, the pair located behind the first coxæ at the edge of the scutum seems to have a strikingly thick-walled capsule which is fully embedded in the chitin of the scutum. It is 0.019 to 0.022 mm. long, 0.016 to 0.022 mm. wide at the base, with the opening 0.011 to 0.014 mm. in diameter. The "tuft" is difficult to recognize here, but is shaped as in the other pairs.

2. Sensilla hastiformia (spear-shaped organs)

The sensilla hastiformia, as described by P. Schulze for the adult ticks, are much smaller than the arrow-

shaped organs. He was unable to make out all the details of the terminal apparatus, but he presumed that they correspond in general to those of the sensilla sagittiformia and that a tuft-shaped structure is also present. The main difference lies, according to Schulze, in the upper portion of the passage leading to the outside. This lacks the long receding arrow-points, so that the "pagoda-shaped chamber," formed by these points, is also missing. The passage is distinctly spear-shaped, in as much as it expands into two mainly horizontal projections at the base.

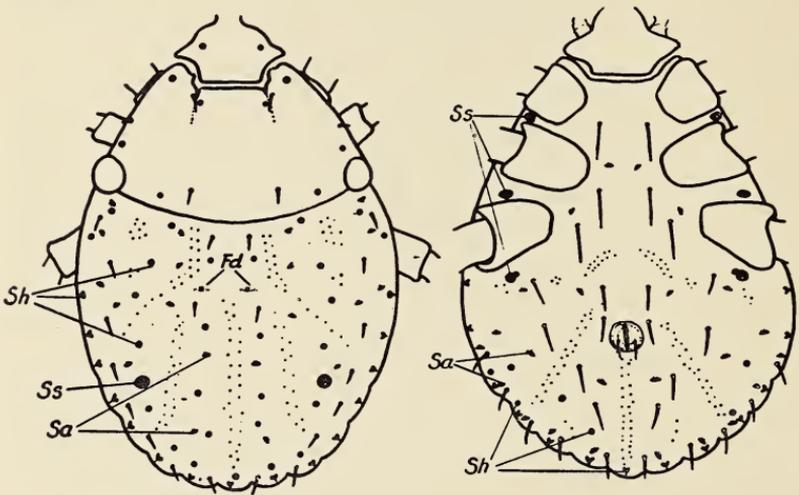
The larval sensillum hastiforme could only be recognized as such after comparing it with the corresponding organ in nymphs and adults (Text-fig. 1, D-F). It lies as a short funnel-shaped structure in the lower part of the integument, which it pierces by means of a narrow passage, ending between the outer folds. The funnel-shaped portion is approximately 0.008 mm. in diameter and 0.005 mm. deep. The walls are about 0.002 mm. thick and the passage is roughly 0.008 mm. long.

We were also unable to recognize the finer structure of the organ, nor could we find anything comparable to a "tuft." In direct view the organ has the appearance of a ring, 0.008 mm. in diameter. Further details cannot be recognized, but by lowering the objective the duct leading inside the body may be followed.

The larvæ of *Rhipicephalus appendiculatus* Neum., *Rh. sanguineus* Latr., *Rh. bursa* Can. and Fanz., and *Rh. evertsi* Neum. studied by us, all have 54 sensilla hastiformia on the body proper; we did not examine the legs. The sensilla are placed strictly symmetrically and neither their position nor their number seem to vary to any extent (Pl. 3, fig. 6). One pair is located on the capitulum, occupying the position taken by the *area porosæ* of the adult female tick. Five pairs are situated on the scutum and nine pairs on the alloscutum, four of these dorsal, one subdorsal and four sublateral. In addition eight pairs are found on the edge of the alloscutum, one sensillum being placed on the edge of each festoon (or parmula), except on the middle festoon. The ar-

range of these eight pairs is therefore metameric and seems to be derived from the primitive segmentation of the opisthosoma.

The "foveæ dorsales" of the larva consist of only one sensillum hastiforme each. The integumental folds bend around their openings, whereas on the contrary the openings of the other sensilla hastiformia lose themselves among the folds of the integument. Aside from the fact



Text-figure 2. Arrangement of the integumentary sense organs of the larva of *Hyalomma dromedarii* Koch: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.

that the openings are more conspicuous, they do not differ from the usual type of sensilla hastiformia.

Ventrally the body bears four pairs of sensilla hastiformia. One pair lies very close to the sensillum sagittiforme of the third coxa. In *Rh. appendiculatus* it is enclosed by the capsule of the sensillum sagittiforme, so that it is difficult to see. Though closely adjacent to it in the other species, the sensillum hastiforme is nevertheless clearly set off.

The number and the arrangement of the sensilla hastiformia of the larva of *Boophilus calcaratus* Birula (Pl. 3, fig. 7) are similar to those of the *Rhipicephalus*, ex-

cept that we were unable to discover the two foremost pairs on the ventral side and that they seem to be missing also on the fourth and fifth festoons counting from the middle.

The larva of *Hyalomma dromedarii* Koch (Text-fig. 2) possesses more sensilla hastiformia than that of *Rhipicephalus*. It should be mentioned especially that the middle festoon also bears a terminal and a dorsal unpaired sensillum. In addition a sensillum hastiforme is located on the dorsal side adjacent to each of the second, third and fourth festoons. It is noteworthy that two pairs of sensilla hastiformia, instead of one pair, were found on the capitulum of one specimen in the position of the areæ porosæ of the adult female.

3. Sensilla auriformia (ear-shaped organs)

The sensilla auriformia discovered by P. Schulze (1942a) in adult ticks may be traced back with certainty to setæ or hairs. They are located directly under the cuticula and consist each of a flat disk, usually inclined a little toward one side, so that it closes outwardly the sensory duct ascending from below, like a lid with overlapping edges (Pl. 1, fig. 3). The disks vary in details and have the shape of an ear, a megaphone or a bell. Their openings face various directions, so that it is possible to see one sensillum in direct view and the other in side view when examining two of them placed close together.

The larval ticks also possess these sensilla in typical form, but the organs are smaller than in the adult. The disk is approximately 0.009 mm. in diameter. Arrangement and number again seem to be strictly uniform, but all the disks lean in one particular direction.

Ten pairs of sensilla auriformia were found on the alloscutum of all larvae of *Rhipicephalus* examined. Five pairs may be seen dorsally some distance from the median line and five pairs on the edge of the alloscutum. Neither capitulum nor scutum seem to have any. Twelve pairs are located on the ventral side, two of them be-

tween the coxæ, the remainder on the opisthosoma, five of the latter in the festoons.

The same number of sensilla auriformia is found in the larvæ of *Hyalomma dromedarii* Koch (Text-fig. 2) as in *Rhipicephalus* and their arrangement is similar. In the larva of *Boophilus calcaratus* Birula (Pl. 3, fig. 7) the pair behind the third coxæ and the first pair on the edge are missing, but the remaining sensilla auriformia are as in the larva of *Rhipicephalus*.

SUMMARY

The larvæ of the Rhipicephalinæ do not possess peculiar integumentary sense organs, as K. W. Neumann (1942) believed, but rather the same types found in the nymphs and adults. The organs are merely in a more primitive state of development and the sensilla laterniformia appear to be missing. Sensilla sagittiformia, sensilla hastiformia and sensilla auriformia may be demonstrated. These organs are strictly specific in number and arrangement within the genera *Rhipicephalus*, *Hyalomma* and *Boophilus*.

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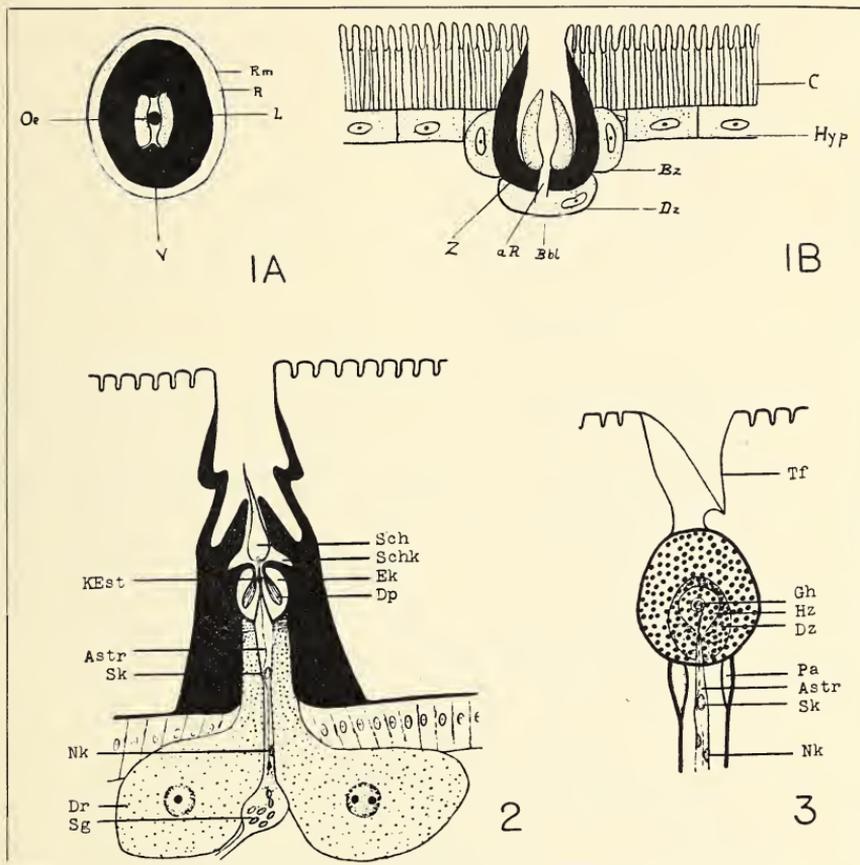
1926. A preliminary report on the morphology of the American dog tick. Trans. Amer. Ent. Soc., vol. 51, pp. 331-369, Pls. 12-14.

EXPLANATION OF PLATE 1

- Fig. 1. Larval integumentary sense organ of *Haemaphysalis punctata* Can. and Fanz., redrawn from K. W. Neumann (1942). A, in direct view; B, in side view: aR, sensory duct; Bbl, internal vesicle; Bz, generative cell; C, cuticula; Dz, gland cell; Hyp, hypodermis; L, lips; Oe, mouth of the sensory duct; R, frame; Rm, fringe; V, protrusions of the frame; Z, tooth.
- Fig. 2. Schematic drawing of a sensillum sagittiforme of *Hyalomma*, after P. Schulze: Astr, axial fiber; Dp, projecting ledges; Dr, gland cell; Ek, terminal chamber; KEst, knot of the scolopale; NK, enveloping cell nucleus; Sch, tuft; Schk, tuft chamber; Sg, sensory cell group outside the duct. The chitinous structure surrounding the sense organ has been omitted.
- Fig. 3. Schematic drawing of a sensillum auriforme on the alloscutum of a female *Hyalomma*, after P. Schulze: Astr, axial fiber; Dz, shaded zone of the disk; Gh, papilla with terminal apparatus in central area of the disk; Hz, unshaded zone; Nk, enveloping cell nucleus; Pa, pigmented and thickened section of the duct; Sk, sensory cell nucleus; Tf, supporting plicature. The chitinous structure surrounding the sensory organ and gland cells has been omitted. The disk covering the sensory cell and the terminal apparatus is assumed to be transparent.

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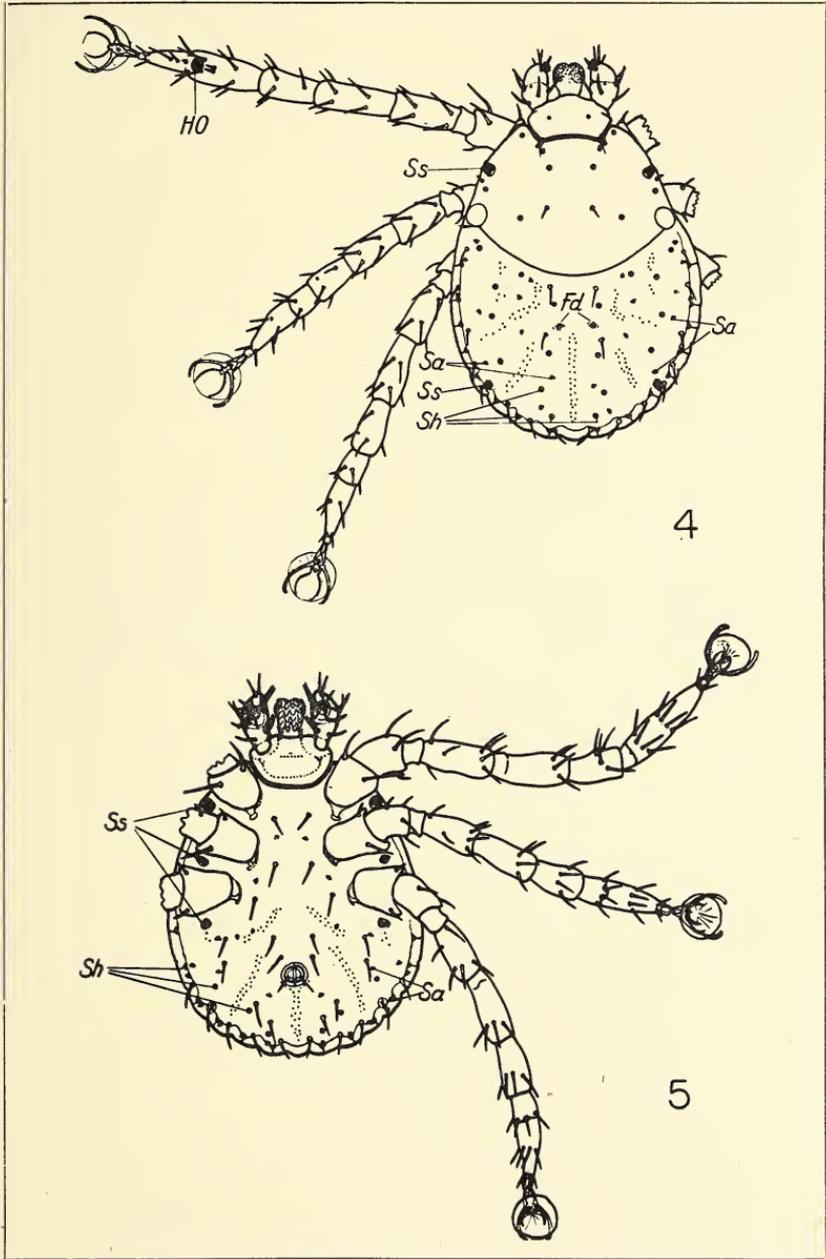
VOL. 56, PLATE 1



DINNICK AND ZUMPT—RHIPICEPHALINÆ

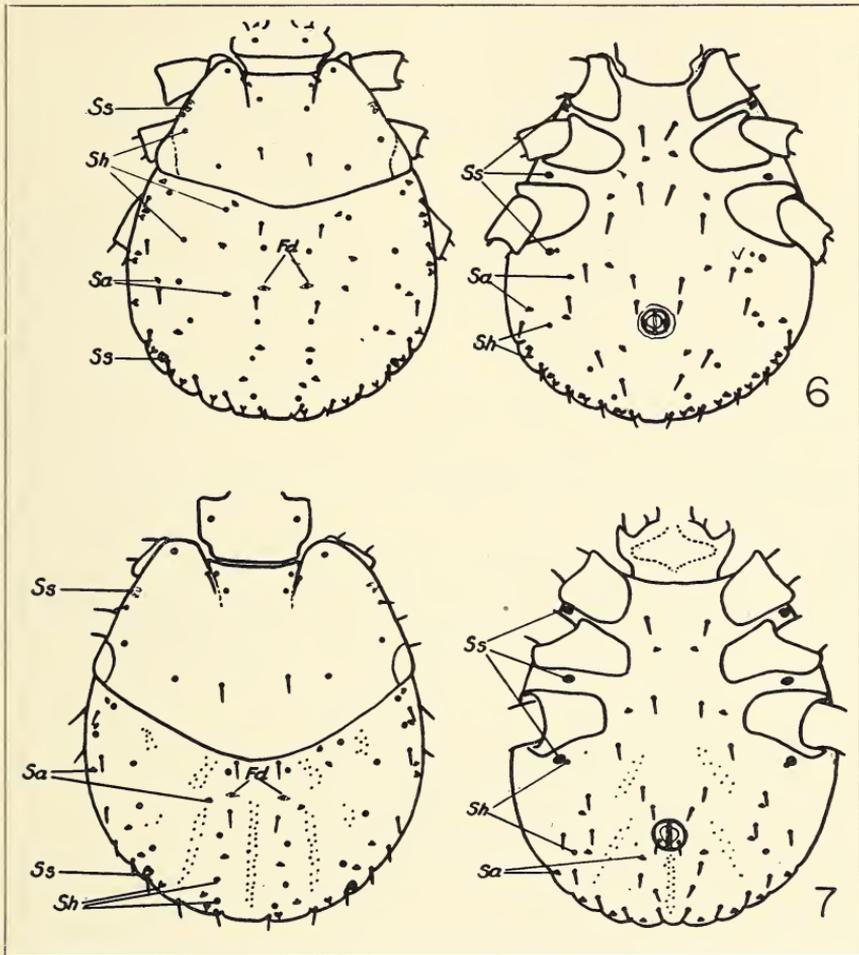
EXPLANATION OF PLATE 2

- Fig. 4. Dorsal view of larva of *Rhipicephalus appendiculatus* Neum., showing sensory organs: Fd, foveæ dorsales; HO, Haller's organ; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.
- Fig. 5. Ventral view of larva of *Rhipicephalus appendiculatus* Neum., showing sensory organs: Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.



EXPLANATION OF PLATE 3

- Fig. 6. Arrangement of the integumentary sense organs of the larva of *Rhipicephalus sanguineus* Latr.: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.
- Fig. 7. Arrangement of the integumentary sense organs of the larva of *Boophilus calcaratus* Birula: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.



DINNICK AND ZUMPT—RHIPICEPHALINÆ

ON THE STATUS OF *CRYPTOCERUS* LATREILLE
AND *CEPHALOTES* LATREILLE (HYMEN-
OPTERA: FORMICIDÆ)

BY MARION R. SMITH

Bureau of Entomology and Plant Quarantine, Agricul-
tural Research Administration, United States
Department of Agriculture

Latreille, in *Hist. Nat. Crust. and Ins.*, volume 3, 1802, included in the family "Formicaires" two genera, *Formica* Linnaeus and the new genus *Cephalotes*. *Cephalotes* was monobasic with *Formica atrata* Linnaeus the only included species (pp. 357-358). In volume 5, 1803, he again placed in "Formicaires" only the two genera but to the group which he had called *Cephalotes* in 1802 he gave the name *Cryptocerus* (p. 311). Distinguishing characters were given but no species were mentioned by name.

Fabricius, 1804, *Systema Piezatorum*, page 418, used the name *Cryptocerus* for *atratus* Linnaeus and 4 new species, including *umbraculatus*; and he cited *Cephalotes* Latreille in synonymy under *Cryptocerus atratus*.

In 1810, Latreille (*Consid. Gen. Crust. Arachn. Ins.*, p. 437) designated *atratus* Fabricius (= *atratus* Linnaeus) as the type of *Cryptocerus*. Since *atratus* was available for type designation of *Cryptocerus*, this action by Latreille has fixed the matter beyond dispute. *Cryptocerus* Latreille is thus an isogenotypic synonym of *Cephalotes* Latreille. The interpretation of *Cryptocerus* by subsequent authors who considered *umbraculatus* Fabricius as its type is erroneous, and a new generic name is needed for *Cryptocerus* of Emery (1915) and authors, not Latreille.

On page 253 of his 1805 work Latreille says "Toutes les espèces de cryptocères, dont la fourmi *atrata* de Lin. et de Fab. est une, sont exotiques. Ces insectes ont un caractère très remarquable, et qu'on ne trouve à aucun de cet ordre; c'est le premier article de leurs antennes qui est inséré et logé de chaque côté, dans une rainure

latérale de la tête.” In the original description of *Cephalotes* he writes “Premier article des antennes inséré et logé, de chaque côté, dans une rainure latérale de la tête,” and in the original description of *Cryptocerus*—“Premier article des antennes s’insérant dans une rainure de la tête.” It seems obvious that Latreille considered *Cryptocerus* (hidden or concealed horn [antenna]) much more descriptive of the genus *Cephalotes* (having a head) and decided to use it instead.

Since the facts in this case are as just stated, the tribe receives the new name, *Cephalotini*, based on the type genus *Cephalotes*, which must be used for *Cryptocerus* of authors. The genera and subgenera involved, with synonymy and types, are as follows:

Genus *Cephalotes* Latreille

Cephalotes Latreille, 1802, Hist. Nat. Crust. and Ins. 3: 357.

Type: *Formica atrata* Linnaeus. Monobasic.

Syn.: *Cryptocerus* Latreille, 1803, Hist. Nat. Crust. and Ins. 5: 311.

Type *Formica atrata* Linnaeus. Designated by Latreille, 1810.

Syn.: *Cryptocerus* Fabricius, 1804, Systema Piezatorum, p. 418 (in part).

Emery, 1915, Bul. Soc. Ent. de France, p. 192 divided *Cryptocerus* into three subgenera: *Paracryptocerus*, n. subgen., type *Cryptocerus spinosus* Mayr; *Cryptocerus*, type *C. umbraculatus* Fabricius, and *Cyathocephalus*, n. subgen., type *Cryptocerus pallens* Klug. Except for *Cryptocerus* he listed additional species in each subgenus. In 1922, in Wytzman's Genera Insectorum, fascicule 174c, pp. 306, 308, he gave a detailed description of each of the above subgenera, cited the same types and listed all the known species.

Since *Cryptocerus* is not available, *Paracryptocerus* will succeed it. The correct arrangement is as follows:

Genus *Paracryptocerus* Emery,
subgenus *Paracryptocerus* Emery

Paracryptocerus Emery, 1915, Bul. Soc. Ent. de France,
p. 192.

Type: *Cryptocerus spinosus* Mayr. By original
designation.

Genus *Paracryptocerus* Emery,
subgenus **Harnedia**, new subgenus

Harnedia is proposed for *Cryptocerus* of Emery, 1915,
and subsequent authors, not of Latreille. Its type is
umbraculatus Fabricius (1804). In 1922, Emery char-
acterized the group and listed all the known species.
The name *Harnedia* is in honor of Mr. R. W. Harned
from whom I have received much encouragement in my
studies of ants.

The following descriptions of the soldier and worker
of this new subgenus are substantially the same as given
by Emery in 1922.

Soldier.—Head usually longer than wide, occasionally
similar to that of *Paracryptocerus* Emery except that the
head is longer and less convex above. Tubercles near
the posterior border of the head usually connected by a
transverse ridge which unites with the lateral borders of
the head forming a surface within these borders known
as a cephalic disk; anterior border of cephalic disk with
a median gap which exposes the mandibles and clypeus.

Thorax very noticeably more robust than that of the
worker and without foliaceous border as in that caste.
Epinotum with more or less distinct spines; exceptionally
(*umbraculatus* Fabricius), the posterior spines of the
epinotum are the longest.

Worker.—Thoracic border of variable form, some-
times spined or toothed as in *Paracryptocerus* Emery but
the posterior pair of the 2 or 3 pairs of teeth on the epi-
notum never the longest. Border of thorax sometimes

divided into 3 parts to correspond to its segments, more or less widely margined, translucent or foliaceous, and without teeth.

Genus *Paracryptocerus* Emery,
subgenus *Cyathomyrmex* Creighton

Cyathocephalus Emery, 1915, Bul. Soc. Ent. de France, p. 192. Preoccupied by Kessler, 1868.

Type: *Cryptocerus pallens* Klug. By original designation.

Cyathomyrmex Creighton, 1933, Psyche 40: 98. New name.

STRUMIGENYS VENATRIX WESSON AND WESSON SYNONYMOUS WITH *S. TALPA* WEBER.—In the course of his studies of dacetine ants, Mr. William L. Brown, Jr. secured a loan of the type of *S. talpa* Weber (1934, Psyche, 41: 63–65, fig. 1) from the collections of the Illinois Natural History Survey. This specimen he very kindly placed at my disposal, since I had not seen it during earlier studies on *Strumigenys* in Ohio (Wesson and Wesson, 1939, Psyche, 46: 91–112, Pl. 3). The type of *talpa* proves to be indistinguishable from paratypes of *S. venatrix* which I had described from southern Ohio, and the latter name should be dropped.

According to Brown's recent revision of the dacetine genera, *S. talpa* should be transferred from the genus *Strumigenys* Fred. Smith to the genus *Smithistruma* Brown (1948, Trans. Amer. Ent. Soc. 74: 101–129, 2 figs.).

—LAURENCE G. WESSON, JR., Department of Physiology, New York University College of Medicine.

THE MALE OF *PRODIDOMUS RUFUS* HENTZ
(*PRODIDOMIDÆ*, *ARANEÆ*)¹

BY ELIZABETH B. BRYANT

Museum of Comparative Zoology

More than a century ago, in 1847, Nicholas M. Hentz, one of the first students of American spiders, found a spider in a box in a dark cellar in Alabama; it had such unusual characters that he erected a new genus and species for it. Both the generic and specific descriptions are brief, but because of the unusual arrangement of the eyes, the genus has been recognized and twenty-four species from all the warm parts of the world have been placed in it. But the genotype specimen has disappeared and the species has long evaded collectors. In 1892, Mr. N. Banks found a few immature specimens under paper in a house in Shreveport, Louisiana, and published a short description of them. These records have been the only accounts of the American species until 1936, when an adult female was found by Miss Sarah Jones under a stone by the road-side near Dallas, Texas. This I described a few months later. Recently, when looking over some spiders in the Jones Collection, now at the Museum of Comparative Zoology, an adult male was found. This specimen was collected in a house at Denton, Texas, the 4th of December 1946, and is here described as the allotype.

Prodidomus rufus Hentz

Prodidomus rufus Hentz, Jour. Boston Soc. Nat. Hist., 1847, 5: 466, pl. 30, fig. 4; reprint, 1875, p. 105, pl. 12, fig. 4, pl. 18, fig. 9.

Male. Length, 3.0 mm., cephal. 1.7 mm. long, 1.4 mm. wide, abd. 1.5 mm. long, 1.0 mm. wide, palpus, 1.9 mm. long.

Cephalothorax pale yellow, smooth and shining, slightly convex, highest between the second coxæ, no thoracic

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

groove or radial furrows, anterior margin broad and slightly rounded, sides rounded, posterior margin slightly less than the anterior; *eyes* eight, anterior row straight by the upper margins, eyes equidistant, a.m.e. largest of the eight, dark, round and convex, separated by about a line, a.l.e. white, convex and round, little more than a radius of the a.m.e., posterior row strongly procurved, the same length as the anterior, eyes white and flat, p.m.e. elliptical, separated by more than the long diameter, p.l.e.

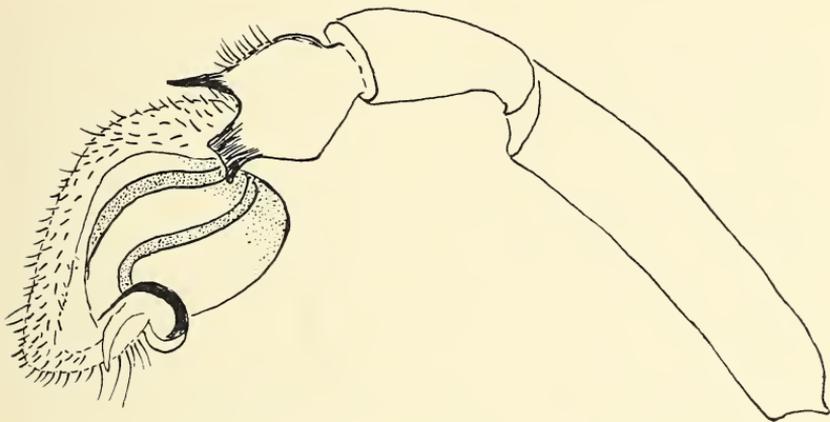


Fig. 1. *Prodidomus rufus* Hentz, left palp.

elliptical, but the long axis at right angles to the p.m.e.; eyes much closer together than in the female; *quadrangle* narrower in front than behind, and higher than wide; *clypeus* below the a.m.e. about a radius of a.m.e., no hairs or bristles on the margin as in the female; *mandibles* yellow, basal third swollen, only slightly divergent, fang groove oblique, no teeth on either margin, fang long and very slender, with the base not enlarged; *labium*, a dull brown, septum distinct between the sternum, slightly wider than long, tip not rebordered; *maxillæ* about twice as long as the labium, tips inclined and almost touching, pointed, basal third very wide, origin of the palpus at the basal third; *sternum* pale, oval, four-fifths as wide as long, flat, with no hairs, ending in a point between the fourth coxæ; *abdomen* oval, and depressed, a deep red,

covered with short white hairs, posterior third with no hairs and many transverse wrinkles, venter pale, spinnerets pale and smaller than in the female; *legs*, 4-1-2-3, pale, coxæ and trochanters very long, and can be seen from the dorsal side, smooth, I femur with a ventral brush of short colorless hairs, no spines, I coxæ the longest, about twice as long as wide, trochanter a little shorter and more slender, IV coxæ and trochanter subequal, and together as long as the femur, a pair of colorless ventral spines at the distal end of the IV tibia, no trichobothria at the tip of the IV metatarsus and tarsus as in the female; *palpus*, longer than the cephalothorax, femur more than half the length, pale, patella pale and slender, twice as long as wide, tibia darker, little more than half as long as the patella, tibial apophysis a slender dark dorsal spur and a broad dark lateral spur with a truncate tip, as figured, the palpal organ nearly as long as the cymbium, bulb strongly convex, pale and extending onto the tibia, the tube dark and very distinct, embolus a dark spiral coil, with the tip resting near a triangular paler point.

Allotype (♂) Texas; Denton, 4 December 1946, (Jones)

The allotype male and the neotype female were found in quite different habitats, the female out of doors, and the male in a house and they do not agree in all characters. The female is larger, pale, and only tinged with red, on the margin of the clypeus there is a fringe of hairs, and on the fourth metatarsus and tarsus are some distinct trichobothria. The male is smaller, the abdomen a deep red, covered with white hairs, the eyes are more closely grouped, the first femur has a brush of ventral hairs and the trichobothria on the fourth leg are lacking. The difference in color may be due to the habitat and the other differences are probably sexual.

In 1918-19, Dalmas published an excellent revision of the family *Prodidomidæ*, which by then included five genera, all with the same arrangement of eyes and similar spinnerets. The genotype, *Prodidomus rufus*, he knew only from the description of the immature specimens by Banks. Dalmas suggests that the Old World

species placed in the genus *Prodidomus* might not belong there. In his diagnosis of the genus, he stresses two characters that are not found in the genotype. All the Old World species have the anterior median eyes the smallest of the eight, and the fourth trochanter longest, often longer than the fourth femur. This is not found in *P. rufus*. The other species from America, *P. nigricauda* Simon, 1892, and *P. opacithorax* Simon, 1892, both from Venezuela, are described with the eyes of the anterior row subequal. If the Old World species are separated from the American, the genus *Miltia*, Simon, 1870, is available as it was established for the species *Emyo amaranthius* Lucus, 1846, from Egypt. This species has the anterior median eyes the smallest of the eight, and the fourth trochanter is the longest.

In the Dalmas revision, twenty-three species of the genus *Prodidomus* have been recognized. These are found in the warm parts of the world, but only five species are known by both sexes.

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SOME FLIES OF THE GENUS *VOLUCELLA* FROM THE NEW WORLD

BY F. M. HULL

University of Mississippi

Recent studies of American Syrphid flies have disclosed a number of species of *Volucella* which appear to be undescribed. This paper presents the descriptions of these species. The types are in the author's collection.

Volucella splendens n. sp.

This bright purplish to bluish species is related to *macula* Wiedemann. It is distinguished by the general color of the abdomen and the rusty orange red face with conspicuous lateral flattened areas on either side of the tubercle. Length 14 mm.

Male. *Head*: the face, cheeks and the front, except for a small brown triangular callus, are entirely pale rusty orange in color. The facial tubercle is large and elongate, more abrupt below, with a patch of blackish pile in the middle and the remainder of the facial pile red. The frontal pile is reddish in the middle and the sides but with some black pile in the junction of the eyes. Antennæ light brownish orange, the third segment elongate, narrow upon a little more than the apical half and this apical portion with parallel sides in the male. Eyes holoptic for a long distance, flattened above with the upper facets greatly enlarged and the ocular pile dense and long and pale brownish yellow. Vertical pile black. The pollen of the face is restricted to the upper portion beneath the antennæ and is distinctly pale brownish yellow. The sides of the upper portion of the face on either side of the tubercle are distinctly flattened leaving a rather sharp ridge laterally and a corresponding well marked crease beside the tubercle; the intervening area is flattened. *Thorax*: the mesonotum is shining black, becoming diffusely brown on the notopleura, the humeri, the intervening area, the margin above the wing and the

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No. 1

THE INTEGUMENTARY SENSE ORGANS OF THE LARVÆ OF RHIPICEPHALINÆ (ACARINA)¹

BY J. DINNIK and F. ZUMPT²

In 1938 Delpy published a short paper describing the location and morphology of the so-called spiracles or respiratory plates ("stigmates respiratoires") of various Ixodid larvæ. He examined for the purpose *Hyalomma dromedarii* Koch, *H. impressum* Koch, *Boophilus annulatus* Say, *Rhipicephalus bursa* Can. and Fanz., and *Hæmaphysalis cinnabarina punctata* Can. and Fanz. Delpy's description is brief and lacks illustrations. He thought that he saw within each "spiracle" 1 or 2 pores, sometimes reduced in size, leading into an atrium provided with two valves at the entrance. The base of the atrium he described as pierced with an opening, and Delpy considered it possible that a tracheal tube was attached at this point.

With regard to their position, Delpy distinguished coxal and abdominal spiracles. The coxal spiracles are in three pairs, placed behind each of the six coxæ. The abdominal spiracles vary greatly in number and position according to the genus. *Hæmaphysalis* is said to have four pairs, *Hyalomma* and *Rhipicephalus* only one pair, while they are entirely lacking in *Boophilus*.

Delpy was not the first, however, to describe supposed spiracles in Ixodid larvæ. Salmon and Stiles (1902) saw

¹ Preliminary Study No. 10 for a Revision of the Genus *Rhipicephalus* Koch. Nos. 1 to 8 of this series were published in the Zeitschrift für Parasitenkunde from 1939 to 1943. No. 9 is to appear in Dechiana (Festschrift f. Prof. Reichensperger).

² Now at The South African Institute for Medical Research, Johannesburg, South Africa.

them before, and they were also mentioned by Oudemans (1906), Zebrowski (1926) and Cooley (1938).

All these authors were mistaken in the interpretation of the function of the organ they had seen. The larvæ of the Ixodidæ do not possess any special respiratory organs. Only Samson (1908) correctly recognized that the so-called "larval spiracles" described by Salmon and Stiles were actually the terminal pores of integumentary sense organs. This correction was, however, overlooked up to quite recently. Even Vitzthum, in his account of the Acarina for "Bronn's Klassen und Ordnungen des Tierreichs" (1940), adopted in detail the description and views of Delpy.

K. W. Neumann (1942) and Elishewitz (1942) first re-examined these structures in an attempt to decide whether they were respiratory organs or integumentary glands. Serial sections of larvæ of *Dermacentor*, *Hæmaphysalis*, *Hyalomma* and *Ixodes* convinced Neumann that neither the Ixodinæ (Prostriata) nor the Rhipicephalinæ (Metastriata) have respiratory organs and that the structures thus far interpreted as spiracles are really integumentary glandular organs.

According to Neumann, these organs are in a direct view more or less oval in outline. "A broad ellipsoid chitinized frame at the periphery is attached to the surrounding cuticula by means of a narrow, prominent, striated edge. The lumen also is oval and contains two parallel, non-contiguous lips. Two small protuberances of the frame extend on each side into the lumen, keeping the lips from touching each other. By lowering the objective, a small circular opening may be recognized in the center between the lips."

"In a side view of the entire organ or in a section, the structure is also more or less elongate oval. The walls consist of a rather thick layer of chitin, decreasing in thickness from the base toward the surface opening. A short duct leads from the base toward the interior of the body. On either side of the mouth of this duct a tooth, anchored to the base of the organ, extends up into its lumen. Serial sections show that these teeth arise from a folding of the walls. Their length is approximately three-fourths of that of the entire organ."

“To what do these several parts correspond? The broad frame is the wall, the lips are the teeth, and the circular opening is the mouth of the short duct.” (See Pl. 1, fig. 1.)

“The organ is securely anchored in the cuticula by the upper third of its length. The subjacent hypodermal cells are broader than high and surround the organ. The adjacent cells (?generative cells) are much higher than broad. Only two seem to be present, placed parallel to the margins of the lips. A large cell, considerably broader than high, lies beneath the organ, in close contact with the entire basal surface. The duct mentioned before is never long enough to pierce this basal cell, but ends with it without tapering downward. The duct is never lined with a tænidium. So far as can be detected, the plasma of this cell is slightly granular, but a prominent clear spot in the center may be interpreted as an internal vesicle. It follows from this description that the structure is an integumentary glandular organ, not a larval respiratory organ with a spiracle and a rudimentary trachea.”

So much for K. W. Neumann's account of the morphology of his integumentary sense organ. In addition he discusses the number and position of these organs in various genera and believes to be justified in stating that originally two pairs were present. According to his account, all the spiracle-like organs show essentially the same structure, though they are sometimes reduced in size, and they seem undoubtedly to be peculiar to the larvæ. He does not mention any other integumentary sense organs besides these so-called “spiracles.”

P. Schulze (1942a) published a detailed study of the integumentary sense organs of adult ticks and found, besides true sensory setæ (sensilla trichoidea), four other types of sensilla which he called *Sensilla auriformia* (ear-shaped organs), *Sensilla sagittiformia* (arrow-shaped organs), *Sensilla hastiformia* (spear-shaped organs), and *Sensilla laterniformia* (lantern-shaped organs).

Large numbers of these organs are located within the hard and soft chitinized integument of the body. On the other hand they are sparse on the legs and palps and,

strangely enough, seem to be entirely missing on the chelicerae. Characteristic for these sensilla is their connection with two glandular cells which extend partially into the sensory duct. These cells secrete into the duct a substance which emerges at the surface after passing an end organ. P. Schulze assumes that the secretion serves as a protective coating against evaporation within the sensillum and on the outer surface, and also as a chemical means of recognition between opposite sexes and individuals of one species.

The sensory function of the sensilla auriformia seems to be of a proprio-receptive nature, serving to perceive changes or shifts within the chitin. It is probable that the other three types, grouped together as "tuft-shaped" sense organs or krobylophores, are vibro-chemoreceptive organs, which react at the same time to chemical as well as to seismic stimulation. They evidently play an important part in the sexual life of the ticks.

We examined the larvæ of *Rhipicephalus sanguineus* Latr., *Rh. appendiculatus* Neum., *Rh. bursa* Can. and Fanz., *Rh. evertsi* Neum., *Rh. simus* Koch, *Hyalomma dromedarii* Koch, and *Boophilus calcaratus* Birula.

The larvæ were merely mounted whole on microscopic slides in Berlese's medium, a procedure which we found to be superior for our purpose to all other methods of mounting. Owing to prevailing conditions we were unable to make sections.

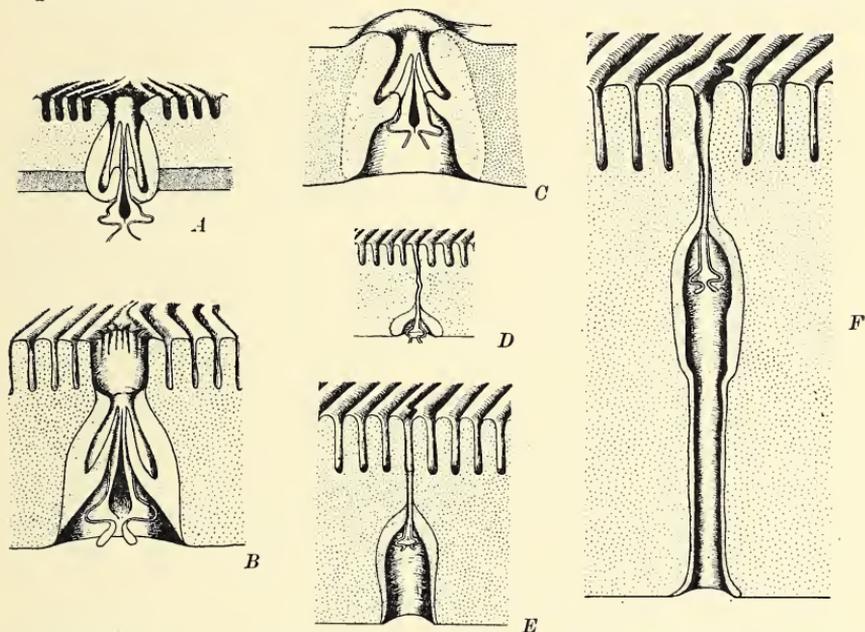
We were able to ascertain that the larvæ are not equipped with peculiar integumentary sense organs. On the contrary we found much the same organs present as in the adults and nymphs. In the larvæ, however, sensilla laterniformia seem to be lacking and the other types of sensilla are to some extent more primitive in development. The organs are distributed over the entire body in fixed numbers and in a definite arrangement.

A detailed account of the three types of sensilla mentioned above follows.

1. Sensilla sagittiformia (arrow-shaped organs)

The sensillum sagittiforme represents a new mode of sensory organ, called by P. Schulze a krobylophore sen-

sory organ, because a tuft-shaped structure is its most striking characteristic. In the adult tick he described this organ as follows in side view (Pl. 1, fig. 2): "The distal portion of the chitinized passage or lumen appears arrow-shaped. Below this lies a narrow pagoda-shaped 'tuft' chamber and farther inside a small, more or less spheroidal 'terminal chamber.' This is separated from



Text-figure 1. A, Sensillum sagittiforme of the opisthosoma of *Rhipicephalus appendiculatus* Neum. B, Same in the larva. C, Same in the nymph. D, Sensillum hastiforme of *Rhipicephalus appendiculatus* Neum. E, Same in the nymph. F, Same in the adult female.

the middle chamber by projecting ledges which leave room only for a small circular opening. The innermost chamber is attached to a simple duct into which the glandular cells extend, enveloping the nerve cells. The surrounding chitin is especially thick beneath the lower portion of the 'arrow points.' The nerve cells decrease in size as they enter the 'terminal chamber.' The axial fiber is attached to a strong scolopale which enlarges to

form a knot and then tapers down, becoming pointed again upon entering the 'pagoda-shaped chamber' in which the 'tuft' is located. This tuft has much the shape of a gas flame and is not chitinized but of a uniform structure, although at times it seems to be somewhat fibrillar."

The larvæ we examined all show, contrary to Delpy's description, four pairs of spiracle-like structures, three of them behind the coxæ, the fourth on the opisthosoma (Pl. 2, figs. 4 and 5). A comparison of their inner structure (Text-fig. 1A-C) with P. Schulze's description and drawings clearly shows that these so-called "larval spiracles" are in reality sensilla sagittiformia. The finer structure of the organ is best seen in the opisthosomal pair of the larvæ of *Rhipicephalus appendiculatus* and *Boophilus calcaratus*. It is pear-shaped and pierces with its conical end the integument on the dorsal face of the fourth festoon. The walls are of thick chitin, the chitinous capsule being 0.012 to 0.016 mm. long and 0.011 to 0.014 mm. broad. A funnel-shaped fold is visible within the capsule. The narrow ends of this capsule, pointing toward the opening, are less strongly chitinized and look in direct view like a pair of lips lying within the capsule (compare Pl. 1, fig. 1). Within these lips lies the tuft-like structure, surrounded by a fine pagoda-like contour.

The sensilla sagittiformia behind the second and third coxæ are very similar in structure to the opisthosomal pair described above. On the other hand, the pair located behind the first coxæ at the edge of the scutum seems to have a strikingly thick-walled capsule which is fully embedded in the chitin of the scutum. It is 0.019 to 0.022 mm. long, 0.016 to 0.022 mm. wide at the base, with the opening 0.011 to 0.014 mm. in diameter. The "tuft" is difficult to recognize here, but is shaped as in the other pairs.

2. Sensilla hastiformia (spear-shaped organs)

The sensilla hastiformia, as described by P. Schulze for the adult ticks, are much smaller than the arrow-

shaped organs. He was unable to make out all the details of the terminal apparatus, but he presumed that they correspond in general to those of the sensilla sagittiformia and that a tuft-shaped structure is also present. The main difference lies, according to Schulze, in the upper portion of the passage leading to the outside. This lacks the long receding arrow-points, so that the "pagoda-shaped chamber," formed by these points, is also missing. The passage is distinctly spear-shaped, in as much as it expands into two mainly horizontal projections at the base.

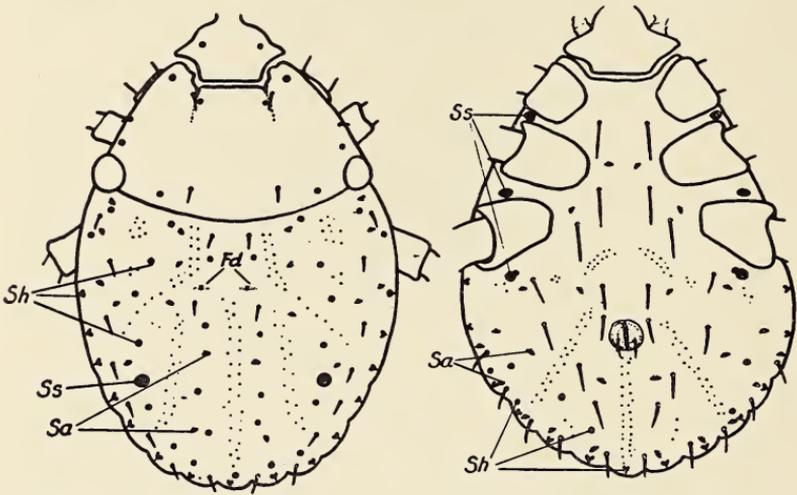
The larval sensillum hastiforme could only be recognized as such after comparing it with the corresponding organ in nymphs and adults (Text-fig. 1, D-F). It lies as a short funnel-shaped structure in the lower part of the integument, which it pierces by means of a narrow passage, ending between the outer folds. The funnel-shaped portion is approximately 0.008 mm. in diameter and 0.005 mm. deep. The walls are about 0.002 mm. thick and the passage is roughly 0.008 mm. long.

We were also unable to recognize the finer structure of the organ, nor could we find anything comparable to a "tuft." In direct view the organ has the appearance of a ring, 0.008 mm. in diameter. Further details cannot be recognized, but by lowering the objective the duct leading inside the body may be followed.

The larvæ of *Rhipicephalus appendiculatus* Neum., *Rh. sanguineus* Latr., *Rh. bursa* Can. and Fanz., and *Rh. evertsi* Neum. studied by us, all have 54 sensilla hastiformia on the body proper; we did not examine the legs. The sensilla are placed strictly symmetrically and neither their position nor their number seem to vary to any extent (Pl. 3, fig. 6). One pair is located on the capitulum, occupying the position taken by the areæ porosæ of the adult female tick. Five pairs are situated on the scutum and nine pairs on the alloscutum, four of these dorsal, one subdorsal and four sublateral. In addition eight pairs are found on the edge of the alloscutum, one sensillum being placed on the edge of each festoon (or parmula), except on the middle festoon. The ar-

range of these eight pairs is therefore metameric and seems to be derived from the primitive segmentation of the opisthosoma.

The "foveæ dorsales" of the larva consist of only one sensillum hastiforme each. The integumental folds bend around their openings, whereas on the contrary the openings of the other sensilla hastiformia lose themselves among the folds of the integument. Aside from the fact



Text-figure 2. Arrangement of the integumentary sense organs of the larva of *Hyalomma dromedarii* Koch: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.

that the openings are more conspicuous, they do not differ from the usual type of sensilla hastiformia.

Ventrally the body bears four pairs of sensilla hastiformia. One pair lies very close to the sensillum sagittiforme of the third coxa. In *Rh. appendiculatus* it is enclosed by the capsule of the sensillum sagittiforme, so that it is difficult to see. Though closely adjacent to it in the other species, the sensillum hastiforme is nevertheless clearly set off.

The number and the arrangement of the sensilla hastiformia of the larva of *Boophilus calcaratus* Birula (Pl. 3, fig. 7) are similar to those of the *Rhipicephalus*, ex-

cept that we were unable to discover the two foremost pairs on the ventral side and that they seem to be missing also on the fourth and fifth festoons counting from the middle.

The larva of *Hyalomma dromedarii* Koch (Text-fig. 2) possesses more sensilla hastiformia than that of *Rhipicephalus*. It should be mentioned especially that the middle festoon also bears a terminal and a dorsal unpaired sensillum. In addition a sensillum hastiforme is located on the dorsal side adjacent to each of the second, third and fourth festoons. It is noteworthy that two pairs of sensilla hastiformia, instead of one pair, were found on the capitulum of one specimen in the position of the areæ porosæ of the adult female.

3. Sensilla auriformia (ear-shaped organs)

The sensilla auriformia discovered by P. Schulze (1942a) in adult ticks may be traced back with certainty to setæ or hairs. They are located directly under the cuticula and consist each of a flat disk, usually inclined a little toward one side, so that it closes outwardly the sensory duct ascending from below, like a lid with overlapping edges (Pl. 1, fig. 3). The disks vary in details and have the shape of an ear, a megaphone or a bell. Their openings face various directions, so that it is possible to see one sensillum in direct view and the other in side view when examining two of them placed close together.

The larval ticks also possess these sensilla in typical form, but the organs are smaller than in the adult. The disk is approximately 0.009 mm. in diameter. Arrangement and number again seem to be strictly uniform, but all the disks lean in one particular direction.

Ten pairs of sensilla auriformia were found on the alloscutum of all larvae of *Rhipicephalus* examined. Five pairs may be seen dorsally some distance from the median line and five pairs on the edge of the alloscutum. Neither capitulum nor scutum seem to have any. Twelve pairs are located on the ventral side, two of them be-

tween the coxæ, the remainder on the opisthosoma, five of the latter in the festoons.

The same number of sensilla auriformia is found in the larvæ of *Hyalomma dromedarii* Koch (Text-fig. 2) as in *Rhipicephalus* and their arrangement is similar. In the larva of *Boophilus calcaratus* Birula (Pl. 3, fig. 7) the pair behind the third coxæ and the first pair on the edge are missing, but the remaining sensilla auriformia are as in the larva of *Rhipicephalus*.

SUMMARY

The larvæ of the Rhipicephalinæ do not possess peculiar integumentary sense organs, as K. W. Neumann (1942) believed, but rather the same types found in the nymphs and adults. The organs are merely in a more primitive state of development and the sensilla laterniformia appear to be missing. Sensilla sagittiformia, sensilla hastiformia and sensilla auriformia may be demonstrated. These organs are strictly specific in number and arrangement within the genera *Rhipicephalus*, *Hyalomma* and *Boophilus*.

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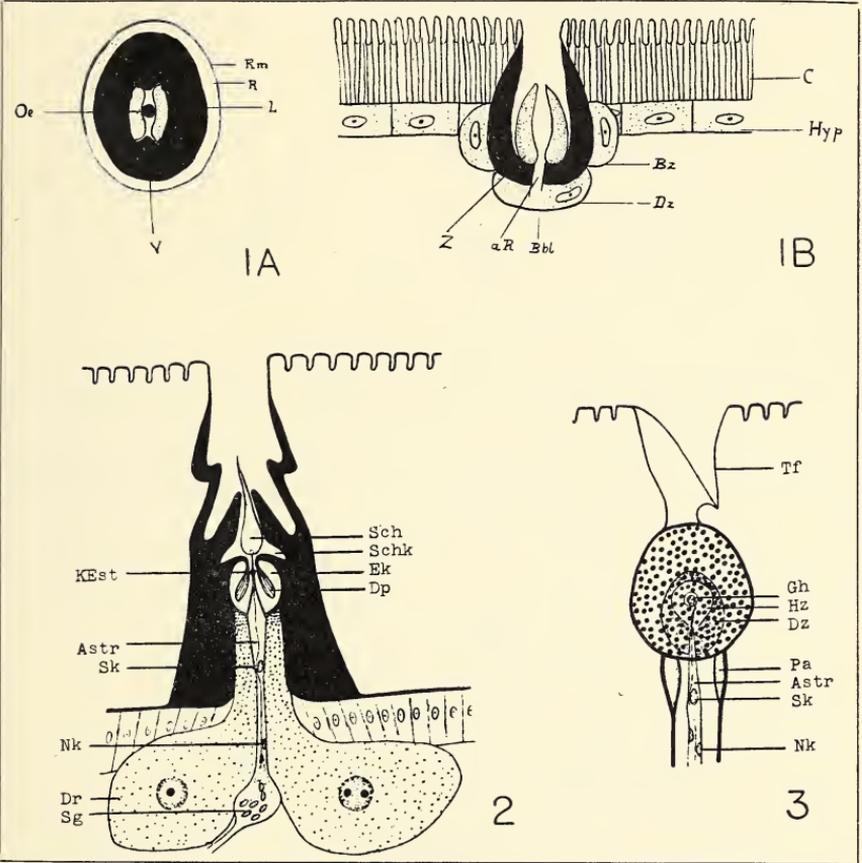
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EXPLANATION OF PLATE 1

- Fig. 1. Larval integumentary sense organ of *Haemaphysalis punctata* Can. and Fanz., redrawn from K. W. Neumann (1942). A, in direct view; B, in side view: aR, sensory duct; Bbl, internal vesicle; Bz, generative cell; C, cuticula; Dz, gland cell; Hyp, hypodermis; L, lips; Oe, mouth of the sensory duct; R, frame; Rm, fringe; V, protrusions of the frame; Z, tooth.
- Fig. 2. Schematic drawing of a sensillum sagittiforme of *Hyalomma*, after P. Schulze: Astr, axial fiber; Dp, projecting ledges; Dr, gland cell; Ek, terminal chamber; KEst, knot of the scolopale; NK, enveloping cell nucleus; Sch, tuft; Schk, tuft chamber; Sg, sensory cell group outside the duct. The chitinous structure surrounding the sense organ has been omitted.
- Fig. 3. Schematic drawing of a sensillum auriforme on the alloscutum of a female *Hyalomma*, after P. Schulze: Astr, axial fiber; Dz, shaded zone of the disk; Gh, papilla with terminal apparatus in central area of the disk; Hz, unshaded zone; Nk, enveloping cell nucleus; Pa, pigmented and thickened section of the duct; Sk, sensory cell nucleus; Tf, supporting plicature. The chitinous structure surrounding the sensory organ and gland cells has been omitted. The disk covering the sensory cell and the terminal apparatus is assumed to be transparent.

PSYCHE, 1949

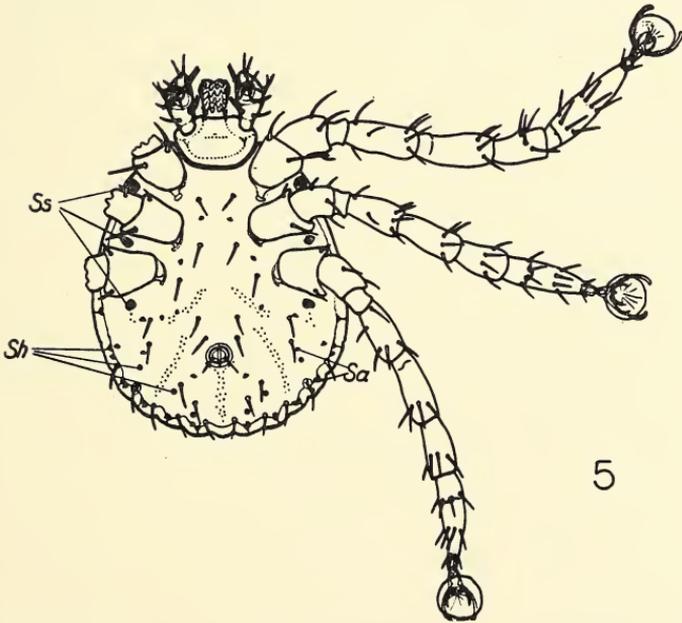
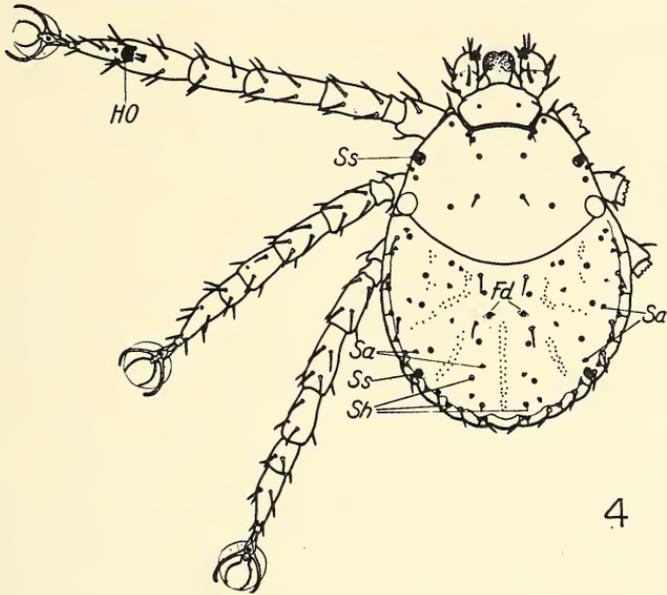
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DINNICK AND ZUMPT—RHIPICEPHALINÆ

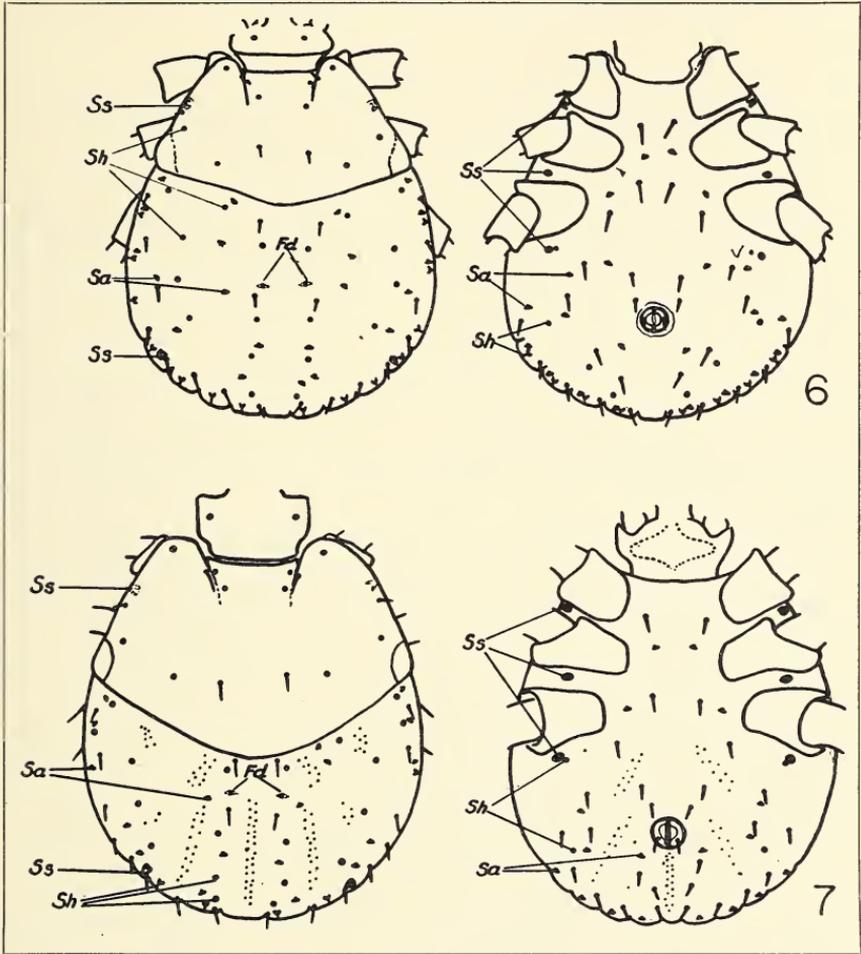
EXPLANATION OF PLATE 2

- Fig. 4. Dorsal view of larva of *Rhipicephalus appendiculatus* Neum., showing sensory organs: Fd, foveæ dorsales; HO, Haller's organ; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.
- Fig. 5. Ventral view of larva of *Rhipicephalus appendiculatus* Neum., showing sensory organs: Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.



EXPLANATION OF PLATE 3

- Fig. 6. Arrangement of the integumentary sense organs of the larva of *Rhipicephalus sanguineus* Latr.: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.
- Fig. 7. Arrangement of the integumentary sense organs of the larva of *Boophilus calcaratus* Birula: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.



DINNIK AND ZUMPT—RHIPICEPHALINÆ

ON THE STATUS OF *CRYPTOCERUS* LATREILLE
AND *CEPHALOTES* LATREILLE (HYMEN-
OPTERA: FORMICIDÆ)

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Latreille, in *Hist. Nat. Crust. and Ins.*, volume 3, 1802, included in the family "Formicaires" two genera, *Formica* Linnaeus and the new genus *Cephalotes*. *Cephalotes* was monobasic with *Formica atrata* Linnaeus the only included species (pp. 357-358). In volume 5, 1803, he again placed in "Formicaires" only the two genera but to the group which he had called *Cephalotes* in 1802 he gave the name *Cryptocerus* (p. 311). Distinguishing characters were given but no species were mentioned by name.

Fabricius, 1804, *Systema Piezatorum*, page 418, used the name *Cryptocerus* for *atratus* Linnaeus and 4 new species, including *umbraculatus*; and he cited *Cephalotes* Latreille in synonymy under *Cryptocerus atratus*.

In 1810, Latreille (*Consid. Gen. Crust. Arachn. Ins.*, p. 437) designated *atratus* Fabricius (= *atratus* Linnaeus) as the type of *Cryptocerus*. Since *atratus* was available for type designation of *Cryptocerus*, this action by Latreille has fixed the matter beyond dispute. *Cryptocerus* Latreille is thus an isogenotypic synonym of *Cephalotes* Latreille. The interpretation of *Cryptocerus* by subsequent authors who considered *umbraculatus* Fabricius as its type is erroneous, and a new generic name is needed for *Cryptocerus* of Emery (1915) and authors, not Latreille.

On page 253 of his 1805 work Latreille says "Toutes les espèces de cryptocerès, dont la fourmi *atrata* de Lin. et de Fab. est une, sont exotiques. Ces insectes ont un caractère très remarquable, et qu'on ne trouve à aucun de cet ordre; c'est le premier article de leurs antennes qui est inséré et logé de chaque côté, dans une rainure

latérale de la tête.” In the original description of *Cephalotes* he writes “Premier article des antennes inséré et logé, de chaque côté, dans une rainure latérale de la tête,” and in the original description of *Cryptocerus*—“Premier article des antennes s’insérant dans une rainure de la tête.” It seems obvious that Latreille considered *Cryptocerus* (hidden or concealed horn [antenna]) much more descriptive of the genus *Cephalotes* (having a head) and decided to use it instead.

Since the facts in this case are as just stated, the tribe receives the new name, *Cephalotini*, based on the type genus *Cephalotes*, which must be used for *Cryptocerus* of authors. The genera and subgenera involved, with synonymy and types, are as follows:

Genus *Cephalotes* Latreille

Cephalotes Latreille, 1802, Hist. Nat. Crust. and Ins. 3: 357.

Type: *Formica atrata* Linnaeus. Monobasic.

Syn.: *Cryptocerus* Latreille, 1803, Hist. Nat. Crust. and Ins. 5: 311.

Type *Formica atrata* Linnaeus. Designated by Latreille, 1810.

Syn.: *Cryptocerus* Fabricius, 1804, Systema Piezatorum, p. 418 (in part).

Emery, 1915, Bul. Soc. Ent. de France, p. 192 divided *Cryptocerus* into three subgenera: *Paracryptocerus*, n. subgen., type *Cryptocerus spinosus* Mayr; *Cryptocerus*, type *C. umbraculatus* Fabricius, and *Cyathcephalus*, n. subgen., type *Cryptocerus pallens* Klug. Except for *Cryptocerus* he listed additional species in each subgenus. In 1922, in Wytsman's Genera Insectorum, fascicule 174c, pp. 306, 308, he gave a detailed description of each of the above subgenera, cited the same types and listed all the known species.

Since *Cryptocerus* is not available, *Paracryptocerus* will succeed it. The correct arrangement is as follows:

Genus *Paracryptocerus* Emery,
subgenus *Paracryptocerus* Emery

Paracryptocerus Emery, 1915, Bul. Soc. Ent. de France,
p. 192.

Type: *Cryptocerus spinosus* Mayr. By original
designation.

Genus *Paracryptocerus* Emery,
subgenus **Harnedia**, new subgenus

Harnedia is proposed for *Cryptocerus* of Emery, 1915,
and subsequent authors, not of Latreille. Its type is
umbraculatus Fabricius (1804). In 1922, Emery char-
acterized the group and listed all the known species.
The name *Harnedia* is in honor of Mr. R. W. Harned
from whom I have received much encouragement in my
studies of ants.

The following descriptions of the soldier and worker
of this new subgenus are substantially the same as given
by Emery in 1922.

Soldier.—Head usually longer than wide, occasionally
similar to that of *Paracryptocerus* Emery except that the
head is longer and less convex above. Tubercles near
the posterior border of the head usually connected by a
transverse ridge which unites with the lateral borders of
the head forming a surface within these borders known
as a cephalic disk; anterior border of cephalic disk with
a median gap which exposes the mandibles and clypeus.

Thorax very noticeably more robust than that of the
worker and without foliaceous border as in that caste.
Epinotum with more or less distinct spines; exceptionally
(*umbraculatus* Fabricius), the posterior spines of the
epinotum are the longest.

Worker.—Thoracic border of variable form, some-
times spined or toothed as in *Paracryptocerus* Emery but
the posterior pair of the 2 or 3 pairs of teeth on the epi-
notum never the longest. Border of thorax sometimes

divided into 3 parts to correspond to its segments, more or less widely margined, translucent or foliaceous, and without teeth.

Genus *Paracryptocerus* Emery,
subgenus *Cyathomyrmex* Creighton

Cyathocephalus Emery, 1915, Bul. Soc. Ent. de France, p. 192. Preoccupied by Kessler, 1868.

Type: *Cryptocerus pallens* Klug. By original designation.

Cyathomyrmex Creighton, 1933, Psyche 40: 98. New name.

STRUMIGENYS VENATRIX WESSON AND WESSON SYNONYMOUS WITH *S. TALPA* WEBER.—In the course of his studies of dacetine ants, Mr. William L. Brown, Jr. secured a loan of the type of *S. talpa* Weber (1934, Psyche, 41: 63-65, fig. 1) from the collections of the Illinois Natural History Survey. This specimen he very kindly placed at my disposal, since I had not seen it during earlier studies on *Strumigenys* in Ohio (Wesson and Wesson, 1939, Psyche, 46: 91-112, Pl. 3). The type of *talpa* proves to be indistinguishable from paratypes of *S. venatrix* which I had described from southern Ohio, and the latter name should be dropped.

According to Brown's recent revision of the dacetine genera, *S. talpa* should be transferred from the genus *Strumigenys* Fred. Smith to the genus *Smithistruma* Brown (1948, Trans. Amer. Ent. Soc. 74: 101-129, 2 figs.).

—LAURENCE G. WESSON, JR., Department of Physiology, New York University College of Medicine.

THE MALE OF *PRODIDOMUS RUFUS* HENTZ
(*PRODIDOMIDÆ*, *ARANEÆ*)¹

BY ELIZABETH B. BRYANT

Museum of Comparative Zoology

More than a century ago, in 1847, Nicholas M. Hentz, one of the first students of American spiders, found a spider in a box in a dark cellar in Alabama; it had such unusual characters that he erected a new genus and species for it. Both the generic and specific descriptions are brief, but because of the unusual arrangement of the eyes, the genus has been recognized and twenty-four species from all the warm parts of the world have been placed in it. But the genotype specimen has disappeared and the species has long evaded collectors. In 1892, Mr. N. Banks found a few immature specimens under paper in a house in Shreveport, Louisiana, and published a short description of them. These records have been the only accounts of the American species until 1936, when an adult female was found by Miss Sarah Jones under a stone by the road-side near Dallas, Texas. This I described a few months later. Recently, when looking over some spiders in the Jones Collection, now at the Museum of Comparative Zoology, an adult male was found. This specimen was collected in a house at Denton, Texas, the 4th of December 1946, and is here described as the allotype.

Prodidomus rufus Hentz

Prodidomus rufus Hentz, Jour. Boston Soc. Nat. Hist., 1847, 5: 466, pl. 30, fig. 4; reprint, 1875, p. 105, pl. 12, fig. 4, pl. 18, fig. 9.

Male. Length, 3.0 mm., ceph. 1.7 mm. long, 1.4 mm. wide, abd. 1.5 mm. long, 1.0 mm. wide, palpus, 1.9 mm. long.

Cephalothorax pale yellow, smooth and shining, slightly convex, highest between the second coxæ, no thoracic

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

groove or radial furrows, anterior margin broad and slightly rounded, sides rounded, posterior margin slightly less than the anterior; *eyes* eight, anterior row straight by the upper margins, eyes equidistant, a.m.e. largest of the eight, dark, round and convex, separated by about a line, a.l.e. white, convex and round, little more than a radius of the a.m.e., posterior row strongly procurved, the same length as the anterior, eyes white and flat, p.m.e. elliptical, separated by more than the long diameter, p.l.e.

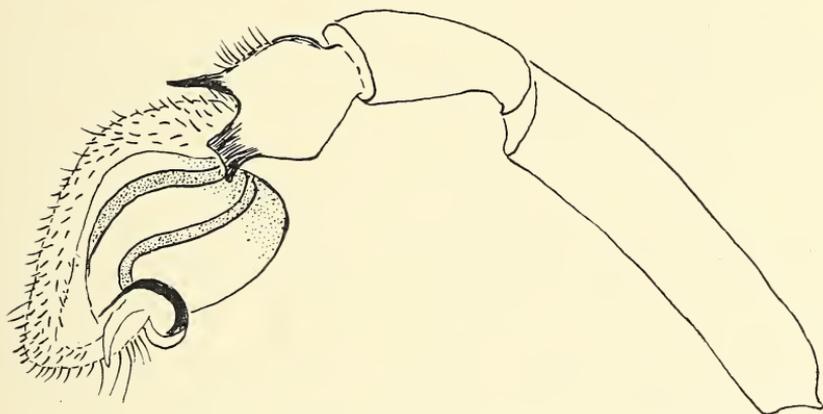


Fig. 1. *Prodidomus rufus* Hentz, left palpus.

elliptical, but the long axis at right angles to the p.m.e.; eyes much closer together than in the female; *quadrangle* narrower in front than behind, and higher than wide; *clypeus* below the a.m.e. about a radius of a.m.e., no hairs or bristles on the margin as in the female; *mandibles* yellow, basal third swollen, only slightly divergent, fang groove oblique, no teeth on either margin, fang long and very slender, with the base not enlarged; *labium*, a dull brown, septum distinct between the sternum, slightly wider than long, tip not rebordered; *maxillæ* about twice as long as the labium, tips inclined and almost touching, pointed, basal third very wide, origin of the palpus at the basal third; *sternum* pale, oval, four-fifths as wide as long, flat, with no hairs, ending in a point between the fourth coxæ; *abdomen* oval, and depressed, a deep red,

covered with short white hairs, posterior third with no hairs and many transverse wrinkles, venter pale, spinnerets pale and smaller than in the female; *legs*, 4-1-2-3, pale, coxæ and trochanters very long, and can be seen from the dorsal side, smooth, I femur with a ventral brush of short colorless hairs, no spines, I coxæ the longest, about twice as long as wide, trochanter a little shorter and more slender, IV coxæ and trochanter subequal, and together as long as the femur, a pair of colorless ventral spines at the distal end of the IV tibia, no trichobothria at the tip of the IV metatarsus and tarsus as in the female; *palpus*, longer than the cephalothorax, femur more than half the length, pale, patella pale and slender, twice as long as wide, tibia darker, little more than half as long as the patella, tibial apophysis a slender dark dorsal spur and a broad dark lateral spur with a truncate tip, as figured, the palpal organ nearly as long as the cymbium, bulb strongly convex, pale and extending onto the tibia, the tube dark and very distinct, embolus a dark spiral coil, with the tip resting near a triangular paler point.

Allotype (♂) Texas; Denton, 4 December 1946, (Jones)

The allotype male and the neotype female were found in quite different habitats, the female out of doors, and the male in a house and they do not agree in all characters. The female is larger, pale, and only tinged with red, on the margin of the clypeus there is a fringe of hairs, and on the fourth metatarsus and tarsus are some distinct trichobothria. The male is smaller, the abdomen a deep red, covered with white hairs, the eyes are more closely grouped, the first femur has a brush of ventral hairs and the trichobothria on the fourth leg are lacking. The difference in color may be due to the habitat and the other differences are probably sexual.

In 1918-19, Dalmas published an excellent revision of the family *Prodidomidae*, which by then included five genera, all with the same arrangement of eyes and similar spinnerets. The genotype, *Prodidomus rufus*, he knew only from the description of the immature specimens by Banks. Dalmas suggests that the Old World

species placed in the genus *Prodidomus* might not belong there. In his diagnosis of the genus, he stresses two characters that are not found in the genotype. All the Old World species have the anterior median eyes the smallest of the eight, and the fourth trochanter longest, often longer than the fourth femur. This is not found in *P. rufus*. The other species from America, *P. nigri-cauda* Simon, 1892, and *P. opacithorax* Simon, 1892, both from Venezuela, are described with the eyes of the anterior row subequal. If the Old World species are separated from the American, the genus *Miltia*, Simon, 1870, is available as it was established for the species *Emyo amaranthius* Lucus, 1846, from Egypt. This species has the anterior median eyes the smallest of the eight, and the fourth trochanter is the longest.

In the Dalmas revision, twenty-three species of the genus *Prodidomus* have been recognized. These are found in the warm parts of the world, but only five species are known by both sexes.

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SOME FLIES OF THE GENUS *VOLUCELLA* FROM THE NEW WORLD

By F. M. HULL

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Recent studies of American Syrphid flies have disclosed a number of species of *Volucella* which appear to be undescribed. This paper presents the descriptions of these species. The types are in the author's collection.

Volucella splendens n. sp.

This bright purplish to bluish species is related to *macula* Wiedemann. It is distinguished by the general color of the abdomen and the rusty orange red face with conspicuous lateral flattened areas on either side of the tubercle. Length 14 mm.

Male. *Head*: the face, cheeks and the front, except for a small brown triangular callus, are entirely pale rusty orange in color. The facial tubercle is large and elongate, more abrupt below, with a patch of blackish pile in the middle and the remainder of the facial pile red. The frontal pile is reddish in the middle and the sides but with some black pile in the junction of the eyes. Antennæ light brownish orange, the third segment elongate, narrow upon a little more than the apical half and this apical portion with parallel sides in the male. Eyes holoptic for a long distance, flattened above with the upper facets greatly enlarged and the ocular pile dense and long and pale brownish yellow. Vertical pile black. The pollen of the face is restricted to the upper portion beneath the antennæ and is distinctly pale brownish yellow. The sides of the upper portion of the face on either side of the tubercle are distinctly flattened leaving a rather sharp ridge laterally and a corresponding well marked crease beside the tubercle; the intervening area is flattened. *Thorax*: the mesonotum is shining black, becoming diffusely brown on the notopleura, the humeri, the intervening area, the margin above the wing and the

post calli. This marginal color is moderately light brown; the mesopleura, pteropleura and upper metapleura, are similarly brown, but ventrally the pleura becomes blackish. There are some bluish reflections upon the posterior half of the mesonotum in the middle and a pair of faint sublateral shining coppery vittæ. The mesonotal pile is chiefly black with five longitudinal stripes of shorter yellow pile which are restricted to the anterior half of the mesonotum and are best seen in the posterior view. The bristles of the thorax and scutellum are black; the mesopleura with one bristle, the bulbous notopleura with four, the post calli with six, the supraalæ region with three, the prescutellar region with eleven, the scutellar margin with fourteen, all of which are strong and more or less tuberculate. The scutellum is somewhat flattened and concave before the apex but without definite crease. The color of the scutellum is dark brown, over the disc which is also microgranulate, the base of the scutellum and the margin hyaline yellowish brown. Scutellum upon the disc with purplish reflections and the disc with very fine black hairs, rather long, which seem to proceed from the granulations but these hairs are scarce and scattered in all of my specimens whereas the granulations are very dense. Squamæ dark brown with brown fringe and border. *Legs*: the femora are dark reddish brown, the anterior pair and middle pair becoming lighter in color on the apical half. The hind pair are almost black especially on the dorsal margin. All of the tibiæ light coffee brown, the hind tibiæ somewhat darker and with a suggestion of a blackish brown post medial band. First three segments of anterior and middle tarsi light reddish brown, the remaining ones black. Hind tarsi similarly colored but the color a little dark. Pile of legs black. Ventral tarsal mats blackish and upon the hind pair deep reddish sepia. *Wings*: with a large, quadrate, dark sepia brown spot in the middle of the anterior half, the costal and the first basal cells, the subcostal cell brownish yellow. Marginal cell closed with a short stalk. *Abdomen*: first segment black, the remaining segments brilliant metallic blue with traces of purple reflections in the mid-

dle and very faint traces of green mixed in the blue along the lateral margins. Abdominal pile entirely black except upon the first segment and narrowly along the base of the second where it is yellowish. Sternites metallic bluish black; not so brilliant as the tergites. The pile chiefly yellow becoming black beyond the middle of the third sternite.

Female. Similar to the male in every respect with the front entirely light reddish chestnut brown divided down the middle with faint linear impressions. The pile of the eyes is more sparse but is of the same color as in the male. Third antennal segment slightly concave in the middle above, the apical portion not with parallel sides. Arista pale yellow with about twenty-five long rays.

Holotype: male, allotype female and one paratype female from Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan.-April 1948.

This species traces to *macula* Wiedemann or to *panamena* Curran in Curran's key.

***Volucella liriopae* n. sp.**

A small species related to *macula* Wiedemann and *obliquicornis* Curran, the tibiae are entirely reddish and the abdomen beyond the first segment is entirely black. There is a large brown spot upon the wings. Length 7 mm.

Male. Head: the face, cheeks and front are light yellowish brown. The tubercle is low with a patch of stiff black hairs in the middle; face otherwise with a few scattered yellow hairs and sparse yellow pollen beneath the antennæ. The frontal callus is dark brown, the frontal pile and the vertical pile black. The antennæ are elongate and entirely light brownish orange with the arista yellowish on the basal half but darker apically and with about twenty-one long rays. The eyes have the upper facets somewhat enlarged but not flattened; the ocular pile is light brownish to reddish yellow and quite thick upon the upper half. *Thorax:* mesonotum with opalescent strong greenish reflections and a coppery reflection where the light strikes. The sides of the mesonotum and the anterior margin and the upper part of the pleura are light

reddish or yellowish brown in color. The mesonotal pile is black with a few pale hairs behind the humeri. The humeri are pale yellow. All pleural pile black. The bristles of the thorax and scutellum are black; there is one bristle upon the mesopleura, three on the notopleura, three above wing, three upon the post calli, six in front of the scutellum and six upon the scutellar margin. The scutellum is dark brown in color, the disc subopaque without posterior depression; the disc also has bluish to coppery reflections and is apparently devoid of pile, although fine granulations suggest that there may have been pile. There are also a few slender black hairs on each basolateral margin. Squamæ brown with dark brown border and fringe. *Legs*: the femora are brown, the hind pair quite dark, the anterior pair somewhat yellowish brown. Anterior and middle tibiæ brown, the hind pair deep sepia. First three segments of all of the tarsi rather light brownish yellow but black pilose, the mat pile on the hind tarsi light reddish yellow; terminal segments of tarsi blackish. *Wings*: distinctly greyish hyaline with a prominent, large, quadrate, sepia brown spot in the middle anteriorly; the remainder of the first basal cell is also blackish except at the base and except just in front of the large brown spot. The posterior cross-veins and the margin of the anal vein are blackish; the stigmal cell is yellow beyond the quadrate brown blotch then becomes blackish for a short distance and beyond this for nearly half of its length the stigmal cell is light brownish grey. Marginal cell closed with a rather long stalk. *Abdomen*: first segment is dark sepia brown, more or less shining; the remaining segments are black with strong opalescent bluish reflections; there is a faint brassy cast where the light strikes them.

Female. Similar to the male; the front is shining light coffee brown on the lower half becoming opalescent blackish on the upper half. There is a medial, linear impression on the upper half of the front and in the middle of the front the slightly raised portion is longitudinally striate with some of the striæ curved.

Holotype: male, allotype, female, Nova Teutonia, Brazil, Jan. to April 1948, collected by Fritz Plaumann.

Volucella impressa n. sp.

This species is related to *pinkusi* Curran and *aster* Curran but is easily distinguished by the wholly black abdomen besides other differences. There is a diffuse brown tinge in the middle of the wing, and a narrow brown stripe between the face and cheeks. Length 10 mm.

Male. *Head*: the face, except the region beneath the antennæ, and cheeks, except the posterior part, light coffee brown in color without any medial black stripe. There is, however, a slender brown stripe from the eye margin to the epistoma. The lower face is somewhat conical and slender. The low tubercle is thickly black pilose, the pile upon the sides of the face reddish yellow. Beneath the antennæ the face is blackish with pale yellow pollen which continues thinly but widely down to the epistoma. The front is sepia brown becoming black near the junction of the eyes with thin, pale brownish yellow pollen. The frontal and vertical pile is black. The eyes are not flattened, the upper facets scarcely enlarged, the ocular pile dense and sepia brown in color, not black. The antennæ are reddish brown throughout, the third segment more narrow on the apical half; the arista is yellowish basally, blackish apically, with about seventeen rather short rays. *Thorax*: the mesonotum and scutellum, except for the humeri and post calli, are entirely black with strong greenish to bluish opalescent color and coppery reflection where the light strikes. The humeri and post calli are light brownish yellow. The mesonotal, pleural and scutellar pile is black and rather dense and fine except for four longitudinal stripes of nearly white pile on the mesonotum which is most readily seen in posterior view. These stripes of pile extend fully three-fourths the length of the mesonotum with the outer pair wider. There are a very few pale hairs at the extreme base of the scutellum, but its ventral fringe is black. The bristles of the thorax are black; there is one bristle upon the mesopleura, three on the notopleura, three above wing, three on the post calli, none in front of the scutellum and ten upon the margin of the scutellum. The scutellum is concolorous with the mesonotum with a very deep, trans-

verse, preapical depression extending the entire apical width of the scutellum. The squamæ are pale brown, the outer border, the margin and the fringe very dark sepia brown. *Legs*: black, only the extreme base of the anterior and middle tibiæ and the extreme apex of their femora yellowish brown. Pile of legs black, the ventral mat of the hind tarsi very nearly black but actually reddish sepia in the middle. *Wings*: pale brownish hyaline with more distinct but diffuse yellowish brown tinge in the middle of the wing in the whole of the stigmal portion of the subcostal cell and in the outer half of the costal cell. Marginal cell widely open. *Abdomen*: the first segment is shining black, the remaining segments black and shining with very strong opalescent greenish color and coppery reflection where the light strikes them. Hypopygium black. Sternites shining black with less conspicuous opalescent reflections. The pile of the first and second sternites widely white through the middle with a few black hairs laterally. Third and fourth sternites with more restricted white pile in the middle.

Female. Similar to the male, the front shining black throughout except upon the preantennal callus which is narrowly reddish. Frontal and vertical pile of the female black. Pile of the abdomen broadly whitish on the basal portion of the second, third and fourth segments, becoming black narrowly on the posterior border of the second segment, black upon the posterior half of the third segment and the posterior half of the fourth segment except in the posterior corners.

Holotype: male, allotype, female, one paratype female, Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan.-Apr., 1948.

Volucella tripunctata n. sp.

A small species characterized by the three brown spots in the middle of the wing, the broad yellow translucent base to the abdomen. Related to *fracta* Curran. Length 7.5 mm.

Male. *Head*: face and the anterior half of the cheeks light yellowish brown. There is an indistinct medial

stripe upon the face which is blackish, a distinct wide stripe from eye margin to epistoma and the posterior half of the cheeks are black. Face with yellowish white pile and the yellow pollen is restricted to the area below the antennæ. The front is black with only a little pollen along the eye margins; its pile is yellowish. The pile of the vertex is black. The eyes are not flattened but the upper facets are considerably enlarged and thickly dark reddish brown pilose; the pile extends more thinly almost to the bottom of the eye. The antennæ are light brown, the arista yellowish but black apically with about fifteen short rays. *Thorax*: the mesonotum and scutellum are shining black, the former with rather distinct purplish reflections which are not opalescent. The scutellum is slightly opalescent in reflection with a strong, complete, transverse, preapical depression which is microgranulate. The post calli and humeri are light brown; pleura black and black pilose. The mesonotal pile and scutellar pile black but with some scattered shorter yellow pile on the mesonotum which extends almost to the scutellum and is not arranged in rows. The bristles of the thorax are black; there is one bristle on the mesopleura, two on the notopleura, three above the wing, two upon the post calli, none in front of the scutellum and eight upon the scutellar margin. Squamæ very dark sepia throughout. *Legs*: the femora are black becoming obscurely dark reddish brown near the apex; the tibiæ are black, very narrowly reddish sepia at the base of the first and second pairs. Anterior tarsi black, their basitarsi brown upon the sides. Middle tarsi black with the basitarsi brown. First two segments of hind tarsi rather light reddish brown, the remaining segments black. Pile of legs black, reddish however, beneath the hind tarsi. *Wings*: very strongly tinged with yellowish brown especially upon the anterior half from which it fades and becomes paler and less yellowish posteriorly. The whole stigmal cell is rather deep brownish yellow beyond the end of the costal cell and with a slightly darker brown spot across this cell at the end of the costa. There are deep, distinct, small brownish spots on the anterior cross vein, the base of the

third vein and at the base of the discal and third posterior cells. Marginal cell closed in the costa. *Abdomen*: first segment and a little more than the basal half of the second segment light yellowish and translucent. The translucent area laterally extends almost to the posterior corners but is narrowly divided in the middle by a medial blackish vitta which reaches nearly to the base of the second segment; the remainder of the second and the whole of the third and fourth segments are shining black. The pile is yellow upon the yellow areas of the first segments, widely yellow on the third segment, except immediately along the posterior margin, and yellow upon the fourth segment. Second sternite and narrow base of the third light translucent yellowish; sternal pile yellowish white.

Female. Similar to the male, the front black and shining with pale yellow pile. The marginal cell rather widely open.

Holotype: male, allotype, female and one paratype female, Nova Teutonia, Brazil, Jan. to April 1948, collected by Fritz Plaumann.

Volucella palmyra n. sp.

A small species related to *zephyrea* Curran but distinguished by the yellow pilose pleura and the entirely black front tarsi. Moreover, the entire hind tibiae are unicolorous brownish black, not half brown. The depression of the scutellum is very shallow and oval. Length 6 mm.

Female. *Head*: the face is rather deeply conical, the tubercle moderate but the face very deeply excavated above. The face and cheeks are pale yellowish brown with a faint trace of a slender brown stripe from epistoma to eye margin. The facial pile is sparse and short and yellow, the yellow pollen restricted to the area beneath the antennae. The front is shining black with only the area about the preantennal callus reddish brown. The pile of the front and ocellar region is sparse, short and yellow, the upper occipital pile behind the ocelli black. Eyes with sparse, short yellowish white pile.

The antennæ are light brownish orange, the third segment rather short but broad on the basal half and narrowing but little apically; the dorsal margin is flat and straight except at the base and apex. Arista yellow, black at the apex, with about fifteen rays. *Thorax*: the mesonotum is very dark sepia brown across the middle with strong bluish to purplish reflection; the blue color is arranged in faint obscure stripes. The sides of the mesonotum, the anterior margin and the post calli are light brown. The upper half of the pleura is lighter and more yellowish brown. Pleural pile brownish to reddish yellow. The mesonotal pile is short and sparse; from posterior view it appears to be chiefly light yellow with some brownish or black pile intermixed, especially in front of the scutellum; from anterior view this pile appears to be almost entirely brown to black. The bristles of the thorax are black; there is one upon the mesopleura, two upon the notopleura, three above wing, two on post calli, none in front of scutellum and six upon the scutellum margin. The scutellum is brown; it is somewhat paler down the middle and in the basal corners but with baso-lateral flattened granulate areas which show a blue reflection and which areas are not longer than wide. Beyond these flattened areas on either side the scutellum has a purplish reflection. The preapical depression is large, quite short oval, and extremely shallow and granulate. Squamæ pale brown with rather darker reddish brown fringe. *Legs*: the femora are blackish becoming yellowish to reddish brown apically. All of the tibiæ are extremely dark sepia brown and almost black throughout. Anterior tarsi black; the middle basitarsi dark brown, the remainder of the segments black. Hind basitarsi rather light reddish brown, the remaining segments black. The pile of the legs is black. *Wings*: tinged with brown which is faintly yellowish; the brown tinge is a little darker on the apical half. There is a large quadrate brown spot restricted to the subcostal cell at the end of and including the tip of the costal cell.

The marginal cell is widely open. *Abdomen*: the first

segment is dark brown, the second shining black with a pair of diffusely margined yellow triangles on the base of the segment which are subtranslucent and divided in the middle by a diffuse blackish vitta. Third and fourth segments extremely dark sepia but appearing chiefly blackish especially in the middle. The pile of the second, third and fourth segments is abundant, very fine and actually entirely very pale yellowish white; in some lights it appears to be blackish.

Holotype: female, Nova Teutonia, Brazil, Fritz Plaumann; Jan.-Apr., 1948.

Volucella nigropoda n. sp.

A yellow and black species. Related to *correcta* Curran, the legs are quite black instead of reddish. More than three-fourths of the mesonotum is black with a purplish reflection. Length 7 mm.

Male. *Head*: the face and the posterior portion of the cheeks and the front are pale yellow. The face has a brownish black middle stripe becoming evanescent between the tubercle and the antennæ. There is a very wide polished black stripe from the lower eye margin to the epistoma. The pile of the front and face is pale yellow; the antennæ are pale brownish orange. The arista are pale, becoming dark only at the extreme tip; it has seventeen rays. The eyes are widely touching, the upper facets only slightly enlarged; the upper ocular pile is very dense, longer than that on the lower half and nearly black in color. This upper pile becomes thinner dorsally and posteriorly beyond the area of the enlarged facets. The lower ocular pile appears to be reddish to yellowish brown. Vertex black with a few black hairs. The eye facets extend to the posterior rim of the head upon the upper one-fourth; the occiput which is yellowish or greyish white pollinose stops at this point. Pile of the occiput very short, sparse and pale yellow. *Thorax*: the mesonotum is widely shining black with an opalescent bluish and strong coppery or purple reflection. The lateral margins are broadly pale yellow but the black medial area is considerably wider than the scutellum and occu-

pies at least three-fifths the width of the mesonotum. The humeri are pale yellow. The scutellum is translucent, light brownish yellow without preapical depression but with a linear marginal crease or furrow running from close to the base on either side around the margin of the dorsal edge of the scutellum. The scutellum has some thirty or more fine long discal black hairs and more numerous but sparse short black hairs together with five pairs of long, slender black bristles on the margin. Mesonotum with two black notopleurals, two supra-alars and two post callar and one mesopleural bristle which are all black. Pleura pale yellow on propleura, pteropleura, metapleura, upper hypopleura and narrowly on the upper sternopleura. Remainder of pleura brownish black. Pleural pile pale yellow. Squamæ translucent greyish with sepia border and fringe, the halteres yellowish white. *Legs*: almost black; actually of a very dark blackish sepia color. The base of the anterior and middle tibiae are a little paler in color but the difference in shade is not readily noticeable. This is also true of the base of all the basitarsi which are actually yellowish brown but heavily obscured by the black pile of the legs. The legs are almost wholly black pilose with a few scattered golden hairs towards the base of the femora. *Wings*: hyaline, the dark brown villi nearly restricted to the outer third. The basal half of the stigmal portion of the subcostal cell lying beyond the confluence of the costa and subcosta is pale yellow. The remaining outer part of this cell is hyaline. There is a diffuse brown spot in the subcostal cell below the confluence of costa and subcosta which is about twice as long as wide. There is a very small faint brown spot at the base of the submarginal cell but the cross veins are not tinged with brown. The marginal cell is barely open and is perhaps better described as closed at the costa. *Abdomen*: first and second segments quite translucent and very pale yellow with the posterior margin of the second segment rather narrowly brownish black; this band is a little wider in the middle of the segment where its band occupies not quite a third of the medial length of the segment. The

base of the third segment is narrowly and diffusely yellowish translucent. This translucent area extends widely down the sides and across the posterior portion of the segment leaving a rather wide, smoky, brownish black band across the middle. The extreme margin of the third segment is narrowly black. Fourth segment chiefly yellowish brown with black posterior margin. The pile of the abdomen is yellow on the yellow areas of the first and second segments but black upon the remainder of the abdomen and quite short except upon the anterior corners of the second segment. First, second and third sternites pale yellow and yellow pilose. The third with a narrow brown post margin.

Holotype: male, Pucallpa, Peru, Dec. 4, 1947, Jose Schunke.

Volucella stigmata n. sp.

A small black species with trivittate face. Related to *fracta* Curran. The facial stripes are black, not brown, the second segment of the abdomen has a pair of distinct rounded triangles of brownish yellow. The abdomen is distinctly black, rather than violaceous brown. Length 8 mm.

Female. *Head*: face and cheeks light brown in color with a distinct, central, medial black stripe upon the face over the tubercle and another from the eye margin to the epistoma. The lower part of the front is obscure reddish brown, the upper part of the front and vertex shining black; the facial and frontal pile is pale yellow. The antennæ are yellowish brown, the arista pale yellow, reddish brown apically and there are only eight rays upon the arista; there may have been one or two others basally. The eyes have sparse, short, yellowish or brownish yellow pile. *Thorax*: the mesonotum and scutellum are black with an opalescent greenish reflection, coppery in some lights. The sides of the mesonotum are yellowish brown. There are two long, slender, black bristles on the notopleura, two above the wing, two upon the post calli, one upon the mesopleura, a single pair of

large ones on the scutellum. The scutellum bears a few, lateral, fine, black hairs. The pleura are dark brown, yellowish on the metapleura and upon the suture between the pteropleura and mesopleura. The scutellum has a prominent wide preapical depression. The squamæ are pale yellow with dark brown border and fringe. The halteres are orange with pale yellow knob. *Legs*: the femora are very dark brown, the hind pair black becoming deep brown distally. All of the tibiæ are very dark reddish sepia. The tarsi are all nearly concolorous with the tibiæ. The middle and posterior basitarsi are a little lighter brown in color. Pile of the legs almost entirely black. *Wings*: hyaline except for a pale yellowish brown tinge which seems to be largely caused by the villi but may be partly caused by the wing itself. There are several brown spots on the wing. There is a quite long, deep brown spot at the confluence of the subcosta and costa which is about three or four times as long as wide; the apex of the costal cell is barely included in this spot; beyond this brown spot, in nearly the middle of the stigmal area of the subcostal cell, there is a faint rectangular brownish smudge or spot. There is a darker brown spot covering the furcation of the third vein at the base of the submarginal cell and immediately below it. There is a trace of brown about the remaining central cross-veins. The marginal cell is widely open. *Abdomen*: the first segment is brownish yellow, the second has a pair of prominent, distinct, narrowly separated, rounded and horizontally elongate triangles of brownish yellow. The remainder of this segment is shining black. The third, fourth and fifth segments are quite black with a faint, opalescent greenish reflection which in some lights is a pale brassy or reddish. First and second sternites, except the posterior margin of the second, together with the basal margin of the third sternite, brownish yellow. Remainder of sternum shining black with sparse subapressed pale yellow pile.

Holotype; female. Pucallpa, Peru, Mar. 12, Jose Schunke.

***Volucella scintillans* n. sp.**

A brilliant metallic green and purple species. Related to *earnestina* Curran. Characterized by the black pile on the base of the apex of abdominal segment and the brown spot on the small cross vein of the wing, besides other differences. Length 9 mm.

Male. *Head*: face rather deeply projecting, brilliant metallic green above, bluish violet below. The cheeks have a large yellowish triangle and are metallic behind. There is a double band of pale yellow pubescence running from the eye margin two-thirds of the way to the epistoma. These bands are separated by the posterior border of the metallic blue part of the face; the second band lies, therefore, on the yellowish triangle of the cheeks. There is a thick band of white pollen extending from each eye margin beneath the antennæ and thence in the middle down almost to the center of the tubercle. The facial pile is fine and white and rather sparse. The front and vertex are metallic green; the frontal pile is white except for a few black hairs; the vertical pile is longer and black. The antennæ are elongate and yellowish brown. Third antennal segment perhaps a little darker in the middle and very slightly concave in the middle dorsally. The arista is yellowish brown, becoming darker apically and has about twenty-five rays. The eyes are widely touching, the upper facets only moderately enlarged, the ocular pile thick and nearly white in color. *Thorax*: the mesonotum and scutellum are brilliant metallic green with faint brassy reflections, only the humeri being yellowish brown in color. On the notopleura and all of the pleura except the metapleura the color deepens until it is a deep purplish blue over most of the pleura with less of a greenish reflection. The pile of the mesonotum and scutellum is entirely black with only a few pale hairs behind the humeri and a few more behind the transverse suture. The scutellum has a deep, preapical depression and four pairs of long, black bristles. Squamæ brownish white with a round dark brown spot; they are brown pilose on the outer edge of the upper squamæ; squamal fringe dark sepia brown.

Halteres yellowish with nearly white knob. *Legs*: black with black pile. *Wings*: nearly hyaline upon the posterior part with slightly brownish appearance due to thick brown villi. The outer part of the costal cell, the first basal cell, the basal portion of the submarginal cell and all of the marginal cell, except the apex, are pale yellowish brown. The basal half of the stigmal portion of the subcostal cell is yellowish, the remaining outer half pale brown. There is a distinct, elongate, dark brown spot just behind the point of confluence of the subcostal vein with the costa. There is a smaller brown spot upon the third longitudinal vein at the base of the submarginal cell, a larger one upon the small cross vein and a large but not quite so dark spot upon the apex of the marginal cell which extends into the submarginal cell. The marginal cell is closed with a short stalk. *Abdomen*: the first segment is black, the second, third and fourth are brilliant shining blue with greenish reflections laterally and purplish ones centrally as well as along the posterior and anterior margins of these segments. The pile of the first segment is almost entirely black, being narrowly white only in the middle. Of the second segment it is entirely black except for a broad band of yellowish white pile in the middle which extends from the base some two-thirds the length of the segment. Pile of third segment entirely black except for a few white hairs basally and sublaterally. Fourth segment's pile entirely black throughout.

Holotype: male. Pucallpa, Peru, Dec. 9, 1947, Jose Schunke.

SYNONYMIC AND OTHER NOTES ON FORMICIDÆ (HYMENOPTERA)*

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In 1945 Dr. E. V. Enzmann published a paper entitled "Systematic Notes on the Genus *Pseudomyrma*."¹ Since this contains more confused taxonomy per page than any other work on the Formicidae I have ever encountered in twelve years of reading in the field, I have considered it advisable to publish an account of some of the synonymy involved.

The worst, but by no means the only, category of errors lies in the series of forms of *Pseudomyrma* described as new from the types which Wheeler had set up in his "Studies of Neotropical Ant-plants and Their Ants," published posthumously in 1942² and overlooked by Enzmann.

Wheeler's types were labelled *as types* in the usual Museum manner, and each series bore Wheeler's clearly legible determination label. Enzmann copied these names and used them in his paper, creating a series of synonym-homonyms, but since he made several mistakes in transcribing the spelling, some of the species may be considered synonymous but not strictly homonymous. Of the remainder of Enzmann's publication, much may be safely ignored by taxonomists, including the erratic keys and the pseudophylogenetic separation into "branches" and "groups." Some forms described as new are from sources other than the Wheeler type material; since the Enzmannian types have not been made available for study, it will devolve upon the future reviser of *Pseudomyrma*, a genus well-scrambled even in pre-Enzmannian times, to decide the fate of the species not treated here.

The species are listed as Wheeler had them, each with the corresponding Enzmannian form beneath it. To

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¹ Psyche, 51: 59-103, 3 pls. (1945).

² Bull. Mus. Comp. Zool. Harvard, 90: 1-262, 56 pls. (1942).

shorten the task, I have given date and page references only; plate and figure references are omitted. References to Wheeler's 1942 and Enzmann's 1945 papers are given in the preceding footnotes. The Museum of Comparative Zoology type catalog numbers are contained in parentheses with the initials (MCZ).

Pseudomyrma alliodora Wheeler

Wheeler, 1942, pp. 157-158.

P. allidora [sic!] E. Enzmann, 1945, pp. 77-78 (MCZ 20533).

Pseudomyrma belti subsp. *saffordi* Wheeler

Wheeler, 1942, p. 162.

P. sabanica var. *saffordi* E. Enzmann, 1945, p. 89 (MCZ 20537).

The term "*sabanica*" is evidently a misspelling of Wheeler's specific name *satanica* (*P. satanica* Wheeler, 1942, pp. 174-175), of which Enzmann considered *saffordi* a variety.

Pseudomyrma belti subsp. *venifica* Wheeler

Wheeler, 1942, pp. 162-163.

P. belti subsp. *venifica* E. Enzmann, 1945, p. 81 (MCZ 20538).

Pseudomyrma belti subsp. *bequaerti* Wheeler

Wheeler, 1942, p. 164.

P. belti subsp. *bequaerti* E. Enzmann, 1945, pp. 80-81 (MCZ 23139).

Pseudomyrma latinoda var. *coronata* Wheeler

Wheeler, 1942, pp. 167-168

P. latinoda var. *coronata* E. Enzmann, 1945, p. 88 (MCZ 20542).

Pseudomyrma latinoda subsp. *bradleyi* Wheeler

Wheeler, 1942, p. 169.

P. bradleyi E. Enzmann, 1945, p. 82 (MCZ 22864).

Pseudomyrma sericea var. *acaciarum* Wheeler

Wheeler, 1942, p. 176.

P. sericea var. *acaciorum* [sic!] E. Enzmann, 1945, p. 90
(MCZ 22865).

Pseudomyrma spinicola subsp. *sclerosa* Wheeler

Wheeler, 1942, pp. 180–181.

P. spinicolæ [sic!] var. *infernalis* E. Enzmann, 1945, p. 91
(MCZ 20547).

Pseudomyrma spinicola subsp. *sclerosa* Wheeler

Wheeler, 1942, pp. 181–182.

P. spinicolæ [sic!] var. *sclerosa* E. Enzmann, 1945, pp. 91–
92 (MCZ 23145).

Pseudomyrma triplaris subsp. *baileyi* Wheeler

Wheeler, 1942, pp. 185–186.

P. triplaris subsp. *biolleyi* [sic!] E. Enzmann, 1945, pp.
93–94 (MCZ 20548).

Pseudomyrma triplaris subsp. *tigrina* Wheeler

Wheeler, 1942, p. 186.

P. triplaris subsp. *trigona* [sic!] E. Enzmann, 1945,
pp. 94–95 (MCZ 23147).

Pseudomyrma triplaris subsp. *boxi* Wheeler

Wheeler, 1942, p. 184.

P. triplaris subsp. *boxi* E. Enzmann, 1945, p. 94 (MCZ
23146).

The two following forms which Wheeler saw, but re-
frained from describing, are easily synonymized with
common species of *Pseudomyrma*.

Pseudomyrma gracilis (Fabricius)

Fabricius, 1805, Syst. Piez., p. 405 (*Formica*).

P. gracilis var. *longinoda* E. Enzmann, 1945, p. 87 (MCZ
26812).

Pseudomyrma triplarina (Weddell)

Weddell, 1849, Ann. Sc. Nat. Bot. (3) **13**: 40-113,
249-268 (*Myrmica*).

P. arboris-sanctæ Emery, 1894, Bull. Soc. Ent. Ital.,
26: 147.

P. arboris-sanctæ var. *ecuadoriana* E. Enzmann, 1945,
pp. 79-80 (MCZ 26809).

The types of *ecuadoriana* are few, partially fragmented, and accompanied by what appear to be *Azteca* workers glued to the card with the *ecuadoriana*. I can see no characters which distinguish them (*ecuadoriana*) from a series of *triplarina* workers from several South American localities in the Wheeler Collection.

Following the publication of Dr. Enzmann's paper on *Pseudomyrma*, others were published by his daughter, Miss Jane Enzmann. All but one of the species described, however, appear to be synonyms of common Nearctic forms. Dr. William S. Creighton has discussed these forms with me, and I am grateful for his opinions on several obscure cases. His forthcoming book, which amounts to a revision of North American ants, will also carry notes on the synonymy of these forms, but technical difficulties prevent him from dealing with them at any length. Most species treated below involve Enzmannian names, but several other forms of older authors are changed in status as well.

Myrmecina americana Emery

M. latreillei subsp. *americana* Emery, 1895, Zool. Jahrb.
Syst., **8**: 271.

M. latreillei subsp. *americana* var. *brevispinosa* Emery,
idem., p. 271.

M. graminicola subsp. *quadrispina* J. Enzmann, 1946,
Jour. N. Y. Ent. Soc., **54**: 13-15, figs. 1, 2, worker.

In the manuscript of his work on North American ants, which he has kindly allowed me to examine, Dr. Creighton has raised the form known for many years as *Myrmecina graminicola* subsp. *americana* to the rank of species.

There appears little objection to this move, though the differences between the Palearctic *graminicola* and the Nearctic form are very slight. The forms *quadrispina* and *brevispinosa*, however, cannot be considered valid forms.

The Enzmannian subspecies (*quadrispina*) was taken (holotype worker) on the south slope of the Blue Hills, a rather restricted elevated area just outside Boston, Massachusetts. Two colonies collected by me in this locality were confined for several months in artificial nests. Specimens killed at the time of collection and others examined after two months of rearing show a wide range of variation in size, sculpture and color. The larger workers, mostly those killed at the time of collection, agree well with the description and figures, as well as my impressions, gained from a rather cursory examination of the type, of *quadrispina*. These workers also agree with Emery's original description of *americana* and with specimens identified as *americana* by Wheeler and by Creighton.

My nests also produced, after a month or so of starvation conditions, small light-colored workers corresponding well with published descriptions of *brevispinosa* and with specimens determined as such in the Wheeler Collection. These workers were raised from small larvæ during a period in which the colonies refused all types of prepared foods, including bread and fats. When ripe seed-heads of timothy and some small herbaceous plants were later introduced, the colony eagerly accepted the seeds as food, but the workers which had previously hatched never became, even after four weeks, as fully colored as the workers reared in the wild. I conclude that the variant *brevispinosa* is merely the stunted workers from either an incipient or poorly-nourished colony.

Both my nests were taken under large, well-embedded stones in a rich, shady beech woods. Each colony occupied a small oval chamber in the soil, about three quarters of an inch in greatest diameter and less than a quarter inch deep, with the smooth lower surface of the stone

forming the immediate roof. The artificial nests were set up on the evening of collection (June 10). A few males also developed from the larvae taken with the nests, and these pupated during early August and developed into adults in late August. All the males escaped both nests through cracks during one night in early September, presumably on nuptial flight, since they had not previously attempted to leave the brood chamber which the ants constructed at the end of each nest from small particles of earth that had been scattered over the nest floor. These chambers were an almost exact replica of the ones found under the stones, open at the top and with a small passage at one side.

The queens never left the brood except on the occasion of the introduction of the first grass seed, when all the workers and one queen left the brood and examined the seeds. The queen returned after a brief period and resumed her watch over the brood.

In studying various *Myrmecina* in the Wheeler Collection, I have seen other forms of very doubtful validity. All these are presently considered subspecies of *graminicola*, under which Wheeler placed them in his original descriptions. *Texana* is supposed to differ from *americana* by its "scotch grain" shagreening of the first gastric segment. However, specimens from many localities in the states east of the Mississippi also possess this characteristic to a varying degree, and specimens from North Carolina and northern Ohio show much heavier sculpture of this type than do the *texana* types. The *texana* types, however, do seem to differ slightly from *americana* in having a much less definitely longitudinal orientation to the rugulation of the head, with the longitudinal rugæ having many prominent transverse spurs and branches. Other Texan specimens I have seen all belong to the typical *americana*, including a specimen identified by Wheeler as *texana*. Since sculpture appears to be one of the several very unstable features of Holarctic *Myrmecina*, I believe that further collecting in Texas and Mexico will show that this form is synonymous with *americana*.

Wheeler's two Oriental forms, *graminicola* subsp. *nipponica* and *graminicola* subsp. *sinensis*, are also doubtful. The former has the anterior clypeal tubercles developed much as in *graminicola*, and seems hardly separable from that form. The latter has the clypeal tubercles reduced and seems scarcely distinguishable from *americana*. I should not be surprised if *sinensis* were to prove to be the same as *sicula*, from the southern Palearctic region; or if both of these (*sicula* and *sinensis*) were identical to *americana*. In fact, the entire Holarctic *Myrmecina* fauna may end by being considered as one huge species cline in which the geographical races have not yet become sufficiently isolated to form distinct subspecies exclusively inhabiting a given area.

Tetramorium cæspitum (Linnæus)

Linnæus, 1785, Syst. Nat. (Ed. 10), 1: 581 (*Formica*)

Myrmica (*Myrmica*) *brevinodis* var. *transversinodis*
J. Enzmann, 1946, Journ. N. Y. Ent. Soc., 54: 47-49, figs. 1, 2, worker.

Dr. Creighton and I are in complete agreement that this form (*transversinodis*) must be added to the long list of synonyms of the common pavement ant. Although I have not seen the type, the description, figures and notes on the habits leave little doubt of the correct placement. This ant should not be mistaken for *Myrmica levinodis*, listed under various names and possibly a subspecies of *M. rubra*, which is an introduced form quite common in the Boston area. *M. levinodis* sometimes enters houses, but then as solitary individuals probably brought in on clothing, as has been my frequent observation in Cambridge. This *Myrmica* possesses a very potent sting, the effects of which may last for several hours.

Crematogaster lineolata (Say)

Say, 1836, Boston Jour. Nat. Hist., 1: 290,
all castes (*Myrmica*).

C. lineolata cerasi var. *punctinodis* J. Enzmann, 1946,
Jour. N. Y. Ent. Soc., 54: 91-92, pl. 2, fig. 7, all
castes.

C. lineolata cerasi var. *wheldeni* J. Enzmann, idem., p. 92, worker.

Dr. Creighton and I agree that these two forms either represent the typical *lineolata* or intergrade with what Dr. Creighton considers subsp. *subopaca*. Enzmann has raised *cerasi* Fitch to subspecific rank, but Dr. Creighton's forthcoming book will show that this name must be dropped.

Crematogaster vermiculata Emery

Emery, 1895, Zool. Jahrb. Syst., 8: 286.

Considered impossible of exact determination, but probably equivalent to *vermiculata* or an intergrade between *vermiculata* and a subspecies, are three forms described in a paper by Jane Enzmann in 1946.³ These all have in common the name *coachellai* and the subgeneric classification as *Crematogaster (Acrocœlia)*, but here the consistency ends. The synonymous forms with page references to Miss. Enzmann's paper are as follows: *C. lineolata* subsp. *coachellai* "E. Enz. in lit.," p. 93, sec. iii. *C. sanguinea* subsp. *coachellai* "E. Enzmann, in lit.," p. 95, couplet 19. *C. lineolata* var. *coachellai* J. Enzmann, Pl. 2 (p. 97), fig. 3.

The first of these three names is given in a grouped list with a superficial characterization of major sections only, the second appears in a dichotomous key, and the third appears in the legend to the plate. It is doubtful whether or not the authorship should be ascribed to E. Enzmann for the first two of these, even though it seems clear that such was intended. The types of these forms have not been made available to me for study, so I consider the form *coachellai* unrecognizable in the absence of a proper description.

In still another paper by Jane Enzmann⁴ the tribe *Aphænogastrini* is set up, a category which is untenable. The genera included in this "tribe" have numerous intergrades with other groups of the *Pheidolini*,⁵ to which

³ Jour. N. Y. Ent. Soc., 54: 91-92 (1946).

⁴ Journ. N. Y. Ent. Soc., 55: 147-152, (1947).

⁵ *Pheidolini* Emery, Rend. Acad. Sc. Bologna, (1913-14).

Aphænogaster and *Novomessor* clearly belong. One astounding error is the appearance of *Lobognathus* as a sub-genus in the key on page 152. This appeared to be miscopy of a large label earlier placed by Dr. Creighton on an unidentified specimen of *Veromessor*: Creighton's label in the Wheeler Collection reads "*lobognathus* new subspecies." The name must be considered a *lapsus* and a synonym of *Veromessor*.⁶

Two of the species described in this paper are minor workers, probably from incipient nests, of two well-known North American ants, which are listed below.

Novomessor albisetosus (Mayr)

Mayr, 1886, Verh. Zool.-bot. Ges. Wien, **36**: 443-446,
(*Aphænogaster*).

N. cockerelli var. *minor* J. Enzmann, 1947, pp. 147-148,
Pl. 8, top.

Aphænogaster fulva Roger

Roger, 1863, Berl. Ent. Zeitschrift, **7**: 190.

Aphænogaster fulva var. *rubida* J. Enzmann, 1947, pp.
147-148, Pl. 8, bottom.

I have not considered other Enzmannian forms because of my unfamiliarity with the groups concerned and because of my lack of time and taste for the task. The publications considered above should certainly suggest to all who examine them the need for some means of formal nullification of the published extremes of such irresponsible taxonomy.

⁶ *Veromessor* Forel, 1917, Bull. Soc. Vaud. Sc. Nat., **51**: 235 (described as subgenus of *Novomessor*).

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post calli. This marginal color is moderately light brown; the mesopleura, pteropleura and upper metapleura, are similarly brown, but ventrally the pleura becomes blackish. There are some bluish reflections upon the posterior half of the mesonotum in the middle and a pair of faint sub-lateral shining coppery vittæ. The mesonotal pile is chiefly black with five longitudinal stripes of shorter yellow pile which are restricted to the anterior half of the mesonotum and are best seen in the posterior view. The bristles of the thorax and scutellum are black; the mesopleura with one bristle, the bulbous notopleura with four, the post calli with six, the supraalæ region with three, the prescutellar region with eleven, the scutellar margin with fourteen, all of which are strong and more or less tuberculate. The scutellum is somewhat flattened and concave before the apex but without definite crease. The color of the scutellum is dark brown, over the disc which is also microgranulate, the base of the scutellum and the margin hyaline yellowish brown. Scutellum upon the disc with purplish reflections and the disc with very fine black hairs, rather long, which seem to proceed from the granulations but these hairs are scarce and scattered in all of my specimens whereas the granulations are very dense. Squamæ dark brown with brown fringe and border. *Legs*: the femora are dark reddish brown, the anterior pair and middle pair becoming lighter in color on the apical half. The hind pair are almost black especially on the dorsal margin. All of the tibiæ light coffee brown, the hind tibiæ somewhat darker and with a suggestion of a blackish brown post medial band. First three segments of anterior and middle tarsi light reddish brown, the remaining ones black. Hind tarsi similarly colored but the color a little dark. Pile of legs black. Ventral tarsal mats blackish and upon the hind pair deep reddish sepia. *Wings*: with a large, quadrate, dark sepia brown spot in the middle of the anterior half, the costal and the first basal cells, the subcostal cell brownish yellow. Marginal cell closed with a short stalk. *Abdomen*: first segment black, the remaining segments brilliant metallic blue with traces of purple reflections in the mid-

dle and very faint traces of green mixed in the blue along the lateral margins. Abdominal pile entirely black except upon the first segment and narrowly along the base of the second where it is yellowish. Sternites metallic bluish black; not so brilliant as the tergites. The pile chiefly yellow becoming black beyond the middle of the third sternite.

Female. Similar to the male in every respect with the front entirely light reddish chestnut brown divided down the middle with faint linear impressions. The pile of the eyes is more sparse but is of the same color as in the male. Third antennal segment slightly concave in the middle above, the apical portion not with parallel sides. Arista pale yellow with about twenty-five long rays.

Holotype: male, allotype female and one paratype female from Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan.-April 1948.

This species traces to *macula* Wiedemann or to *panamena* Curran in Curran's key.

Volucella liriopae n. sp.

A small species related to *macula* Wiedemann and *obliquicornis* Curran, the tibiae are entirely reddish and the abdomen beyond the first segment is entirely black. There is a large brown spot upon the wings. Length 7 mm.

Male. Head: the face, cheeks and front are light yellowish brown. The tubercle is low with a patch of stiff black hairs in the middle; face otherwise with a few scattered yellow hairs and sparse yellow pollen beneath the antennae. The frontal callus is dark brown, the frontal pile and the vertical pile black. The antennae are elongate and entirely light brownish orange with the arista yellowish on the basal half but darker apically and with about twenty-one long rays. The eyes have the upper facets somewhat enlarged but not flattened; the ocular pile is light brownish to reddish yellow and quite thick upon the upper half. *Thorax:* mesonotum with opalescent strong greenish reflections and a coppery reflection where the light strikes. The sides of the mesonotum and the anterior margin and the upper part of the pleura are light

reddish or yellowish brown in color. The mesonotal pile is black with a few pale hairs behind the humeri. The humeri are pale yellow. All pleural pile black. The bristles of the thorax and scutellum are black; there is one bristle upon the mesopleura, three on the notopleura, three above wing, three upon the post calli, six in front of the scutellum and six upon the scutellar margin. The scutellum is dark brown in color, the disc subopaque without posterior depression; the disc also has bluish to coppery reflections and is apparently devoid of pile, although fine granulations suggest that there may have been pile. There are also a few slender black hairs on each basolateral margin. Squamæ brown with dark brown border and fringe. *Legs*: the femora are brown, the hind pair quite dark, the anterior pair somewhat yellowish brown. Anterior and middle tibiæ brown, the hind pair deep sepia. First three segments of all of the tarsi rather light brownish yellow but black pilose, the mat pile on the hind tarsi light reddish yellow; terminal segments of tarsi blackish. *Wings*: distinctly greyish hyaline with a prominent, large, quadrate, sepia brown spot in the middle anteriorly; the remainder of the first basal cell is also blackish except at the base and except just in front of the large brown spot. The posterior cross-veins and the margin of the anal vein are blackish; the stigmal cell is yellow beyond the quadrate brown blotch then becomes blackish for a short distance and beyond this for nearly half of its length the stigmal cell is light brownish grey. Marginal cell closed with a rather long stalk. *Abdomen*: first segment is dark sepia brown, more or less shining; the remaining segments are black with strong opalescent bluish reflections; there is a faint brassy cast where the light strikes them.

Female. Similar to the male; the front is shining light coffee brown on the lower half becoming opalescent blackish on the upper half. There is a medial, linear impression on the upper half of the front and in the middle of the front the slightly raised portion is longitudinally striate with some of the striæ curved.

Holotype: male, allotype, female, Nova Teutonia, Brazil, Jan. to April 1948, collected by Fritz Plaumann.

Volucella impressa n. sp.

This species is related to *pinkusi* Curran and *aster* Curran but is easily distinguished by the wholly black abdomen besides other differences. There is a diffuse brown tinge in the middle of the wing, and a narrow brown stripe between the face and cheeks. Length 10 mm.

Male. *Head*: the face, except the region beneath the antennæ, and cheeks, except the posterior part, light coffee brown in color without any medial black stripe. There is, however, a slender brown stripe from the eye margin to the epistoma. The lower face is somewhat conical and slender. The low tubercle is thickly black pilose, the pile upon the sides of the face reddish yellow. Beneath the antennæ the face is blackish with pale yellow pollen which continues thinly but widely down to the epistoma. The front is sepia brown becoming black near the junction of the eyes with thin, pale brownish yellow pollen. The frontal and vertical pile is black. The eyes are not flattened, the upper facets scarcely enlarged, the ocular pile dense and sepia brown in color, not black. The antennæ are reddish brown throughout, the third segment more narrow on the apical half; the arista is yellowish basally, blackish apically, with about seventeen rather short rays. *Thorax*: the mesonotum and scutellum, except for the humeri and post calli, are entirely black with strong greenish to bluish opalescent color and coppery reflection where the light strikes. The humeri and post calli are light brownish yellow. The mesonotal, pleural and scutellar pile is black and rather dense and fine except for four longitudinal stripes of nearly white pile on the mesonotum which is most readily seen in posterior view. These stripes of pile extend fully three-fourths the length of the mesonotum with the outer pair wider. There are a very few pale hairs at the extreme base of the scutellum, but its ventral fringe is black. The bristles of the thorax are black; there is one bristle upon the mesopleura, three on the notopleura, three above wing, three on the post calli, none in front of the scutellum and ten upon the margin of the scutellum. The scutellum is concolorous with the mesonotum with a very deep, trans-

verse, preapical depression extending the entire apical width of the scutellum. The squamæ are pale brown, the outer border, the margin and the fringe very dark sepia brown. *Legs*: black, only the extreme base of the anterior and middle tibiæ and the extreme apex of their femora yellowish brown. Pile of legs black, the ventral mat of the hind tarsi very nearly black but actually reddish sepia in the middle. *Wings*: pale brownish hyaline with more distinct but diffuse yellowish brown tinge in the middle of the wing in the whole of the stigmal portion of the subcostal cell and in the outer half of the costal cell. Marginal cell widely open. *Abdomen*: the first segment is shining black, the remaining segments black and shining with very strong opalescent greenish color and coppery reflection where the light strikes them. Hypopygium black. Sternites shining black with less conspicuous opalescent reflections. The pile of the first and second sternites widely white through the middle with a few black hairs laterally. Third and fourth sternites with more restricted white pile in the middle.

Female. Similar to the male, the front shining black throughout except upon the preantennal callus which is narrowly reddish. Frontal and vertical pile of the female black. Pile of the abdomen broadly whitish on the basal portion of the second, third and fourth segments, becoming black narrowly on the posterior border of the second segment, black upon the posterior half of the third segment and the posterior half of the fourth segment except in the posterior corners.

Holotype: male, allotype, female, one paratype female, Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan.–Apr., 1948.

Volucella tripunctata n. sp.

A small species characterized by the three brown spots in the middle of the wing, the broad yellow translucent base to the abdomen. Related to *fracta* Curran. Length 7.5 mm.

Male. *Head*: face and the anterior half of the cheeks light yellowish brown. There is an indistinct medial

stripe upon the face which is blackish, a distinct wide stripe from eye margin to epistoma and the posterior half of the cheeks are black. Face with yellowish white pile and the yellow pollen is restricted to the area below the antennæ. The front is black with only a little pollen along the eye margins; its pile is yellowish. The pile of the vertex is black. The eyes are not flattened but the upper facets are considerably enlarged and thickly dark reddish brown pilose; the pile extends more thinly almost to the bottom of the eye. The antennæ are light brown, the arista yellowish but black apically with about fifteen short rays. *Thorax*: the mesonotum and scutellum are shining black, the former with rather distinct purplish reflections which are not opalescent. The scutellum is slightly opalescent in reflection with a strong, complete, transverse, preapical depression which is microgranulate. The post calli and humeri are light brown; pleura black and black pilose. The mesonotal pile and scutellar pile black but with some scattered shorter yellow pile on the mesonotum which extends almost to the scutellum and is not arranged in rows. The bristles of the thorax are black; there is one bristle on the mesopleura, two on the notopleura, three above the wing, two upon the post calli, none in front of the scutellum and eight upon the scutellar margin. Squamæ very dark sepia throughout. *Legs*: the femora are black becoming obscurely dark reddish brown near the apex; the tibiæ are black, very narrowly reddish sepia at the base of the first and second pairs. Anterior tarsi black, their basitarsi brown upon the sides. Middle tarsi black with the basitarsi brown. First two segments of hind tarsi rather light reddish brown, the remaining segments black. Pile of legs black, reddish however, beneath the hind tarsi. *Wings*: very strongly tinged with yellowish brown especially upon the anterior half from which it fades and becomes paler and less yellowish posteriorly. The whole stigmal cell is rather deep brownish yellow beyond the end of the costal cell and with a slightly darker brown spot across this cell at the end of the costa. There are deep, distinct, small brownish spots on the anterior cross vein, the base of the

third vein and at the base of the discal and third posterior cells. Marginal cell closed in the costa. *Abdomen*: first segment and a little more than the basal half of the second segment light yellowish and translucent. The translucent area laterally extends almost to the posterior corners but is narrowly divided in the middle by a medial blackish vitta which reaches nearly to the base of the second segment; the remainder of the second and the whole of the third and fourth segments are shining black. The pile is yellow upon the yellow areas of the first segments, widely yellow on the third segment, except immediately along the posterior margin, and yellow upon the fourth segment. Second sternite and narrow base of the third light translucent yellowish; sternal pile yellowish white.

Female. Similar to the male, the front black and shining with pale yellow pile. The marginal cell rather widely open.

Holotype: male, allotype, female and one paratype female, Nova Teutonia, Brazil, Jan. to April 1948, collected by Fritz Plaumann.

Volucella palmyra n. sp.

A small species related to *zephyrea* Curran but distinguished by the yellow pilose pleura and the entirely black front tarsi. Moreover, the entire hind tibiae are unicolorous brownish black, not half brown. The depression of the scutellum is very shallow and oval. Length 6 mm.

Female. *Head*: the face is rather deeply conical, the tubercle moderate but the face very deeply excavated above. The face and cheeks are pale yellowish brown with a faint trace of a slender brown stripe from epistoma to eye margin. The facial pile is sparse and short and yellow, the yellow pollen restricted to the area beneath the antennae. The front is shining black with only the area about the preantennal callus reddish brown. The pile of the front and ocellar region is sparse, short and yellow, the upper occipital pile behind the ocelli black. Eyes with sparse, short yellowish white pile.

The antennæ are light brownish orange, the third segment rather short but broad on the basal half and narrowing but little apically; the dorsal margin is flat and straight except at the base and apex. Arista yellow, black at the apex, with about fifteen rays. *Thorax*: the mesonotum is very dark sepia brown across the middle with strong bluish to purplish reflection; the blue color is arranged in faint obscure stripes. The sides of the mesonotum, the anterior margin and the post calli are light brown. The upper half of the pleura is lighter and more yellowish brown. Pleural pile brownish to reddish yellow. The mesonotal pile is short and sparse; from posterior view it appears to be chiefly light yellow with some brownish or black pile intermixed, especially in front of the scutellum; from anterior view this pile appears to be almost entirely brown to black. The bristles of the thorax are black; there is one upon the mesopleura, two upon the notopleura, three above wing, two on post calli, none in front of scutellum and six upon the scutellum margin. The scutellum is brown; it is somewhat paler down the middle and in the basal corners but with baso-lateral flattened granulate areas which show a blue reflection and which areas are not longer than wide. Beyond these flattened areas on either side the scutellum has a purplish reflection. The preapical depression is large, quite short oval, and extremely shallow and granulate. Squamæ pale brown with rather darker reddish brown fringe. *Legs*: the femora are blackish becoming yellowish to reddish brown apically. All of the tibiæ are extremely dark sepia brown and almost black throughout. Anterior tarsi black; the middle basitarsi dark brown, the remainder of the segments black. Hind basitarsi rather light reddish brown, the remaining segments black. The pile of the legs is black. *Wings*: tinged with brown which is faintly yellowish; the brown tinge is a little darker on the apical half. There is a large quadrate brown spot restricted to the subcostal cell at the end of and including the tip of the costal cell.

The marginal cell is widely open. *Abdomen*: the first

segment is dark brown, the second shining black with a pair of diffusely margined yellow triangles on the base of the segment which are subtranslucent and divided in the middle by a diffuse blackish vitta. Third and fourth segments extremely dark sepia but appearing chiefly blackish especially in the middle. The pile of the second, third and fourth segments is abundant, very fine and actually entirely very pale yellowish white; in some lights it appears to be blackish.

Holotype: female, Nova Teutonia, Brazil, Fritz Plaumann; Jan.-Apr., 1948.

Volucella nigropoda n. sp.

A yellow and black species. Related to *correcta* Curran, the legs are quite black instead of reddish. More than three-fourths of the mesonotum is black with a purplish reflection. Length 7 mm.

Male. *Head*: the face and the posterior portion of the cheeks and the front are pale yellow. The face has a brownish black middle stripe becoming evanescent between the tubercle and the antennæ. There is a very wide polished black stripe from the lower eye margin to the epistoma. The pile of the front and face is pale yellow; the antennæ are pale brownish orange. The arista are pale, becoming dark only at the extreme tip; it has seventeen rays. The eyes are widely touching, the upper facets only slightly enlarged; the upper ocular pile is very dense, longer than that on the lower half and nearly black in color. This upper pile becomes thinner dorsally and posteriorly beyond the area of the enlarged facets. The lower ocular pile appears to be reddish to yellowish brown. Vertex black with a few black hairs. The eye facets extend to the posterior rim of the head upon the upper one-fourth; the occiput which is yellowish or greyish white pollinose stops at this point. Pile of the occiput very short, sparse and pale yellow. *Thorax*: the mesonotum is widely shining black with an opalescent bluish and strong coppery or purple reflection. The lateral margins are broadly pale yellow but the black medial area is considerably wider than the scutellum and occu-

pies at least three-fifths the width of the mesonotum. The humeri are pale yellow. The scutellum is translucent, light brownish yellow without preapical depression but with a linear marginal crease or furrow running from close to the base on either side around the margin of the dorsal edge of the scutellum. The scutellum has some thirty or more fine long discal black hairs and more numerous but sparse short black hairs together with five pairs of long, slender black bristles on the margin. Mesonotum with two black notopleurals, two supra-alars and two post callar and one mesopleural bristle which are all black. Pleura pale yellow on propleura, pteropleura, metapleura, upper hypopleura and narrowly on the upper sternopleura. Remainder of pleura brownish black. Pleural pile pale yellow. Squamæ translucent greyish with sepia border and fringe, the halteres yellowish white. *Legs*: almost black; actually of a very dark blackish sepia color. The base of the anterior and middle tibiæ are a little paler in color but the difference in shade is not readily noticeable. This is also true of the base of all the basitarsi which are actually yellowish brown but heavily obscured by the black pile of the legs. The legs are almost wholly black pilose with a few scattered golden hairs towards the base of the femora. *Wings*: hyaline, the dark brown villi nearly restricted to the outer third. The basal half of the stigmal portion of the subcostal cell lying beyond the confluence of the costa and subcosta is pale yellow. The remaining outer part of this cell is hyaline. There is a diffuse brown spot in the subcostal cell below the confluence of costa and subcosta which is about twice as long as wide. There is a very small faint brown spot at the base of the submarginal cell but the cross veins are not tinged with brown. The marginal cell is barely open and is perhaps better described as closed at the costa. *Abdomen*: first and second segments quite translucent and very pale yellow with the posterior margin of the second segment rather narrowly brownish black; this band is a little wider in the middle of the segment where its band occupies not quite a third of the medial length of the segment. The

base of the third segment is narrowly and diffusely yellowish translucent. This translucent area extends widely down the sides and across the posterior portion of the segment leaving a rather wide, smoky, brownish black band across the middle. The extreme margin of the third segment is narrowly black. Fourth segment chiefly yellowish brown with black posterior margin. The pile of the abdomen is yellow on the yellow areas of the first and second segments but black upon the remainder of the abdomen and quite short except upon the anterior corners of the second segment. First, second and third sternites pale yellow and yellow pilose. The third with a narrow brown post margin.

Holotype: male, Pucallpa, Peru, Dec. 4, 1947, Jose Schunke.

Volucella stigmata n. sp.

A small black species with trivittate face. Related to *fracta* Curran. The facial stripes are black, not brown, the second segment of the abdomen has a pair of distinct rounded triangles of brownish yellow. The abdomen is distinctly black, rather than violaceous brown. Length 8 mm.

Female. *Head*: face and cheeks light brown in color with a distinct, central, medial black stripe upon the face over the tubercle and another from the eye margin to the epistoma. The lower part of the front is obscure reddish brown, the upper part of the front and vertex shining black; the facial and frontal pile is pale yellow. The antennæ are yellowish brown, the arista pale yellow, reddish brown apically and there are only eight rays upon the arista; there may have been one or two others basally. The eyes have sparse, short, yellowish or brownish yellow pile. *Thorax*: the mesonotum and scutellum are black with an opalescent greenish reflection, coppery in some lights. The sides of the mesonotum are yellowish brown. There are two long, slender, black bristles on the notopleura, two above the wing, two upon the post calli, one upon the mesopleura, a single pair of

large ones on the scutellum. The scutellum bears a few, lateral, fine, black hairs. The pleura are dark brown, yellowish on the metapleura and upon the suture between the pteropleura and mesopleura. The scutellum has a prominent wide preapical depression. The squamæ are pale yellow with dark brown border and fringe. The halteres are orange with pale yellow knob. *Legs*: the femora are very dark brown, the hind pair black becoming deep brown distally. All of the tibiæ are very dark reddish sepia. The tarsi are all nearly concolorous with the tibiæ. The middle and posterior basitarsi are a little lighter brown in color. Pile of the legs almost entirely black. *Wings*: hyaline except for a pale yellowish brown tinge which seems to be largely caused by the villi but may be partly caused by the wing itself. There are several brown spots on the wing. There is a quite long, deep brown spot at the confluence of the subcosta and costa which is about three or four times as long as wide; the apex of the costal cell is barely included in this spot; beyond this brown spot, in nearly the middle of the stigmal area of the subcostal cell, there is a faint rectangular brownish smudge or spot. There is a darker brown spot covering the furcation of the third vein at the base of the submarginal cell and immediately below it. There is a trace of brown about the remaining central cross-veins. The marginal cell is widely open. *Abdomen*: the first segment is brownish yellow, the second has a pair of prominent, distinct, narrowly separated, rounded and horizontally elongate triangles of brownish yellow. The remainder of this segment is shining black. The third, fourth and fifth segments are quite black with a faint, opalescent greenish reflection which in some lights is a pale brassy or reddish. First and second sternites, except the posterior margin of the second, together with the basal margin of the third sternite, brownish yellow. Remainder of sternum shining black with sparse subappressed pale yellow pile.

Holotype; female. Pucallpa, Peru, Mar. 12, Jose Schunke.

***Volucella scintillans* n. sp.**

A brilliant metallic green and purple species. Related to *earnestina* Curran. Characterized by the black pile on the base of the apex of abdominal segment and the brown spot on the small cross vein of the wing, besides other differences. Length 9 mm.

Male. *Head*: face rather deeply projecting, brilliant metallic green above, bluish violet below. The cheeks have a large yellowish triangle and are metallic behind. There is a double band of pale yellow pubescence running from the eye margin two-thirds of the way to the epistoma. These bands are separated by the posterior border of the metallic blue part of the face; the second band lies, therefore, on the yellowish triangle of the cheeks. There is a thick band of white pollen extending from each eye margin beneath the antennæ and thence in the middle down almost to the center of the tubercle. The facial pile is fine and white and rather sparse. The front and vertex are metallic green; the frontal pile is white except for a few black hairs; the vertical pile is longer and black. The antennæ are elongate and yellowish brown. Third antennal segment perhaps a little darker in the middle and very slightly concave in the middle dorsally. The arista is yellowish brown, becoming darker apically and has about twenty-five rays. The eyes are widely touching, the upper facets only moderately enlarged, the ocular pile thick and nearly white in color. *Thorax*: the mesonotum and scutellum are brilliant metallic green with faint brassy reflections, only the humeri being yellowish brown in color. On the notopleura and all of the pleura except the metapleura the color deepens until it is a deep purplish blue over most of the pleura with less of a greenish reflection. The pile of the mesonotum and scutellum is entirely black with only a few pale hairs behind the humeri and a few more behind the transverse suture. The scutellum has a deep, preapical depression and four pairs of long, black bristles. Squamæ brownish white with a round dark brown spot; they are brown pilose on the outer edge of the upper squamæ; squamal fringe dark sepia brown.

Halteres yellowish with nearly white knob. *Legs*: black with black pile. *Wings*: nearly hyaline upon the posterior part with slightly brownish appearance due to thick brown villi. The outer part of the costal cell, the first basal cell, the basal portion of the submarginal cell and all of the marginal cell, except the apex, are pale yellowish brown. The basal half of the stigmal portion of the subcostal cell is yellowish, the remaining outer half pale brown. There is a distinct, elongate, dark brown spot just behind the point of confluence of the subcostal vein with the costa. There is a smaller brown spot upon the third longitudinal vein at the base of the submarginal cell, a larger one upon the small cross vein and a large but not quite so dark spot upon the apex of the marginal cell which extends into the submarginal cell. The marginal cell is closed with a short stalk. *Abdomen*: the first segment is black, the second, third and fourth are brilliant shining blue with greenish reflections laterally and purplish ones centrally as well as along the posterior and anterior margins of these segments. The pile of the first segment is almost entirely black, being narrowly white only in the middle. Of the second segment it is entirely black except for a broad band of yellowish white pile in the middle which extends from the base some two-thirds the length of the segment. Pile of third segment entirely black except for a few white hairs basally and sublaterally. Fourth segment's pile entirely black throughout.

Holotype: male. Pucallpa, Peru, Dec. 9, 1947, Jose Schunke.

SYNONYMIC AND OTHER NOTES ON FORMICIDÆ (HYMENOPTERA)*

BY WILLIAM L. BROWN, JR.

The Biological Laboratories, Harvard University

In 1945 Dr. E. V. Enzmann published a paper entitled "Systematic Notes on the Genus *Pseudomyrma*."¹ Since this contains more confused taxonomy per page than any other work on the Formicidae I have ever encountered in twelve years of reading in the field, I have considered it advisable to publish an account of some of the synonymy involved.

The worst, but by no means the only, category of errors lies in the series of forms of *Pseudomyrma* described as new from the types which Wheeler had set up in his "Studies of Neotropical Ant-plants and Their Ants," published posthumously in 1942² and overlooked by Enzmann.

Wheeler's types were labelled *as types* in the usual Museum manner, and each series bore Wheeler's clearly legible determination label. Enzmann copied these names and used them in his paper, creating a series of synonym-homonyms, but since he made several mistakes in transcribing the spelling, some of the species may be considered synonymous but not strictly homonymous. Of the remainder of Enzmann's publication, much may be safely ignored by taxonomists, including the erratic keys and the pseudophylogenetic separation into "branches" and "groups." Some forms described as new are from sources other than the Wheeler type material; since the Enzmannian types have not been made available for study, it will devolve upon the future reviser of *Pseudomyrma*, a genus well-scrambled even in pre-Enzmannian times, to decide the fate of the species not treated here.

The species are listed as Wheeler had them, each with the corresponding Enzmannian form beneath it. To

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¹ Psyche, 51: 59-103, 3 pls. (1945).

² Bull. Mus. Comp. Zool. Harvard, 90: 1-262, 56 pls. (1942).

shorten the task, I have given date and page references only; plate and figure references are omitted. References to Wheeler's 1942 and Enzmann's 1945 papers are given in the preceding footnotes. The Museum of Comparative Zoology type catalog numbers are contained in parentheses with the initials (MCZ).

Pseudomyrma alliodoræ Wheeler

Wheeler, 1942, pp. 157-158.

P. allidora [sic!] E. Enzmann, 1945, pp. 77-78 (MCZ 20533).

Pseudomyrma belti subsp. *saffordi* Wheeler

Wheeler, 1942, p. 162.

P. sabanica var. *saffordi* E. Enzmann, 1945, p. 89 (MCZ 20537).

The term "*sabanica*" is evidently a misspelling of Wheeler's specific name *satanica* (*P. satanica* Wheeler, 1942, pp. 174-175), of which Enzmann considered *saffordi* a variety.

Pseudomyrma belti subsp. *venifica* Wheeler

Wheeler, 1942, pp. 162-163.

P. belti subsp. *venifica* E. Enzmann, 1945, p. 81 (MCZ 20538).

Pseudomyrma belti subsp. *bequaerti* Wheeler

Wheeler, 1942, p. 164.

P. belti subsp. *bequaerti* E. Enzmann, 1945, pp. 80-81 (MCZ 23139).

Pseudomyrma latinoda var. *coronata* Wheeler

Wheeler, 1942, pp. 167-168

P. latinoda var. *coronata* E. Enzmann, 1945, p. 88 (MCZ 20542).

Pseudomyrma latinoda subsp. *bradleyi* Wheeler

Wheeler, 1942, p. 169.

P. bradleyi E. Enzmann, 1945, p. 82 (MCZ 22864).

Pseudomyrma sericea var. *acaciarum* Wheeler

Wheeler, 1942, p. 176.

P. sericea var. *acaciorum* [sic!] E. Enzmann, 1945, p. 90
(MCZ 22865).

Pseudomyrma spinicola subsp. *sclerosa* Wheeler

Wheeler, 1942, pp. 180–181.

P. spinicolæ [sic!] var. *infernalis* E. Enzmann, 1945, p. 91
(MCZ 20547).

Pseudomyrma spinicola subsp. *sclerosa* Wheeler

Wheeler, 1942, pp. 181–182.

P. spinicolæ [sic!] var. *sclerosa* E. Enzmann, 1945, pp. 91–
92 (MCZ 23145).

Pseudomyrma triplaris subsp. *baileyi* Wheeler

Wheeler, 1942, pp. 185–186.

P. triplaris subsp. *biolleyi* [sic!] E. Enzmann, 1945, pp.
93–94 (MCZ 20548).

Pseudomyrma triplaris subsp. *tigrina* Wheeler

Wheeler, 1942, p. 186.

P. triplaris subsp. *trigona* [sic!] E. Enzmann, 1945,
pp. 94–95 (MCZ 23147).

Pseudomyrma triplaris subsp. *boxi* Wheeler

Wheeler, 1942, p. 184.

P. triplaris subsp. *boxi* E. Enzmann, 1945, p. 94 (MCZ
23146).

The two following forms which Wheeler saw, but re-
frained from describing, are easily synonymized with
common species of *Pseudomyrma*.

Pseudomyrma gracilis (Fabricius)

Fabricius, 1805, Syst. Piez., p. 405 (*Formica*).

P. gracilis var. *longinoda* E. Enzmann, 1945, p. 87 (MCZ
26812).

Pseudomyrma triplarina (Weddell)

Weddell, 1849, Ann. Sc. Nat. Bot. (3) 13: 40-113,
249-268 (*Myrmica*).

P. arboris-sanctæ Emery, 1894, Bull. Soc. Ent. Ital.,
26: 147.

P. arboris-sanctæ var. *ecuadoriana* E. Enzmann, 1945,
pp. 79-80 (MCZ 26809).

The types of *ecuadoriana* are few, partially fragmented, and accompanied by what appear to be *Azteca* workers glued to the card with the *ecuadoriana*. I can see no characters which distinguish them (*ecuadoriana*) from a series of *triplarina* workers from several South American localities in the Wheeler Collection.

Following the publication of Dr. Enzmann's paper on *Pseudomyrma*, others were published by his daughter, Miss Jane Enzmann. All but one of the species described, however, appear to be synonyms of common Nearctic forms. Dr. William S. Creighton has discussed these forms with me, and I am grateful for his opinions on several obscure cases. His forthcoming book, which amounts to a revision of North American ants, will also carry notes on the synonymy of these forms, but technical difficulties prevent him from dealing with them at any length. Most species treated below involve Enzmannian names, but several other forms of older authors are changed in status as well.

Myrmecina americana Emery

M. latreillei subsp. *americana* Emery, 1895, Zool. Jahrb. Syst., 8: 271.

M. latreillei subsp. *americana* var. *brevispinosa* Emery, idem., p. 271.

M. graminicola subsp. *quadrispina* J. Enzmann, 1946, Jour. N. Y. Ent. Soc., 54: 13-15, figs. 1, 2, worker.

In the manuscript of his work on North American ants, which he has kindly allowed me to examine, Dr. Creighton has raised the form known for many years as *Myrmecina graminicola* subsp. *americana* to the rank of species.

There appears little objection to this move, though the differences between the Palearctic *graminicola* and the Nearctic form are very slight. The forms *quadrispina* and *brevispinosa*, however, cannot be considered valid forms.

The Enzmannian subspecies (*quadrispina*) was taken (holotype worker) on the south slope of the Blue Hills, a rather restricted elevated area just outside Boston, Massachusetts. Two colonies collected by me in this locality were confined for several months in artificial nests. Specimens killed at the time of collection and others examined after two months of rearing show a wide range of variation in size, sculpture and color. The larger workers, mostly those killed at the time of collection, agree well with the description and figures, as well as my impressions, gained from a rather cursory examination of the type, of *quadrispina*. These workers also agree with Emery's original description of *americana* and with specimens identified as *americana* by Wheeler and by Creighton.

My nests also produced, after a month or so of starvation conditions, small light-colored workers corresponding well with published descriptions of *brevispinosa* and with specimens determined as such in the Wheeler Collection. These workers were raised from small larvae during a period in which the colonies refused all types of prepared foods, including bread and fats. When ripe seed-heads of timothy and some small herbaceous plants were later introduced, the colony eagerly accepted the seeds as food, but the workers which had previously hatched never became, even after four weeks, as fully colored as the workers reared in the wild. I conclude that the variant *brevispinosa* is merely the stunted workers from either an incipient or poorly-nourished colony.

Both my nests were taken under large, well-embedded stones in a rich, shady beech woods. Each colony occupied a small oval chamber in the soil, about three quarters of an inch in greatest diameter and less than a quarter inch deep, with the smooth lower surface of the stone

forming the immediate roof. The artificial nests were set up on the evening of collection (June 10). A few males also developed from the larvae taken with the nests, and these pupated during early August and developed into adults in late August. All the males escaped both nests through cracks during one night in early September, presumably on nuptial flight, since they had not previously attempted to leave the brood chamber which the ants constructed at the end of each nest from small particles of earth that had been scattered over the nest floor. These chambers were an almost exact replica of the ones found under the stones, open at the top and with a small passage at one side.

The queens never left the brood except on the occasion of the introduction of the first grass seed, when all the workers and one queen left the brood and examined the seeds. The queen returned after a brief period and resumed her watch over the brood.

In studying various *Myrmecina* in the Wheeler Collection, I have seen other forms of very doubtful validity. All these are presently considered subspecies of *graminicola*, under which Wheeler placed them in his original descriptions. *Texana* is supposed to differ from *americana* by its "scotch grain" shagreening of the first gastric segment. However, specimens from many localities in the states east of the Mississippi also possess this characteristic to a varying degree, and specimens from North Carolina and northern Ohio show much heavier sculpture of this type than do the *texana* types. The *texana* types, however, do seem to differ slightly from *americana* in having a much less definitely longitudinal orientation to the rugulation of the head, with the longitudinal rugæ having many prominent transverse spurs and branches. Other Texan specimens I have seen all belong to the typical *americana*, including a specimen identified by Wheeler as *texana*. Since sculpture appears to be one of the several very unstable features of Holarctic *Myrmecina*, I believe that further collecting in Texas and Mexico will show that this form is synonymous with *americana*.

Wheeler's two Oriental forms, *graminicola* subsp. *nipponica* and *graminicola* subsp. *sinensis*, are also doubtful. The former has the anterior clypeal tubercles developed much as in *graminicola*, and seems hardly separable from that form. The latter has the clypeal tubercles reduced and seems scarcely distinguishable from *americana*. I should not be surprised if *sinensis* were to prove to be the same as *sicula*, from the southern Palearctic region; or if both of these (*sicula* and *sinensis*) were identical to *americana*. In fact, the entire Holarctic *Myrmecina* fauna may end by being considered as one huge species cline in which the geographical races have not yet become sufficiently isolated to form distinct subspecies exclusively inhabiting a given area.

Tetramorium cespitum (Linnæus)

Linnæus, 1785, Syst. Nat. (Ed. 10), 1: 581 (*Formica*)

Myrmica (*Myrmica*) *brevinodis* var. *transversinodis*
J. Enzmann, 1946, Journ. N. Y. Ent. Soc., 54: 47-49, figs. 1, 2, worker.

Dr. Creighton and I are in complete agreement that this form (*transversinodis*) must be added to the long list of synonyms of the common pavement ant. Although I have not seen the type, the description, figures and notes on the habits leave little doubt of the correct placement. This ant should not be mistaken for *Myrmica lævinodis*, listed under various names and possibly a subspecies of *M. rubra*, which is an introduced form quite common in the Boston area. *M. lævinodis* sometimes enters houses, but then as solitary individuals probably brought in on clothing, as has been my frequent observation in Cambridge. This *Myrmica* possesses a very potent sting, the effects of which may last for several hours.

Crematogaster lineolata (Say)

Say, 1836, Boston Jour. Nat. Hist., 1: 290,
all castes (*Myrmica*).

C. lineolata cerasi var. *punctinodis* J. Enzmann, 1946,
Jour. N. Y. Ent. Soc., 54: 91-92, pl. 2, fig. 7, all
castes.

C. lineolata cerasi var. *wheldeni* J. Enzmann, idem., p. 92, worker.

Dr. Creighton and I agree that these two forms either represent the typical *lineolata* or intergrade with what Dr. Creighton considers subsp. *subopaca*. Enzmann has raised *cerasi* Fitch to subspecific rank, but Dr. Creighton's forthcoming book will show that this name must be dropped.

Crematogaster vermiculata Emery

Emery, 1895, Zool. Jahrb. Syst., 8: 286.

Considered impossible of exact determination, but probably equivalent to *vermiculata* or an intergrade between *vermiculata* and a subspecies, are three forms described in a paper by Jane Enzmann in 1946.³ These all have in common the name *coachellai* and the subgeneric classification as *Crematogaster (Acrocælia)*, but here the consistency ends. The synonymous forms with page references to Miss. Enzmann's paper are as follows: *C. lineolata* subsp. *coachellai* "E. Enz. in lit.," p. 93, sec. iii. *C. sanguinea* subsp. *coachellai* "E. Enzmann, in lit.," p. 95, couplet 19. *C. lineolata* var. *coachellai* J. Enzmann, Pl. 2 (p. 97), fig. 3.

The first of these three names is given in a grouped list with a superficial characterization of major sections only, the second appears in a dichotomous key, and the third appears in the legend to the plate. It is doubtful whether or not the authorship should be ascribed to E. Enzmann for the first two of these, even though it seems clear that such was intended. The types of these forms have not been made available to me for study, so I consider the form *coachellai* unrecognizable in the absence of a proper description.

In still another paper by Jane Enzmann⁴ the tribe *Aphanogastrini* is set up, a category which is untenable. The genera included in this "tribe" have numerous intergrades with other groups of the *Pheidolini*,⁵ to which

³ Jour. N. Y. Ent. Soc., 54: 91-92 (1946).

⁴ Journ. N. Y. Ent. Soc., 55: 147-152, (1947).

⁵ *Pheidolini* Emery, Rend. Acad. Sc. Bologna, (1913-14).

Aphænogaster and *Novomessor* clearly belong. One astounding error is the appearance of *Lobognathus* as a *sub-genus* in the key on page 152. This appeared to be miscopy of a large label earlier placed by Dr. Creighton on an unidentified specimen of *Veromessor*: Creighton's label in the Wheeler Collection reads "*lobognathus* new subspecies." The name must be considered a *lapsus* and a synonym of *Veromessor*.⁶

Two of the species described in this paper are minor workers, probably from incipient nests, of two well-known North American ants, which are listed below.

Novomessor albisetosus (Mayr)

Mayr, 1886, Verh. Zool.-bot. Ges. Wien, **36**: 443-446,
(*Aphænogaster*).

N. cockerelli var. *minor* J. Enzmann, 1947, pp. 147-148,
Pl. 8, top.

Aphænogaster fulva Roger

Roger, 1863, Berl. Ent. Zeitschrift, **7**: 190.

Aphænogaster fulva var. *rubida* J. Enzmann, 1947, pp.
147-148, Pl. 8, bottom.

I have not considered other Enzmannian forms because of my unfamiliarity with the groups concerned and because of my lack of time and taste for the task. The publications considered above should certainly suggest to all who examine them the need for some means of formal nullification of the published extremes of such irresponsible taxonomy.

⁶ *Veromessor* Forel, 1917, Bull. Soc. Vaud. Sc. Nat., **51**: 235 (described as subgenus of *Novomessor*).

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ON A SMALL COLLECTION OF FULGOROIDEA (HOMOPTERA) FROM THE VIRGIN ISLANDS¹

BY R. G. FENNAH

Entomologist, Food-crop Pests Investigation,
Windward and Leeward Islands

The Virgin Islands, which lie between 18°55 N. 64°10 W. and 18°25 N. 65°00 W., are the eastern outliers of the Greater Antilles. St. Thomas, the westernmost, is separated by a channel 30 miles wide from Culebra, off Puerto Rico, while St. John is 70 miles from the St. Barts group to the south. St. Croix, though politically grouped with the Virgin Islands, is not considered here as it stands apart from the chain of islands between St. Thomas and Anegada.

The natural vegetation of these islands consists to an overwhelming extent of dry scrub. At the summit of the highest points occur small patches of woodland with the characteristics of true mountain forest.

As far as Fulgoroidea are concerned, the affinities of the fauna are unquestionably with that of Puerto Rico, and it would seem (in the absence of collections from the St. Barts group) that the islands represent the furthest limit of some of the Greater Antillean species. Of the species discussed below *Bothriocera eborea* Fenn. and *Sogata furcifera* (Horv.) are the only two which range southward through the Leeward and Windward Islands: *Oliarus campestris* Fenn., *Petrusa marginata*

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

(Brunn.) and *Melormenis quadripunctata* (F.) occur in the Greater Antilles and in the Leeward Islands (Anguilla, St. Kitts, Nevis, Montserrat) but not in the Windward Islands; *Cubana tortriciformis* Muir is represented in the Lesser Antilles by very close geographical equivalents grouped around the St. Vincent *Cubana tortrix* Uhl.; *Neurotmeta* occurs as far south as Dominica; *Oliarus campestris* is very clearly replaced in the Windward Islands and Trinidad by *O. maidis* Fenn. The group of species or subspecies closely resembling *Acanalonia depressa* Mel. has no representatives in the Lesser Antilles, while the *Thionia* described below is not very close to any Lesser Antillean species. The genera *Ladella*, *Remosa*, and *Tangella* and the flatid *Parthenormenis* described below do not occur in the Lesser Antilles and have no obvious equivalents there, though by contrast the forest-dwelling *Chasmacephala* of the Windward Islands clearly shares a common ancestry with the Greater Antillean *Parahydriena* and *Cyphoceratops*.

In so small a collection little significance can be attached to the absence of species but, in view of their abundance in the Leeward Islands as far north as Anguilla, the writer would have expected to find a species of *Ilesia* among the flatids of the littoral zone. The genus *Antillormenis* does not reach northward of the Leeward Islands and even here occurs only in Montserrat.

CIXIIDÆ

Cubana Uhler

Uhler 1895 *Proc. Zool. Soc. Lond.*: 62. Haplotype, *Cubana tortrix* Uhler *loc. cit.*: 62.

Cubana tortriciformis Muir

Muir 1924 *Proc. Haw. Ent. Soc.* 5, 3: 461.

A single female taken by the writer at Road Town, Tortola (Feb. 25, 1944) is assigned to this species. The specimen differs from the type of *C. tortrix* only in having the distal fuscous line in the tegminal membrane overlying cell R2 and the large spot basad of it biconcave on its inner face. It is probable that *Pintalia alta* Osborn is this species.

Oliarus (*Melanoliarus*) Fenn.

Fennah 1945 *Proc. Biol. Soc. Wash.* 58: 141. Subgenotype, *Oliarus maidis* Fenn. 1945 *Proc. U. S. Nat. Mus.* 95: 423.

Oliarus (*Melanoliarus*) *campestris* Fenn.

Fennah 1945 *loc. cit.*: 141.

One male was taken by the writer on Jost Van Dyke (Feb. 18, 1944). In this subgenus of *Oliarus* each ovary comprises sixteen ovarioles. In the closely allied genus *Vincentia* each ovary has eighteen ovarioles.

Bothriocera Burm.

Burmeister 1835 *Handbuch der Entomologie*: 156. Haplo-type, *Bothriocera tinealis* Burmeister *loc. cit.*: 156.

Bothriocera eborea Fenn.

Fennah 1943 *Psyche* 52: 14.

Three males and four females were taken by the writer on Jost Van Dyke on *Coccoloba uvifera* (Feb. 18, 1944), and two males and eight females on Tortola (Feb. 15-17, 1944).

DELPHACIDÆ

Sogata Distant

Distant 1906 *F. B. I.* 3: 471. Orthotype, *Sogata dohertyi* Distant *loc. cit.*: 471.

Sogata furcifera (Horv.)

Delphax furcifer Horvath 1899 *Term. Fuz.* 22: 372.

One male taken by the writer at Road Town, Tortola (Feb. 14, 1944). This generic assignment is merely provisional pending revision of the family.

TROPIDUCHIDÆ

The tropiduchid fauna of Central America and the West Indies is rich in genera and nomenclatorial confusion has arisen as a result of changed conceptions of generic limits. In his classification of the family Melichar accorded tribal status to genera in which a costal area with transverse veinlets is present in the tegmina; genera within this group characterised by marked elonga-

tion of the vertex were separated as a further tribe (Peggiogini). These tribal characters are not rigorous in their application, but intergrade with those found in the Tambiniini both in West Indian and Australasian genera. The development of a costal area, for example, may vary within a single genus. The South American *Rotunosa indicanda* (Wlk.) has a narrow costal area with distinct transverse veinlets in the distal part of the corium; nearer the base the costal area narrows and these veinlets progressively merge into the membrane, where they are visible only as faint striæ, and finally disappear. In *Rotunosa grandis* (Fenn.) the costal vein is slightly submarginal and devoid of transverse veinlets, though towards the node faint transverse striæ can be detected. This condition can be matched elsewhere in tambiniine Tropiciduchidæ. As far as American genera are concerned the writer proposes to regard all in which the antennæ are short, with the second joint subglobose, the mesonotum less than 1.5 times as broad as long with the lateral discal carinæ parallel in their basal half, the tegmina thin and subhyaline, with a line of transverse veins between the node and apex of the clavus as belonging to a single subfamily. This group appears to be naturally related to the Old World *Tropiciduchus*.

A key to the new world genera, based on this view, is given below, being modified from the writer's earlier key to Tambiniini (*sensu* Melichar).

KEY TO NEW WORLD GENERA OF TROPIDUCHINI

- (1) (2) Tegmina with a distinct costal area, subequal in width to costal cell, traversed by veinlets to margin for most of length (3)
- (2) (1) Tegmina with costal vein marginal, or very narrowly separated, no veinlets to margin along most of length (11)
- (3) (4) Vertex twice as long as broad or nearly so
Pseudotangia Metcalf
- (4) (3) Vertex relatively shorter (5)
- (5) (6) Vertex as long as broad or slightly longer than broad (7)
- (6) (5) Vertex broader than long (9)

- (7) (8) Frons with an oblique ridge distally on each side of middle *Vanuoides* Metcalf
- (8) (7) Frons with median carina only *Ladella* Stål
- (9) (10) Median carina of vertex Λ -shaped
Tangyria Uhler
- (10) (9) Median carina simple, not forked basally
Tangella Metcalf and Bruner
- (11) (12) Vertex as long as pronotum and mesonotum, more than twice as long as broad (13)
- (12) (11) Vertex produced before eyes but not greatly prolonged anteriorly (15)
- (13) (14) Vertex with median carina simple to base
Remosa Distant
- (14) (13) Vertex with median carina forked basally
Rotunosa Distant
- (15) (16) Tegmina with one or no transverse line distad of nodal line (17)
- (16) (15) Tegmina with numerous irregular cross-veins in membrane (25)
- (17) (18) Vertex distinctly longer than broad (19)
- (18) (17) Vertex not longer than broad (21)
- (19) (20) Tegmina with a row of subapical areoles distad of nodal line *Athestia* Melichar
- (20) (19) Tegmina with only apical areoles distad of nodal line, no subapical line *Biruga* Fennah
- (21) (22) Vertex three times as broad as long
Colgorma Kirkaldy
- (22) (21) Vertex twice as broad as long, or less (23)
- (23) (24) Species more than 7 mm. long; lateral pronotal fields and mesopleurites green
Neorudia Fennah
- (24) (23) Species less than 7 mm. long; lateral pronotal fields at margin and a spot on mesopleurites piceous *Amapala* Melichar
- (25) (26) Vertex with median carina simple, unbranched basally (27)
- (26) (25) Vertex with median carina λ or Λ -shaped (33)
- (27) (28) Frons ecarinate, sides of vertex parallel
Pelitropis Van Duzee
- (28) (27) Frons medially carinate (29)

- (29) (30) Tegmina with M not forked before nodal line; two irregular ranks of transverse veins in membrane distad of nodal line *Amaclardea* Muir
- (30) (29) Tegmina with M forked before nodal line, more than two ranks of irregular transverse veins in membrane (31)
- (31) (32) Media forking near base of tegmen
Monopsis Spinola
- (32) (31) Media forking near middle of tegmen
Neurotmeta Guérin-Méneville
- (33) (34) Vertex with median carina λ -shaped (35)
- (34) (33) Vertex with median carina Λ -shaped (39)
- (35) (36) Vertex longer than broad, directed upward distally *Dictyotangia* Fennah
- (36) (35) Vertex not longer in middle line than broad across base (37)
- (37) (38) Vertex as broad as long in middle, lateral margins of frons not meeting lateral margins of vertex, a broad callus on anterior margin of vertex *Aripoa* Fennah
- (38) (37) Vertex broader than long, lateral margins of frons meeting lateral margins of vertex, anterior margin of vertex not callused
Neotangia Melichar
- (39) (40) Submarginal carinæ of pronotum obsolete, represented only by a hump, species about 6 mm. long, tawny, marked with spots of darker brown *Tangidia* Uhler
- (40) (39) Submarginal carinæ of pronotum very sharp, arcuate, species about 8.6 mm. long, uniformly pale green *Dioxyomus* Fennah

Ladella Stål

Stål 1859 *Berl. Ent. Zeit.* 3: 319. Haplotype, *Monopsis pallida* Wlk.

Ladella pallida (Wlk.)

Monopsis pallida Walker 85. List Hom. 2: 325.

The figures were kindly made by Mr. W. E. China from the type. It is very distinct from the Puerto Rican species identified as *Monopsis pallida* by Stål and figured

by Melichar (1914 *Ver. Nat. Ver. Brunn* 53: 106). The latter species, based on Stål's labelled specimen in the Berlin collection, requires a new name, for which *Ladella stáli* is now proposed.

Tangella Metcalf and Bruner

Metcalf and Bruner 1930 *Psyche* 37, 4: 397. Orthotype
Tangia kraatzi Stål *Berl. Ent. Zeit.* 3: 318.

Tangella schaumii (Stål)

Tangia schaumii Stål 1859 *Berl. Ent. Zeit.* 3: 318.

Male. Length, 5.6 mm.; tegmen, 4.9 mm.

Vertex 3.3 times as broad as long in middle line, medially carinate, carina broad, obsolete at apex, simple at base; frons in middle line 1.5 times as long as broad, a broad callus across basal margin, median carina rather broad. Pronotum with disc large, carinæ stout, two carinæ at each lateral margin between eye and tegula; mesonotum relatively long, lateral carinæ of disc parallel in basal half. Tegmina with costal area broad with about 14 transverse veinlets, nodal line straight, Sc + R fork distad of M fork which is distad of Cu 1 fork, none of these veins forked again before nodal line, membrane with five or six irregular ranks of transverse veinlets, about 16 cells adjoining apical margin between node and apex of clavus. Post-tibiæ with three spines.

Anal segment relatively narrow, each lateral angle produced into a spatulate vertical lobe. Ædeagus laterally flattened, upcurved distally, a long spine lying below it on left, bent across to right and curved upward at apex, a group of four processes at apex of ædeagus, the basal process sinuate and spinose, the lateral flattened, symmetrical, pointed distally, the median acicular.

Redescribed from a male taken, along with a nymph, on Jost Van Dyke (Feb. 18, 1944).

Tangyria Uhler

Uhler 1901 *Proc. Ent. Soc. Wash.* 4.: 512. Haplotype,
Tangyria frontalis Uhl.

Tangyria frontalis Uhler

Uhler 1901 *loc. cit.*: 512.

The figures, made by the writer from a female specimen from Port au Prince, Haiti, in the U. S. National Museum bearing Uhler's label, are published to facilitate identification of this genus.

Amaclardea Muir

Muir 1931 *Ann. Mag. Nat. Hist.* (10) 7: 301. Orthotype, *Amaclardea gowdeyi* Muir.

Amaclardea gowdeyi Muir

Muir 1931 *loc. cit.*: 302.

The figures were made by Mr. China from the type. The genus has not yet been reported outside Jamaica.

Neurotmeta Guérin-Ménéville

Guérin-Ménéville 1856 *Hist. Fisica. Homopt.*: 180. Logotype, *Neurotmeta sponsa* Guérin-Ménéville.

Neurotmeta viridis (Wlk.)

Monopsis viridis Walker 1851 *List Hom.* 2: 325.

Ædeagus with two short spines closely approximated and directed caudad lying adpressed to ventral surface, the spine on left slightly curved laterad at apex; apical portion of ædeagus membranous, with a broad opening on right side, an aciculate porrect sclerotised and pigmented spine near dorsal margin directed caudad, a broad tapering process near ventral margin on right, rather flattened, somewhat sclerotised but not pigmented, curved dorsad distally, acute at apex.

The Lesser Antillean representatives of *Neurotmeta* agree with the species before the writer in all adult structures examined, with the exception of the ædeagal armature, which differs considerably in detail, although conforming to a standard basic pattern of two or three ventral spines along the ventral margin, and from one to four processes directed caudad on the apical membranous portion.

One male and four females and a nymph taken by the writer on *Coccoloba uvifera*, Virgin Gorda (Feb. 11,

1944), and one female and two nymphs on the same host, Tortola (Feb. 21, 1944). Walker's type from St. Thomas is a female, and the above assignment requires confirmation.

Colgorma Kirkaldy

Kirkaldy 1904 *Ent.* 37: 279. Orthotype, *Achilus dilutus* Stål.

Colgorma diluta (Stål)

Achilus dilutus Stål 1859 *Eugen. Resa.* 4: 271.

This genus superficially resembles the following, but is readily separated by the tribal character of a relatively long mesonotum. The frons of the type species is longer than broad (1.3:1) and medially longitudinally tumid rather than carinate.

Tangiopsis Uhler

Uhler 1901 *Proc. Ent. Soc. Wash.* 4: 512. Haplotype, *Tangiopsis tetrastichus* Uhler.

Tangiopsis tetrastichus Uhler

Uhler 1901 *loc. cit.*: 513.

The figures are of the Haitian type in the U. S. National Museum, and are given merely to illustrate the differences between *Tangiopsis* and *Colgorma*, as no material of either genus is to hand from the Virgin Islands.

ACANALONIIDÆ

Acanalonia Spinola

Spinola 1839 *Ann. Soc. Ent. France.* (1) 8: 447. Haplotype, *Acanalonia servillei* Spin.

Acanalonia depressa Melichar

Melichar 1901 *Ann. K. K. Nat. Hist. Hofmus* 16, 3: 190, pl. 1, fig. 6.

Ædeagus submembranous, not pigmented, a broad fold laterally on each side near base, narrowing distally into a ribbon-like process which recurves at apex and lies below ædeagus to its base, giving off a small S-shaped spine

laterally, and truncate at apex; remaining portions as figured.

Two males taken by the writer on Jost Van Dyke (Feb. 18, 1944). These specimens differ from Melichar's description and figure only in the profile of the head. According to Dr. Paul Oman, material from St. Thomas and St. Croix differs from the Puerto Rican *A. brevifrons* Muir in being smaller, and having the vertex more sharply declivous, the portion of the head in front of the lateral frontal carinæ shorter, the costal margin of the tegmina more strongly curved and the anterior portion of the apical margin more broadly rounded. The male genitalia of the specimen before the writer are very close to those of *A. impressa* Metc. and Bruner. The species is evidently polytypic and the taxonomic relationship of its members might be most appropriately expressed by regarding *brevifrons* and *impressa* as geographical subspecies.

ISSIDÆ

Thionia Stål

Stål 1859 *Berl. Ent. Zeit.* 3: 321. Logotype, *Issus longipennis* Spinola 1839 *Ann. Soc. Ent. France* (1) 8: 348.

Thionia argo sp. n.

Male. Length, 5.8 mm.; tegmen, 4.3 mm. Female. Length, 6.7 mm.; tegmen, 5.0 mm.

Vertex broader than long in middle line (1.5:1), slightly depressed, anteriorly transverse, posteriorly angulately excavate, frons very slightly longer than broad, median carina most prominent in basal half, four callosities on each side near margin, lateral discal carinæ visible only near base where they curve to unite at middle. Posttibiæ bispinose.

Fuscous; all carinæ and margins, parallel oblique striæ on clypeus, minute speckling on frons, vertex, pro- and mesonotum, and sometimes a transverse bar in basal third of frons, and abdominal ventrites testaceous; sides of head on concealed surface behind eyes and a round spot in each lateral field of pronotum piceous. Tegmina

translucent, testaceous, marbled with fuscous, though not in basal third of corium, three oval spots in cell R, a similar spot basally and a fainter spot distally in cell M 3+4 fuscous-piceous. Veins fuscous-piceous, paler in clavus. Transverse veins mostly pallid.

Anal segment of male elongate-rhomboidal, convex-truncate at apex, anal foramen near middle. *Æ*edeagus moderately short, tubular, curved upward distally, dorsal margin with an eminence on each side at base and at middle, the latter bearing a short tooth directed caudad, a pair of long spines arising laterally at middle, curved outward, cephalad and finally mesad; *æ*edeagus distally reflected anteriorly in the form of a trough, striate and membranous. Genital styles short and stout, subtriangular, expanding distally; apical process broad, hollowed out on its anterior surface, minutely pointed at apex and with a crescentic plate attached laterally near its base.

Anal segment of female very long distad of anal foramen, deeply rounded at apex.

Nymph with vertex relatively shorter than in adult, the pro- and mesotibiæ distinctly foliate and post-tibiæ four-spined.

Described from four males and seven females and four nymphs taken by the writer on Jost Van Dyke (Feb. 18, 1944). This species may well prove to be closely allied to the Puerto Rican *Thionia borinquensis* Doz. and the Jamaican *Thionia impressa* Melichar, though it differs markedly in the coloration of the tegmina. Holotype ♂ and allotype ♀ at Mus. Comp. Zool. No. 27819.

FLATIDÆ

Parthenormenis gen. nov.

Frons as long as broad, apical margin little shorter than basal, lateral margins shallowly arcuate; vertex obsolete. Pronotum anteriorly roundly convex, posteriorly subangulately concave, a distinct broad callus along anterior margin near middle, a slight median sulcus posteriorly; mesonotum not inflated with median carina indicated only at base, lateral carinæ feebly present

throughout; post-tibiæ bispinose, abdomen dorsally rounded, not conical. Tegmina moderately expanding distally, costal margin straight distad of middle, apical margin straight, apical angle rounded, sutural angle rectangulate, rather abruptly rounded, costal area slightly narrower than costal cell one third from base, costal veinlets shorter than apical veins, apical veins mostly forked, apical line slightly irregular but distinct, joining costa anteriorly, nodal line indistinguishable, Sc simple to apex, R forking near middle of tegmen, M forking slightly basad of R fork, Cu 1 forking basad of M fork. Wings with R simple to apex, M with two branches, Cu 1 with five branches.

Anal segment of female broadly ovate, indented at apex, anal foramen relatively small. Ovipositor with third valvulæ each armed with nine or ten stout spines in two rows, with a single spine situated on inner face remote from margin.

Type species, *Parthenormenis sanctæ-ursulæ* sp. n.

Parthenormenis sanctæ-ursulæ sp. n.

Female. Length, 6.0 mm.; tegmen, 6.2 mm.

Testaceous-yellowish; pronotum and mesonotum clouded fuscous, legs faintly so; abdomen pallid, sclerotised portions of genitalia piceous. Tegmina translucent, brownish, anterior half of costal membrane and transverse veinlets just basad of apical line of cross-veins pallid; base of costal cell, except at margin, and base of clavus deeply infuscate. Veins on corium deeply fuscous, on membrane concolorous. Wings infuscate, veins dark fuscous. Insect in life powdered brownish or pruinose, somewhat variegated.

Ovipositor with third valvulæ armed on posterior margin with a row of five or six stout teeth; basad of this an inner row of two or three teeth, and a single tooth still further basad on inner face.

Described from a single female taken by the writer at 1,000 ft., Tortola (Feb. 20, 1944). Type at Mus. Comp. Zool. No. 27930. The genus, to which at present only this species is referred, is distinguished by having the

apical margin of the tegmina transverse, not oblique, and the sutural angle boldly, though not sharply, rectangulate, and by the armature of the third valvulæ. It differs from *Ormenoides* Mel. in the shape of the frons, and from *Ormenana* Metc. in that of the tegmina.

Melormenis Metcalf

Metcalf 1938 *Bull. Mus. Comp. Zool.* 82, 5: 395. Orthotype, *Cicada quadripunctata* F.

Melormenis quadripunctata (F.)

Cicada quadripunctata Fabricius 1794 *Ent. Syst.* 4: 30.

Ten males and eight females, Jost Van Dyke (Feb. 18, 1944), twenty-six males and sixteen females, Tortola (Feb. 14-17, 19-24, 1944), three males, Virgin Gorda (Feb. 11, 1944).

Petrusa Stål

Stål 1869 *Hem. Fabr.* 2: 111; (1866 *Hem. Afr.*: 237).

Haplotype, *Cicada marginata* Brunnich.

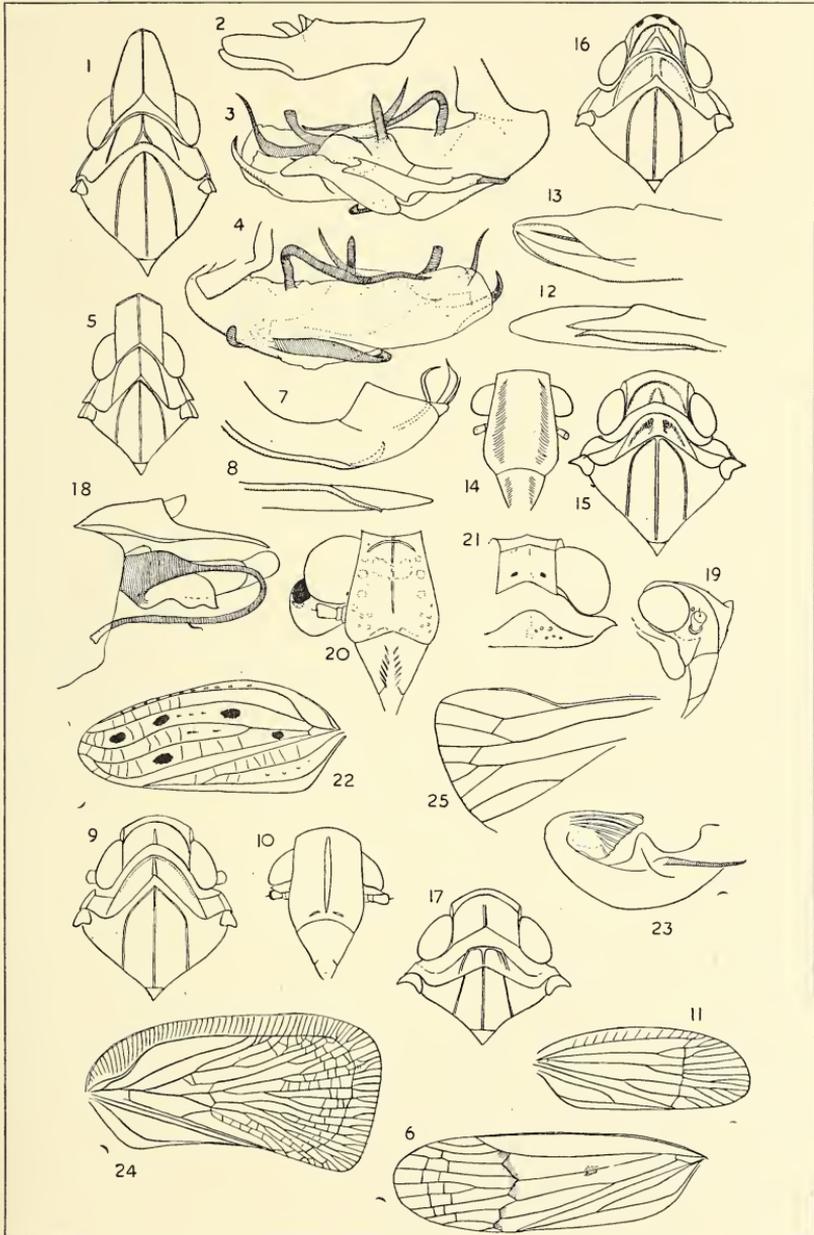
Petrusa marginata (Brunnich)

Cicada marginata Brunnich 1767, in Linné *Syst. Nat.* 1 (2): 710.

Four males and ten females taken by the writer on Jost Van Dyke (Feb. 18, 1944), six males and seven females, Tortola (Feb. 14-17, 1944), eight males and four females, Virgin Gorda (Feb. 11, 1944). Both color forms are represented in each batch of material.

EXPLANATION OF PLATE 4

1. *Ladella pallida* (Wlk.) vertex, pronotum and mesonotum.
2. idem, anal segment of male, ventrolateral view.
3. idem, ædeagus, right side.
4. idem, ædeagus, left side.
5. *Amaclardea gowdeyi* Muir, vertex, pronotum and mesonotum.
6. idem, tegmen.
7. *Tangella schaumii* (Stål), ædeagus, left side.
8. idem, ædeagus, ventral view.
9. idem, vertex, pronotum and mesonotum.
10. idem, frons and clypeus.
11. idem, tegmen.
12. *Neurotmeta viridis* (Wlk.), ædeagus, ventral view.
13. idem, ædeagus, right side.
14. *Colgorma diluta* (Stål) frons and basal part of clypeus.
15. idem, vertex, pronotum and mesonotum.
16. *Tangyria frontalis* Uhl., vertex, pronotum and mesonotum.
17. *Tangiopsis tetrastichus* Uhl., vertex, pronotum and mesonotum.
18. *Acanalonia depressa* Mel., anal segment and ædeagus, left side.
19. idem, head in profile.
20. *Thionia argo* Fenn., frons and clypeus.
21. idem, vertex and pronotum.
22. idem, tegmen.
23. idem, ædeagus, left side.
24. *Parthenormenis sanctæ-ursulæ* Fenn., tegmen.
25. idem, apical portion of wing.



FENNAH—FULGOROIDEA

A NEW GENUS AND SPECIES OF THERIDIIDÆ
FROM EASTERN TEXAS (ARANEÆ)¹

BY ELIZABETH B. BRYANT

Museum of Comparative Zoology

Among some material sent me several years ago, by Miss Sarah E. Jones collected by her at Dallas, Texas, was a small male spider which particularly attracted my attention. Tentatively I placed it in the little known genus *Umfila* Keyserling, (Theridiidæ), based on a single species from Brazil. Recently, I had the pleasure of showing it to Dr. Alexander Petrunkevitch of Yale University. He kindly called my attention to characters which certainly preclude it from that genus and suggested that a new genus be erected for it.

Genus *Mufila* gen. nov.

Cephalothorax about as wide as long, anterior margin broadly convex, longer than the posterior margin, cephalic portion rather high, thoracic groove long, in a depression; *eyes* closely grouped, differing little in size, anterior row slightly recurved, a.m.e. largest of the eight, posterior row almost straight, lateral eyes touching; *quadrangle* wider in front and not as high as wide; *clypeus* very high, about three times the height of the quadrangle; *mouth parts* weak; *sternum* oval, three-quarters as wide as long, anterior margin rounded, posterior margin pointed and extending between the fourth coxæ; *abdomen* narrow, pointed above the spinnerets, with a corneous ridge at the base which connects with a large epigastric scutum; *legs*, 4-1-2-3, with no spines, a tarsal comb of 6 to 7 curved bristles on the fourth metatarsus; *palpus* large, patella short and much rounded on the dorsal side, tibia small. Female not known.

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

Genotype: *Mufila texana* spec. nov.

The genus *Mufila* probably belongs with the *Asageninae*, as a remnant of a stridulating organ remains on the base of the abdomen. It differs from the other genera in that sub-family by the very broad cephalothorax, the high clypeus and the closely grouped eyes that vary little in size. It differs from the genus *Umfila* Keys. by the cephalothorax which is as wide as long, the very high clypeus, the pointed sternum, and the lack of a dorsal scutum on the abdomen.

Mufila texana spec. nov.

Figure 1

Male. Length, 2.5 mm., ceph. 1.2 mm. long, 1.2 mm. wide, abd. 1.4 mm. long, 0.7 mm. wide.

Cephalothorax golden brown, shining, with a few short hairs below the a.m.e., almost circular, anterior margin strongly convex, and wider than the posterior margin, sides rounded, almost flat, cephalic portion highest, thoracic groove long and deep, in a depressed area; *eyes* closely grouped, area slightly elevated, each eye heavily ringed with black, and not varying much in size, anterior row slightly recurved, a.m.e. largest of the eight, separated by about a diameter and from the a.l.e. by a little less, posterior row the same length as the anterior row, almost straight, eyes equidistant and subequal, p.m.e. separated by little more than a diameter, lateral eyes touching; *quadrangle* wider in front and not as high as wide; *clypeus* Below a.m.e. almost equals three times the ocular area, with a stripe of short dark hairs directed upward, from the margin to the a.m.e.; *mandibles* dark, small and vertical, weak, fang short; *labium* very narrow, more than twice as wide as long, suture between the labium and sternum very indistinct; *maxillae* yellow, shaded with gray, more than twice as long as the labium and strongly inclined; *sternum* bright yellow, darker about the margins, slightly convex, three-quarters as wide as long, anterior margin rounded, posterior margin pointed, first pair of coxæ widely separated, fourth pair

of coxæ separated by more than a diameter and the sternum carried between; *abdomen* oval, pointed above the spinnerets, two-thirds as wide as long, brown with five white spots, at the base a corneous line which may be the remnant of a sound organ, but no cross ridges on the cephalothorax remain, many long scattered hairs from corneous pits, venter pale, with a strongly marked epigastric scutum that covers the basal third and connects

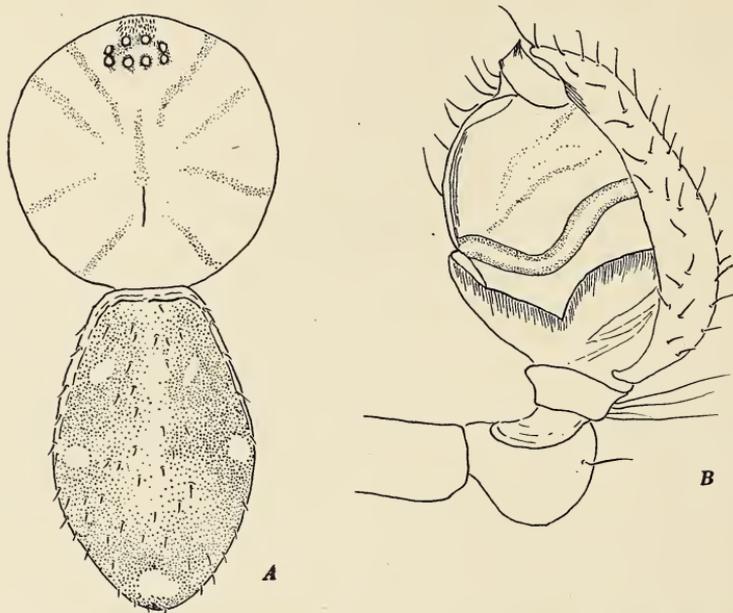


Figure 1. *Mufila texana* spec. nov. ♂. A, Dorsal view. B, Left palpus, lateral view.

with the corneous ridge on the dorsum, a broad dark ring surrounds the spinnerets which may be chitinized, spinnerets small, posterior spiracle probably opens directly anterior to the spinnerets, two small chitinized ovals about the middle of the venter, may be muscle spots;

legs, $\frac{1 \quad 2 \quad 3 \quad 4^*}{2.0 \quad 1.8 \quad 2.0 \quad 2.6}$, rather short, pale yellow, with the

* The leg formula used was suggested by Mrs. Harriet Frizzell and modified by Dr. Alex. Petrunkevitch in "A Study in Amber Spiders," Trans. Conn. Acad., 1942, 34, p. 137. The lower figure represents the length of the leg divided by the length of the carapace.

distal joints darker, femora with a dark anterior lateral line, much fainter on the posterior pairs, all joints with rows of small hairs, no spines, tarsal comb of 6 or 7 curved bristles on the fourth metatarsus; *palpus*, large for the size of the spider, shorter than the cephalothorax, femur pale and bent, other joints dark, patella short and much swollen on the dorsal side, tibia very small and pressed close to the cymbium, palpal organ short, barrel-shaped, embolus probably a short black spine at the tip.

Holotype: ♂ Texas; Dallas, on the outside of a house, 9 July 1936, (Jones); in MCZ.

A CORRECTION.—In *Pysche*, Vol. 56, No. 1, I published a synonymic list involving some species in *Pseudomyrma* and other genera of ants (pp. 41-49). On page 43 occur two errors, the first of which was made at the printing office *after* the page proof had been read by both author and editor. Page 43, line 5, should read "*Pseudomyrma spinicola* subsp. *infernalis*", not "subsp. *sclerosa*." Line 9 on the same page mistakenly omits an "e" from "subsp. *scelerosa*", the latter being Wheeler's original spelling. Enzmann's transcription of the name was "*sclerosa*".—W. L. BROWN, JR., Biological Laboratories, Harvard University.

A NOTE ON *PHEIDOLE* (*MACROPHEIDOLE*)
RHEA WHEELER (HYMENOPTERA:
FORMICIDÆ)

BY ROBERT E. GREGG

Department of Biology, University of Colorado

This species was described by Wheeler (1908), from a single, very large, deälated female collected at Nogales, Arizona. Though later synonymized (Wheeler, 1915), with *Pheidole fimbriata* Roger of tropical America, M. R. Smith (1943), has reviewed in detail the status of *Pheidole rhea*, drawing pertinent distinctions between it and *fimbriata*. He has shown that *rhea* deserves specific rank, and has provided a description of both the soldier and the worker castes.

Through the assistance of Mr. L. F. Byars and Mr. J. B. Zuck, I have received a large series of specimens of *Ph. rhea* from the type locality, representing all castes with the exception of the males. The ants were obtained at different periods from the same colony located near the top of a dry hillside on Washington Drive, Nogales, Arizona. The site was characterized by very rocky soil originally covered with coarse desert grasses and weeds. Fortunately, my wife and I were able to visit the spot in April, 1948, and collect additional material before the nest was completely destroyed by landscaping. It was first discovered under a stone, but had moved after being disturbed. The total number of specimens secured are as follows, according to caste: 201 soldiers, 262 workers (*media*), and 274 workers (*minima*). The species is highly polymorphic, and for convenience several size classes of individuals are grouped as *media*, although no sharp gaps are detectable in the series from largest to smallest individuals. One deälated female was captured by Mr. Zuck from under a stone, and though isolated, is believed to have come from the same nest as

the above series. Dates on which the ants were obtained are March 2, 1947 (wingless female), June 18, 1947; March 29, April 10, April 14, and April 25, 1948. Besides these specimens, a few soldiers and numerous workers have been added to our collection from Colossal Cave State Park, southeast of Tucson, Arizona, which we visited on April 20, 1948. The ants were collected as they foraged for the seeds of various desert plants near the entrance to the cave.

On comparing my material with the detailed descriptions published by Smith for the soldier and worker of *rhea*, it seemed that a new form of the species might be recognized, especially in view of the much greater size of the soldiers in my samples and certain differences in the queen. However, after studying specimens from the Pinal Mountains and the Santa Catalina Mountains of Arizona (sent respectively through the courtesy of the United States National Museum and the Museum of Comparative Zoology), the variability of the species noted by Smith is fully confirmed, and it is impossible to discern adequate bases for erecting a new subspecies at this time. Nevertheless, it is desirable to record certain features of my Nogales specimens which depart from the published accounts.

The great variability and continuous gradation in size from the smallest to the largest individuals makes it difficult to distinguish *rhea* from other species if only the smaller intermediates are available, although its long epinotal spines should suffice. The upper size limit of the soldier has been uncertain, and Smith gives 5.5 mm. as the size for the soldier in his description. He does mention, though, an unusual soldier from Escuinapa, Mexico, which is 8 mm. The soldiers which I have measured reach 9.8 to 10.2 mm. in the largest size class, and may be regarded as the probable upper limit since they approach the queen which is 14.3 mm. (Wheeler). This increase over the 8 mm. linear dimension noted by Smith, is accentuated by the allometric growth in proportions of the head which accompany it, rendering the soldiers quite huge. The width of the soldier head varies from

3.3 mm. to 3.7 mm., while its length, excluding the mandibles, varies from 3.6 mm. to 4.0 mm. All possible intermediates connect the soldier with the smallest worker which measures 3 mm. (Smith), or 4 mm. among my material.

Ph. fimbriata is furnished with tufts of short, dense, erect hairs on the under surfaces of the petiole and post-petiole, while these are absent on *rhea* (s. str.). The ants before me show a few, spaced hairs in those positions. Also, some of the intermediate sizes possess a slender, acute, erect spine on the ventral aspect of the petiolar peduncle, and others show an aborted spine, while most have only a slight elevation. The eyes of the *rhea* soldier have 15 facets, according to Smith, but my examples show only 13 to 14 facets; *fimbriata* has 11 or 12. The color of the largest soldiers and some of the intermediates is somewhat lighter than that indicated in the description, or of those received for study; it is distinctly red on the middle and posterior portions of the head, though the thorax and abdomen are brownish to black.

The single specimen of wingless female in my possession differs also from Wheeler's description of the type, and is probably another indication of the considerable variation to which the species is subject. The head is distinctly broader than long (exclusive of the mandibles), and the posterior border of the orbit is precisely at the middle of the head, rather than in front of it. The clypeus has an obvious median elevation or carina, and a broad, shallow emargination, opposite to the condition of these structures in Wheeler's specimen. The thorax through the wing insertions is as broad or broader than the head through the posterior corners (narrower in *rhea*), the petiole is subquadrate rather than suborbicular, and the mesonotum is not shagreened, but very smooth and shining with a few striations near the middle of the posterior border and on the sides of the anterior border. The gaster is distinctly shagreened and feebly shining. In size, this ant is 14 mm., and therefore not quite as long as Wheeler's specimen.

In view of the fact that Wheeler described *rhea* from a lone female, the marked variability of the other castes subsequently obtained, and the lack of females definitely known to be from the same colony as the series of soldiers and workers in the Nogales nest, it is advisable to withhold description of a new form unless indicated otherwise by additional material.

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EPICAUTA DIVERSICORNIS AND ITS ALLIES
IN THE NEOTROPICAL REGION
(COLEOP., MELOIDÆ)¹

BY F. G. WERNER

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Epicauta diversicornis and related species form a closely-knit group which can be defined as possessing the following characters in the male. Posterior tibiæ with a row of short teeth internally at the apex. First two antennal segments enlarged, denuded except for scattered erect setæ, and shiny, the first not excavated externally at the tip. Anterior tibiæ with a single spur and anterior tarsi with the first segment flattened, usually shiny and expanded.

All of the known species in the group are moderately slender and almost uniform in width (see figure in Champion, 1892). Except for size and color there is great similarity in all the species. None has been seen less than ten millimeters long or more than twenty. Females can be known by the distinctive shape and usually can be placed by color and locality. All the species have a small scutellar and humeral spot on the elytra when fully marked. There are several species outside the group which have females similar to those in the group so that caution should be observed when making determinations.

Attention should be called to the variation that occurs in the width of the first two antennal segments of the male. An example is shown in figures 4 and 5, both of *diversicornis*. This much variation occurs also in *isthmica* and probably in the other species with these segments flattened.

All the known species of *Epicauta* with the posterior tibial comb are restricted to the region from Southwestern

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

United States to Guiana and Colombia. The *diversicornis* group is interesting in that it contains the only species known to occur in South America.

A key to the males of the known species follows. Except where noted, all specimens on which ranges are based have been examined by the author.

1. First antennal segment triangular in cross-section, with three almost flat surfaces 2
 First antennal segment flattened or oval in cross-section, with at most two flat surfaces 4
2. First tarsal segment slightly longer than second, with uniform sparse pubescence. Antennæ as in figure 2. Brown, clothed with cinereous pubescence, which is denser in a line down each elytron. *Mexico*: Nayarit (Tepic), Morelos (Cuernavaca), Yucatan (Chichen Itza) *E. forticornis* (Haag), 1880
 First tarsal segment shorter than second, denuded, shiny 3
3. First two antennal segments equal to rest in length. Black, the elytra luteous, uniformly clothed with cinereous to luteous pubescence. *U.S.*: Texas (Val Verde Co. to El Paso Co.), New Mexico (southern), Arizona (Douglas, Sta. Catalina Mts.). *Mexico*: Nuevo Leon (Monterrey) *E. polingi* Werner, 1943
 First two antennal segments longer than the rest. Brown, with the margins of the elytra paler and with paler pubescence. *U.S.*: Arizona (Maricopa Co. to Gila Co.). *Mexico*: Sonora (Imuris).
 E. liebecki Werner, 1943
 First two antennal segments shorter than the rest. Brown to luteous, with uniform cinereous pubescence. *U.S.*: Arizona (Maricopa Co. to Cochise Co.). *Mexico*: Sonora (Arizpe)
 E. arizonica Werner, 1943
4. Second antennal segment distinctly more than half as long as first. Fig. 1 and fig. 3 5
 Second antennal segment half as long as first or shorter. Fig. 4 to fig. 8. 6
5. First segment of anterior tarsi longer than second, not expanded and with at least scattered pubescence.

Antennæ as in fig. 1. Body brown, elytra luteous, with uniform pale pubescence. *Mexico*: Jalisco (Guadalajara), Nayarit (Tepic, fide Dugès), Morelos (Cuernavaca) *E. humeralis* (Dugès), 1889
 First segment of anterior tarsi shorter and broader than second, partly denuded and shiny. Brown, with the margins of the elytra paler and with a fringe of denser pubescence. Antennæ as in fig. 3. *Guiana* fide Erichson, *Venezuela* (Las Trincheras), *Colombia* (Amaya-Cispata Bay), *Panama* (Ft. Clayton, C.Z.) [= *Lytta intermedia* Haag, 1880]

- E. flagellaria* (Erichson), 1848
6. Second antennal segment distinctly longer than the following three. Fig. 4 and fig. 5. Black or dark brown, the elytra luteous. First segment of the anterior tarsi subequal to second, slightly expanded, shiny. *Mexico*: Sinaloa (Mazatlan, Venodio), Nayarit (Tepic), Jalisco (Guadalajara), Michoacan (Apatzingan), Hidalgo (Pachuca), D.F. (Mexico City), Morelos (Cuernavaca), Guerrero (Acapulco), Vera Cruz (Cordoba). [= *Macrobasis flavens* Dugès, = *Macrobasis diversicornis*, Champion, in part.]

E. diversicornis (Haag), 1880
 Second antennal segment at most slightly more than equal to the following two. Fig. 6 to fig. 8. 7

7. Second antennal segment slightly longer than the following two. First segment thickened, oval in cross-section. See fig. 6. Dark brown to black, with the margins of the elytra fringed with pale pubescence. Averaging smaller than *diversicornis* and the other species in the group in its region. *Mexico*: Durango (Canelas, fide Dugès), Jalisco (Colima Vulcano), Nayarit (Tepic). *E. beckeri* (Dugès), 1889
 Second segment of antennæ slightly longer than the following two. First segment flattened. See fig. 7. Dark brown, with uniform pale to dark pubescence. As small as *beckeri*, usually less than 12 mm. *Guatemala* (Guatemala City), *Mexico* (Chiapas), *Salvador* (Sta. Ana). *E. candèzi* (Haag), 1880
 Second segment of antennæ only slightly longer

than the third. See fig. 8. Middle tarsi with a fringe of long hairs along the inside. Panama to Vera Cruz. *E. isthmica* sp. n.

***Epicauta isthmica* sp. n.**

Length: 10 to 20 mm. Body black, elytra brown to luteous; legs except for tarsi, palpi, labrum, labium and clypeus luteous. Pubescence uniform, moderately dense, decumbent, cinereous to pale luteous. There is a dark scutellar and humeral spot, dark pubescence on the tarsi (some pale pubescence at the base of the first segments) and on the tips of the femora and outer edge of the tibiae. No dark pubescence on the abdominal sternites except on the apex of the fifth. Any of this dark pubescence may be greatly reduced or even absent.

Head subquadrate; eyes prominent, transverse, excavated but moderately broad, four-sevenths as long as broad at the broadest place when seen from the side, separated dorsally by an area slightly narrower than their greatest width. Surface of head densely but finely punctured, uniformly, densely microreticulate. Antennal caluses narrow, denuded, without punctures. Median impressed line distinct down to the level of the eyes, not augmented by a denuded border. Mouth parts except for mandibles luteous. Last segment of maxillary palpi quite narrow, half as long as wide at the widest place, two-thirds from the base. Male antennae as in figure 8 or with the first two segments broader or slightly narrower, the first two segments black to luteous. Female antennae as in *diversicornis* but with the second segment slightly shorter than the third.

Pronotum narrower than head, one-third longer than broad. Sides roughly parallel for the basal three-fourths, then converging at a sixty degree angle, the side slightly arcuate and the change in angle not abrupt. Basal impressed line distinct. Median impressed line fine but distinct. Surface more densely punctured than on head. Scutellum black. Elytra brown to luteous, with the luteous form more prevalent in the northern part of the range.

Underside uniformly pale pubescent, except for the apical half of the fifth abdominal sternite. The apices of the abdominal sternites have a fringe of slightly denser pubescence so that they appear indistinctly margined.

Anterior tibiae of male denuded externally, with one straight, spiniform apical spur. First segment of male anterior tarsi denuded except for a few hairs along the outer margin and apex, shiny, expanded on the inner margin, concave behind. Middle tarsi of male with a fringe of long erect black hairs along the inside. Each hair of this fringe is as long as the fourth segment. Posterior tibial spurs expanded spiniform, the outer shorter than the inner.

Holotype: ♂, Cabima, *Panama* May 28, 1911 A. Busck (USNM)

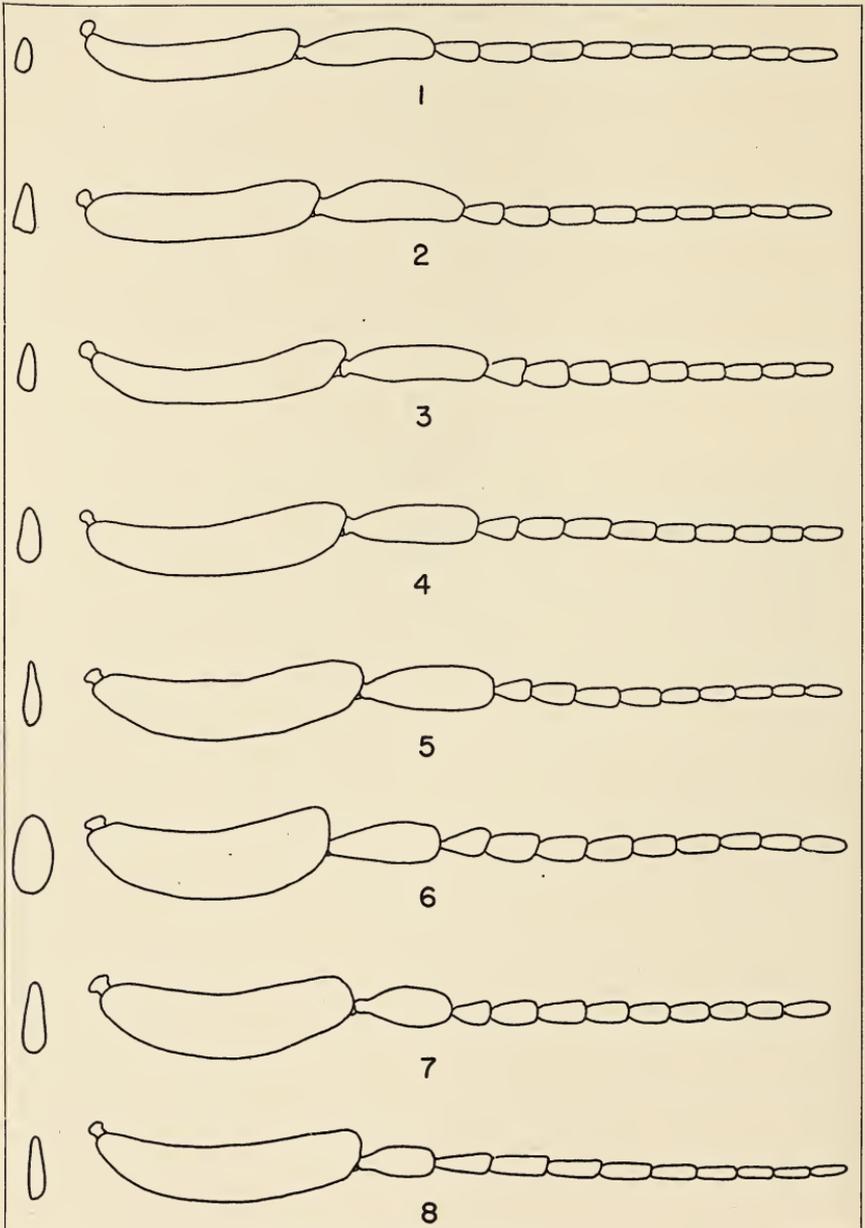
Allotype: ♀, eutopotypical (USNM)

Paratypes: *Panama*: 7♂♂, 6♀♀, topotypical (USNM); 2♂♂, Bocas del Toro (USNM); 2♂♂, 1♀, Taboga I. (USNM); 2♀♀, La Chorrera (USNM); 4♂♂, 4♀♀, La Chorrera (Cal. Ac.); 1♂, 3♀♀, St. Maria, El Real (MCZ); 2♂♂, 2♀♀, Sta. Rosa (Chic. N.H.M.); 1♀, Panama (MCZ). *Canal Zone*: 4♂♂, 3♀♀, Madden Dam (Cal. Ac.); 6♂♂, 5♀♀, Madden Dam (Cal. Ac.); 5♂♂, 2♀♀, Ft. Clayton (Cal. Ac.); 1♀, Gamboa (Cal. Ac.); 2♂♂, Ancon (Chic. N.H.M.) 1♂, 1♀, Ancon (Ohio); 1♀, Ancon (USNM); 1♀, Culebra (Ohio); 3♂♂, Barro Colorado I. (USNM); 1♂, 1♀, Paraiso (USNM); 1♂, Tabernilla (USNM); 1♀, Alhajuelo (USNM); 1♀, Canal Zone (USNM). *Costa Rica*: 3♂♂, 2♀♀, Bebedero, Guanacaste (USNM); 1♂, 1♀, Santa Elena, Guanacaste (USNM); 1♀, Guanacaste (USNM); 1♂, Sarchi (USNM); 2♂♂, 1♀, Port Parker (Cal. Ac.); 2♀♀, Costa Rica (Chic. N.H.M.). *Nicaragua*: 1♀, Managua (USNM). *Honduras*: 1♂, 1♀, La Libertad, Comay (MCZ); 1♂, San Pedro S. (Chic. N.H.M.). *Salvador*: 1♂, Santa Ana (USNM). *British Honduras*: 1♀, Punta Gorde (Parker). *Mexico*: 2♂♂, 3♀♀, La Gloria, Cardel, Vera Cruz (USNM); 2♂♂, 2♀♀, Atoyac, Vera Cruz (USNM).

EXPLANATION OF PLATE 5

Male antennæ. Cross-section of first segment on left.

- Fig. 1. *Epicauta forticornis* (Haag)
- Fig. 2. *Epicauta humeralis* (Dugès)
- Fig. 3. *Epicauta flagellaria* (Erichson)
- Fig. 4. *Epicauta diversicornis* (Haag)
- Fig. 5. *Epicauta diversicornis* (Haag)
- Fig. 6. *Epicauta beckeri* (Dugès)
- Fig. 7. *Epicauta candèzi* (Haag)
- Fig. 8. *Epicauta isthmica* sp. n.



WERNER—EPICAUTA DIVERSICORNIS

A NEW AMERICAN *AMBLYOPONE*, WITH NOTES
ON THE GENUS (HYMENOPTERA:
FORMICIDÆ)¹

BY WILLIAM L. BROWN, JR.

Biological Laboratories, Harvard University

Amblyopone (*Stigmatomma*) *trigonignatha* new species

Figure 1

Holotype worker: Total length measured from lateral profile, mandibles included but sting excluded, $6.12 \pm .10$ mm.; Weber's length of alitrunk, $1.60 \pm .05$ mm.; maximum measurable length of the head from the center of the anterior clypeal border to a line connecting the posterior extremities of the occipital corners, $1.22 \pm .005$ mm.; maximum width of head, $1.05 \pm .005$ mm.; cephalic index, 86 ± 1 ; left mandible, straightline distance, when closed, from the point of contact with the anterior border of head to apex, $0.80 \pm .01$ mm., or, more roughly, about two thirds of the length of the head proper.

Head a little more slender than in *A. (S.) pallipes* (Haldeman), sides gently convex, greatest width at about the anterior third, slightly convergent behind and passing into the rounded occipital corners through easy curves; posterior border of head moderately but distinctly concave in outline. "Amblyoponine teeth" at the anterolateral corners of the head reduced to small, bluntly rounded tubercles which are more or less hidden in dense pilosity; this reduction much greater than in any small specimens of the *pallipes* complex I have seen. Clypeus dorsally weakly convex, its anterior apron rather narrow, with a very feebly convex anterior border which appears straight at some angles of view. This apron is rather abruptly terminated on each lateral extremity by an angle which marks the boundary between

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

it and the medial wall of a notch which receives the acute, triangular basal mandibular tooth. Anterior margin of clypeal apron set with twelve small, regular separated denticles which are truncate, subcylindrical and not socketted on subconical tubercles as are those of *pallipes* and its subspecies, also one of these tubercles on each short lateral margin. This makes 14 denticles in all, more than in *pallipes*, all separate, smaller and more regular than in the *pallipes* complex, and with the exception of the tooth on each lateral margin, on approximately the same level. Eyes about the same size and in the same

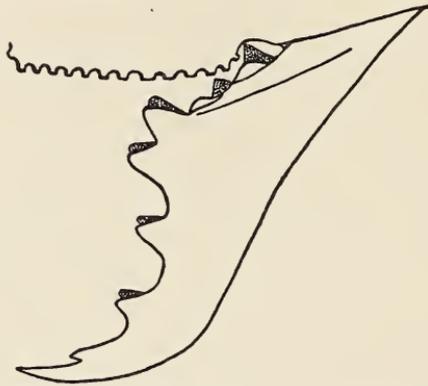


Figure 1. *Amblyopone* (*Stigmatomma*) *trigonignatha* new species, worker, left mandible and anterior clypeal border.

position as in medium-sized *pallipes* workers, with only 3 or 4 of the facets actually pigmented in each. A faint median depression on the cephalic dorsum at about the midlength evidently represents a vestige of the anterior ocellus.

Mandibles distinctive; considering only the basal halves each forming an obtuse triangle, with the inner border of the basal part just before the midlength distinctly angulate at somewhat more than a right angle; this angle, which is capped by two massive, blunt double teeth partially fused at their bases, marks off fairly distinct basal and apical borders. The basal border bears two rows of teeth, a dorsal and a ventral; there are two teeth in each row, the ventral ones triangular,

acute, the dorsal low and rounded and alternating with the ventral ones so that all may be seen from a position directly dorsad. The more basal of the two ventral teeth is the larger, and this fits into the notch mentioned above just lateral to the clypeal apron. The apical border distad of the two large double teeth at the angle with two more blunt, massive double teeth, which are well separated; these followed by a smaller acute tooth just before the acute, stoutly spiniform apex. Seen from the side, the mandibles are nearly twice as thick dorsoventrally as in *pallipes*, and not quite so strongly projecting anteriorly; the apices somewhat recurved.

The alitrunk is very similar to that of small *pallipes* workers, but perhaps very slightly more slender; the rounded lamellæ at the base of the propodeal declivity smaller. The petiolar node is very slightly longer than broad seen from above, much as in smaller workers of *pallipes*.

Sculpture throughout less pronounced than in *pallipes*, the head and thorax shining to the naked eye. Seen at very high magnifications, the dorsum of the head is sown with very small, regular punctures which are separated from each other by plane, shining surfaces which do not form the fine longitudinal costulation or rugulation seen in the forms of *pallipes*. Clypeus very indistinctly and irregularly longitudinally striate; mandibles striate longitudinally as in *pallipes*, but less regularly and distinctly. Sculpture of dorsum of alitrunk much like that of the head, but the sides posteriorly are longitudinally striate as in *pallipes*; propodeal declivity with a large central area devoid of transverse striæ and smooth and shining.

Color rather uniform medium ferruginous. Other characters of structure and pilosity within the range of variability shown by small to medium-sized *pallipes* workers from the eastern United States. Male and female unknown.

Holotype worker, Museum of Comparative Zoology, Harvard University, Catalog No. 28231. Collected at Concord, North Carolina, by Dr. D. L. Wray, who sifted

it from leaf mold by means of the Berlese funnel. One *Stigmatomma pallipes* worker was also taken by the same funnel, a fact which has caused me to examine a large quantity of *pallipes* specimens in making sure that the new species cannot be an extreme example of the very variable common species. I have found it very generally true that closely related ant species often occur in the same Berlese batch, especially with forms living in or beneath the soil cover or in rotten logs, so the proximity of the two forms in collecting need not trouble us too much. The differences are so striking that I cannot consider *trigonignatha* as merely an abnormal specimen of *pallipes*, and the sting rules out the possibility of it being an ergatoid male like those found in *Ponera*.

Amblyopone (Stigmatomma) pallipes (Haldeman)

Typhlopone pallipes Haldeman, 1844, Proc. Acad. Nat. Sci. Phila., 2: 54, worker.

Stigmatomma pallipes subsp. *montigena* Creighton, 1940, Amer. Mus. Novit., No. 1079, p. 7, figs. 6 and 8.

The remainder of the synonymy is given in Creighton's paper cited above on page 3. The correct spelling of Provancher's name is *Arotropus binodosus*, not "*Atropus binodus*," as Creighton has it.

Since Dr. Creighton's paper describing the form *montigena* was published, I have been accumulating *Stigmatomma* specimens year by year from various states, principally Pennsylvania, North Carolina and Tennessee. I have looked over specimens from the Pennsylvania Alleghenies (where *Stigmatomma* is often the most abundant or *only* ant occurring in very wet mountain valleys in which rhododendron and hemlock form the main cover) with the hope of finding *montigena* specimens. I succeeded in finding some specimens with a rather convex anterior clypeal border, but these were often mixed in the same colony with specimens having the border nearly straight. Two specimens from rich, low beech woods in a city park in Philadelphia, however, showed very marked convexity of the clypeal border to a degree comparable with the *montigena* types; since these latter

specimens were taken in very close association with several other workers having much less convex borders, I believe that the geographical basis of this subspecies becomes very weak. The length of the funicular joints, the sculpture, and the presence or absence of a tubercle distad of the basal tooth are also variable characters in both Pennsylvania and North Carolina specimens, and the first of these auxiliary characters is subject to differences brought about by the contraction of funicular joints into one another to different degrees at death in alcohol. In conclusion, Dr. Creighton's material, while reasonably abundant, just happened to show a distributional pattern which led naturally to the erection of a subspecies. The additional material now available shows so many contradictory features that *montigena* cannot be retained as a separate form any longer.

Amblyopone (Stigmatomma) subterranea Creighton

I regard this form for the present as a good species, though it was described as a subspecies of *pallipes* in Creighton's 1940 paper (p. 8, fig. 4). Though the difference from *pallipes* is very slight, it seems constant in the specimens from Kansas, and the specimen from Austin, Texas, may also be considered as of this form instead of as a *pallipes-subterranea* intergrade. Buren has reported this form from Iowa, so the range appears wide in the plains states. Specimens of *pallipes* from Illinois and western Tennessee do not seem to intergrade with *subterranea*, and no true intergrades seem yet to have been reported from anywhere, with the exception of the single doubtful specimen from Texas. Though it is true, as Creighton states in his description, that most of the sculpture of *subterranea* is rather light, the Kansan and Texan specimens show rather characteristically strong longitudinal rugulæ in the area just behind the frontal region of the dorsum of the head which are not quite like those of *pallipes*. The structure of the anterior clypeal border seems rather distinct and diagnostic also.

Though Creighton regarded the single Arizona record of *Stigmatomma* as doubtful in 1940, there have been

several collections made in that state by Mr. R. G. Wesson since Creighton's writing. Dr. Creighton has suggested to me in a letter that these specimens may provide a basis for reviving Wheeler's Arizona race, but since these collections are not presently available to me, I shall provisionally accept the synonymy of this form under *S. pallipes pallipes*.

Subgenera of the genus *Amblyopone* Erichson

In 1934, Mr. John Clark of Melbourne¹ adopted Wheeler's earlier suggestion² that *Stigmatomma* Roger, *Fulakora* Mann and *Xymmer* Santschi were only subgenera of *Amblyopone* Erichson. On the basis of workers alone, it is hard to see why any of these names should be maintained if the known world fauna of the complex is considered as a whole. An examination of the venation of the winged males and females of several species referred at present to *Amblyopone* (*aberrans* Wheeler, several forms of the *australis-cephalotes* complex) and to *Stigmatomma* (*rothneyi* Forel, *pallipes* (Haldeman), *pallipes oregonensis* Wheeler) reveals a difference which, if consistent in the two groups, will serve to separate them satisfactorily as subgenera; I should not be surprised to find this character intergradient and thus not any longer separatory when more of the males and females are known. In *Stigmatomma*, the second free abscissa of Rs (Rs FA 2), the vein which splits the cubital cell longitudinally, is present in its entirety (somewhat weak in *rothneyi*), while in all the *Amblyopone sensu stricto*, this vein is entirely gone and the cubital cell resulting is very large and undivided. Furthermore, the venation of the *Stigmatommata* from the United States (not *rothneyi*) is more primitive in that the first free abscissa of M (M FA 1), the posterior part of the vein persistently called the "basal vein," is lined up or nearly lined up with crossvein cu-a, a condition characteristic of the Myrmeciini and also of at least some *Mystrium* Roger and *Myopopone* Roger.

¹ Clark, 1934, Mem. Nat. Mus. Victoria, No. 8, p. 27.

² Wheeler, 1927, Proc. Amer. Acad. Arts & Sci. 62: p. 1.

I have not seen any winged forms of *Fulakora* Mann; this genus or subgenus cannot at present be separated from *Stigmatomma*, since the prime character, approximation of the frontal carinae, is intermediate through to *S. williamsi* Wheeler (Philippines) in at least two Australian forms of *Fulakora* described by Clark (*punctulata*, *gracilis*). *Williamsi* and *silvestrii* Wheeler (Japan) form a very close series connecting forms like *punctulata* with those like *denticulata* Mayr and other "typical" *Stigmatomma*. In the absence of evidence to the contrary, I propose that the name *Fulakora* Mann be considered a synonym of *Amblyopone* (*Stigmatomma*).

Two synonyms were unwittingly created by Wheeler (see synonymy below) when he stated that he thought the use of Clark's names, proposed *in lit.* at an earlier date, to be "inadvisable." Both names were put in print, with genotypes stated. According to present practice as employed by many systematists, these names are available and in force, a fact pointed out to me by my friend, Mr. Floyd G. Werner. It appears best to list them formally as synonyms. The arrangement below shows my conclusions as to the relationships of the names discussed above. For fuller synonymy, references can be found in Emery's section on the Amblyoponini in the *Genera Insectorum*.

Genus *Amblyopone* Erichson

Erichson, 1841, Arch. Naturg., 8: 254, 260.

Neoamblyopone Wheeler, 1927, Proc. Amer. Acad. Arts and Sci., 62: 1.

Protamblyopone Wheeler, Idem., p. 1.

As far as I can see, there is only one valid subgenus in addition to *Amblyopone* (s. str.):

Subgenus *Stigmatomma* Roger

Roger, 1895, Berlin. Ent. Zeitschr., 3: 250.

Stigmatomma (*Xymmer*) Santschi, 1914, Boll. Lab. Zool. Portici, 8: 311.

Ximmer Emery, 1919, Ant. Soc. Ent. Belg., 59: 106, as subgen. of *Stigmatomma*.

Fulakora Mann, 1919, Bull. Mus. Comp. Zool., **63**: 279,
subgen. of *Stigmatomma*.

Amblyopone (*Xymmer*) Clark, 1934, Mem. Nat. Mus.,
Melbourne, No. 8, p. 27.

A. (*Stigmatomma*) Clark, 1934, Idem., p. 27.

A. (*Fulakora*) Clark, 1934, Idem., p. 27 *et suiv.*

Since both Santschi and Emery have shown (works cited in synonymy) that Santschi's *Xymmer muticum* is connected to *Stigmatomma* through *A. (S.) belli* Forel, I can see no reason for retaining *Xymmer* as a separate subgenus any longer.

NORTH AMERICAN MENOPONIDÆ (MALLOPHAGA). III; NOTES ON SOME OF
KELLOGG'S TYPES

BY K. C. EMERSON

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Kellogg in his numerous papers on Mallophaga described many new North American species. The taxonomic importance of the male genitalia was unknown to him, and a large number of his host records have been proven incorrect. The latter item, particularly, has led to great confusion; the only solution has been to remount and examine his type specimens.

His types in many instances have proved to be immature specimens of known species. For such instances indicative of incorrect host designation, records of the correct host with the same date and locality information can be found leaving little doubt that the hosts were not kept separated in the game bag.

Hopkins has presented an interesting discussion on synonymy of Mallophagan names, and the author agrees with his views. The purpose of this paper is not to discuss the validity of certain forms sometimes referred to the names listed, but the validity of those names.

The author wishes to acknowledge the kindness of Dr. G. F. Ferris in lending the Stanford University Collection containing V. L. Kellogg's type material, and of Mr. G. H. E. Hopkins of the Tring Museum and Miss Theresa Clay of the British Museum for their help and criticisms.

Colpocephalum abbotti Kellogg 1899 = *Actornithophilus lari* (Packard 1870). The type is an immature specimen, and the correct host is probably *Larus* sp.

Colpocephalum fumidum Kellogg 1896 = *Actornithophilus lari* (Packard 1870). The type is an immature specimen, and the correct host is probably *Larus* sp.

Colpocephalum grandiculum Kellogg and Chapman 1899 = *Actornithophilus lari* (Packard 1870). The type is an immature specimen, and the correct host is probably *Larus* sp.

Colpocephalum patulum Kellogg and Kuwana 1900 = *Actornithophilus bicolor* (Piaget 1880). Absolute synonymy.

Menopon striatum Kellogg 1899 = *Amyrsidea lagopi* (Grube 1851). Absolute synonymy.

Menopon irrumpens Kellogg and Chapman 1899 = *Austromenopon navigans* (Kellogg 1896). Absolute synonymy; with each sex being described as a different species.

Menopon petulans Kellogg and Chapman 1899 = *Austromenopon paululum* (Kellogg and Chapman 1899). *M. paululum* was described from male specimens collected from the Black-vented Shearwater, *Puffinus opisthomelas* Coues; the Sooty Shearwater, *Puffinus griseus* (Gmelin); and the Pink-footed Shearwater, *Puffinus creatopus* Coues. I designate as lectotypes the types collected from *Puffinus griseus* (Gmelin). *M. petulans* was described from a single female specimen collected from the Sooty Shearwater, *Puffinus griseus* (Gmelin). The types of both species were collected on the same day from the same locality. An examination of the types proved them to represent only a single species with the name *paululum* having page priority.

Colpocephalum laticeps Kellogg 1896 = *Ciconiphilus obscurus* (Giebel 1874). Absolute synonymy, and the latter name may prove to be a synonym of *Ciconiphilus decim-fasciatum* (Boisduval and Lacordaire 1835).

Menopon decoratum Kellogg 1896 described from specimens taken from the White-tailed Kite has led to a great deal of confusion. The correct host for this species is the California Cuckoo, *Coccyzus americanus occidentalis* Ridgway; and the correct name should be *Cuculiphilus decoratum* (Kellogg 1896). This species is distinctly different from *Cuculiphilus fasciatus* (Scopoli 1763), which probably does not occur in North America.

Menopon galapagensis Kellogg and Kuwana 1902 = *Cuculiphilus snodgrassi* (Kellogg and Kuwana 1902). Absolute synonymy, and the correct host is *Coccyzus melacoryphus* Vieillot.

Menopon longicephalum Kellogg 1896 = *Menopon galinae* (Linnæus 1758). Absolute synonymy.

Menopon mesoleucum americanum Kellogg 1896 = *Myrsidea interruptus* (Osborn 1896). Absolute synonymy.

Menopon titan impar Kellogg 1896 = *Piagetiella peralis* (Leidy 1878). Absolute synonymy.

Menopon titan linearis Kellogg 1896 = *Piagetiella bursæ-pelecani* (Perry 1876). Absolute synonymy.

Ferris has stated that *Menopon tridens pacificum* Kellogg 1896 could not be separated from *Pseudomenopon tridens* (Burmeister 1838). The author has compared Kellogg's material of *M. tridens insolens*, *M. tridens par*, and a slide labeled "var C" with specimens of *P. tridens* (Burmeister 1838) collected from *Fulica atra atra* (Linnæus) and believes them to be the same. The forms were separated only on size; but in any large series from the American Coot, *Fulica americanus* Gmelin, forms representing all of Kellogg's sub-species can be found.

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ADDITIONS TO *EPICAUTA*, WITH NEW SYNONYMY AND A CHANGE OF NAMES (COLEOPTERA: MELOIDÆ)¹

BY F. G. WERNER

Biological Laboratories, Harvard University

The numerous specimens of *Epicauta* which have been made available to the author in the past two years have included several new species from the United States and Lower California as well as specimens which indicate that some of the former conclusions regarding our species were erroneous. The most important changes are included in this paper. The author owes a debt of gratitude to the curators of almost all the major museums in North America for their generosity and especially to Mr. Frank H. Parker and Mr. G. P. Mackenzie, who have been most free with specimens from their private collections and with information of real value in understanding the limits of some of our species.

The arrangement followed is that of my former paper on the genus, and changes that will have to be made in the key to species and in descriptions will be noted in their proper places under the species concerned.

Epicauta tenebrosa sp. n.

Epicauta pedalis, Horn, 1873, Proc. Am. Phil. Soc. 13: 99 (in part). Werner, 1945, Bull. M. C. Z. 45: 440 (in part).

Arizona specimens which have been assigned to *Epicauta pedalis* Lec. should be referred to this species. The

¹Published with a grant from the Museum of Comparative Zoology at Harvard College.

California Academy series of *pedalis* from Lower California, the type locality, shows that there is a constant difference between the Lower California and Arizona specimens. From *pedalis*, *tenebrosa* can be distinguished in either sex by the lack of a pale sutural margin on the elytra and by its smaller size. The males have much more slender antennæ and have the tip of the ædeagus of a different shape. (Fig. 1.)

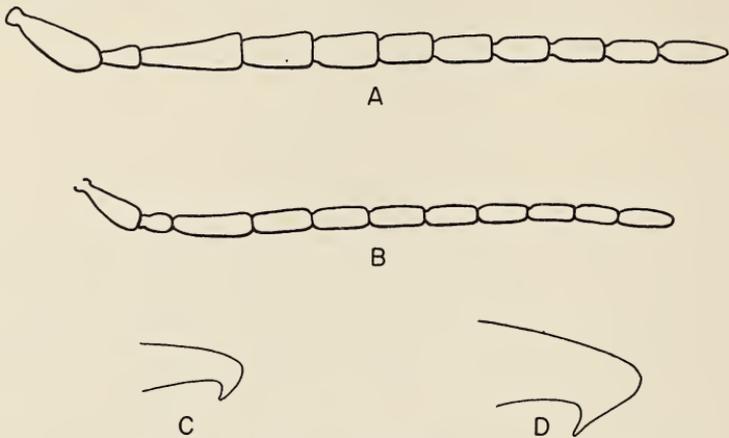


Fig. 1. A. Antenna of *Epicauta pedalis* Lec., male. B. Antenna of *Epicauta tenebrosa* sp. n., male. C. Tip of ædeagus of *Epicauta pedalis*, male. D. Tip of ædeagus of *Epicauta tenebrosa*, male.

Length: 8 to 10 mm. Black, moderately densely clothed with decumbent pubescence, which is tan on the elytra, paler on the head and pronotum and cinereous on the underside. Legs pale brown. Head subquadrate, with moderately dense and deep punctures, distinctly microreticulate on the intervals. Suture very distinctly impressed. Antennal calluses small, denuded, shiny. Eyes prominent, transverse, slightly wider than in *pedalis*. Antennæ in both sexes quite slender, tapering, reaching almost to the middle of the elytra, two and four-fifths times as long as an anterior tibia. First segment slightly thickened, reaching halfway across the eye; second short, three-sevenths as long as the first; third slightly longer than first; fourth four-fifths as long as third; succeeding segments decreasing slightly in length and width. The

third and following segments are just perceptibly flattened, especially in the male.

Pronotum as broad as long, subquadrate, with the sides parallel for the basal three-fourths, then converging at a forty-five degree angle, with the anterior angles rounded. Surface like that of head. Midline distinctly impressed and narrowly denuded. Basal impressed line distinct but not denuded. Elytra with a narrow denuded zone across the base, where normally covered by the base of the pronotum. Tips of femora and tibiae and all of tarsi, except for a few hairs at the base of the basal segments, with dark brown pubescence. Anterior tibiae of male with a single stout, slightly incurved spur. Posterior tibial spurs slightly broadened and flattened, the outer broader and longer.

Holotype: ♂, Tucson, *Arizona* VII-30 (Fall Coll. M.C.Z. No. 28221)

Allotype: ♀, topotypical, VIII-1 (Fall Coll.)

Paratypes: Tucson, *Arizona*: 1♀ VII-21 (Fall Coll.), 1♀ VII-21 (Liebeck Coll.), 6♂♂, 6♀♀ Aug. 1935 Bryant (Parker). Sabino Canyon, Santa Catalina Mts., *Arizona*: 1♀ 7-14-32 E. D. Ball (Parker), 1♂, 1♀ 7-12-32 R. H. Beamer (U. Kansas), 1♂ VII-26-1948 F. Werner & W. Nutting, at light (Werner).

Tenebrosa runs to couplet 63 in my key. It can be distinguished from *pedalis* by the characters mentioned above and from *balli* by the normal mandibles and the presence of a single spur on the anterior tibiae in the male.

Epicauta bispinosa sp. n.

This is the third species to be discovered in the United States belonging to a very closely-knit group, composed of *E. maculata* (Say), *normalis* Werner and *bispinosa* sp. n. These all have the same color, form and markings and the females cannot be distinguished except by association with males. All have numerous denuded spots over the whole body and elytra and have the elytra covering the abdomen almost completely and not conspicuously bulging. The male of *maculata* has the last segment of the labial palpi expanded and suborbicular in outline and the

second segment also expanded, one short, incurved spur on the anterior tibiae and the first segment of the anterior tarsi padded almost to the base. The male of *normalis* differs from it in having unexpanded palpi and in having the pad confined to the apical third of the first anterior tarsal segment but is like it in having a single anterior tibial spur. The male of *bispinosa* has two slender spurs on the anterior tibiae as in the females of all three, has unexpanded palpi and the pad of the first anterior tarsal segment as in *maculata*. This combination of characters in the males is exactly like that of the female of any of the three species and it is only by the genitalia that the male can be distinguished from the females at all.

Length: 9 to 12 mm. Black, quite densely clothed with pale olive-cinereous to cinereous pubescence, with scattered denuded spots as in *maculata* (Say). Indistinguishable from *maculata* and *normalis* in shape, proportions and sculpture of head and pronotum. Antennae almost identical with those of *maculata*, which vary slightly in different sized specimens.

Holotype: ♂ 10 mi. E. of Sonoita, Sta. Cruz Co., Arizona, alt. 4800 ft., in grassland, Aug. 1, 1948. F. Werner, E. & W. Nutting. Feeding on leaves of *Chamaesaracha coronopus* (Dunal) A. Gray. (M.C.Z. No. 28219)

Allotype: ♀ eutopotypical (M.C.Z.)

Paratypes: 62♂♂, 9♀♀ eutopotypical, in U.S.N.M., Chicago Nat. Hist. Mus., U. Kansas., Cal. Acad., collections of F. H. Parker, G. P. Mackenzie and F. Werner.

In an area less than one hundred miles square in southeastern Arizona there occur no less than four distinct, apparently very closely related species in the *maculata* group (*maculata*, *normalis*, *bispinosa* and *nogales*). One would expect that if these species were interfertile a fair number of hybrid forms would occur. There has been no attempt made to cross one with another experimentally but so far no morphological evidence of hybridization has come under observation. It is within the realm of possibility that hybrids do occur, at least among the first three species, since there is no difference in habitus, all varying greatly in the size and number of denuded spots

and in body size so that unusual specimens might be overlooked in the field.

When one examines the distribution of the four species in Arizona, a region well-known for its diversity of habitat and life zones, he gets some clue as to the possible reasons for segregation. *E. maculata*, ranging across the Great Plains and even as far east as Ohio, extends its range westward south of the Rockies onto the Colorado Plateau, just north of the Arizona White Mts., where it is quite abundant, feeding on the leaves of a species of *Amaranthus* and *Salsola*. It also reaches the plateau to the north of the Huachuca Mts., where it is likewise abundant and feeds on the same or similar plants. On this plateau and nearby it is taken occasionally on *Solanum elaeagnifolium*. The specimens on this plant tend toward smaller spots and more luteous pubescence than most populations and may represent a separate race. A series collected by Mr. Parker at Phoenix was feeding on *Kallstromia*. It does not seem to differ from normal specimens from other parts of the range.

The record of *E. normalis* is not as complete. It is found from the Rockies to the Sierras and seems to range farther north than *maculata*. It has been taken in the Chiricahua and Huachuca Mts. and at Willcox. No food plant records had been kept for these specimens. The Willcox series was mixed with *maculata* but no attempt had been made to segregate by food plant or exact locality. It seems possible that *normalis* usually is found at higher altitudes than its near relatives. Extensive collecting on the plateau in 1948 did not produce any specimens.

E. nogales has turned up only in or near the Santa Cruz river valley and it is quite evident that it must have a more extended range in the adjacent part of Mexico. The other species have not been taken in this valley.

The occurrence of the fourth species, *E. bispinosa*, on the plateau north of the Huachuca Mts. in an area where *E. maculata* also occurs abundantly, would be quite inexplicable were it not for some observations made at the time it was taken. Both species were abundant at a roadside stop 10 miles east of Sonoita. *Maculata* was feeding

on *Amaranthus* and *Salsola*, in considerable numbers. Under these plants were scattered patches of *Chamæsaracha*, a low solanaceous plant, which had *bispinosa* feeding on them. The species, as mentioned before, differ only in the male secondary sexual characters and several specimens were collected from both hosts before the differences were discovered. Then careful collecting by host plant revealed that out of 87 *maculata* and 63 *bispinosa* males not a single one was on the wrong plant. It can be safely surmised that the females show the same selection.

The question of expressing the known relationships in the taxonomy of the group is one to which the author has given considerable thought and which he has discussed with his colleagues in some detail. Dr. George Horn would probably have left at least the three very similar species as one, readily identifiable, species. This approach is particularly attractive to one who attempts to determine numerous museum specimens but is becoming increasingly indefensible as we attempt to apply the taxonomist's results to problems in the field.

Assuming that we attach names to all three forms, we still have at least two possible techniques, each with some merit. Using the extreme similarity of the three as a criterion, we can place them all in one species, with the typical and two other subspecies, with supposed geographical replacement. This view would be strengthened if *bispinosa* were found to have a wide range in northern Mexico and *maculata* not. It serves to point out the extremely great similarity of the three. It is weakened by the lack of evidence that the three hybridize where they meet, as in southeastern Arizona. We expect subspecies to be populations which have differentiated slightly behind barriers but which have not gone so far in differentiation that they cannot interbreed wherever they come together geographically.

The alternative method, and the one which the present author favors, is to call each a species. From the available evidence we have three geographically isolated species which show no tendency to interbreed. Where the ranges of *maculata* and *normalis* meet, along the front of

the Rockies, an altitudinal segregation acts and the same mechanism may act in Arizona where the ranges overlap. Where *maculata* and *bispinosa* overlap, or where one has differentiated from the other as the case may be, strict adherence to host plant specificity serves to segregate the two in the adult stage and present a barrier to interbreeding.

Present-day conditions in Arizona are exceedingly favorable for study of host specificity of *Epicauta*. A good proportion of the land is heavily grazed, the only comparatively untouched parts of many areas being along the main roads where the vegetation is protected by fences. Any adults of the herb-feeding species that emerge congregate on the roadside plants. A fairly high percentage of the individuals in the area must assemble here. Being parasitic and living in an area of uncertain rainfall, the number of individuals varies greatly from year to year. When a patch is found which supports blister beetles it usually has several species within a small area. Under such conditions one would expect any possible hybridization to occur. When none does occur, it is certainly an indication that there is some barrier, be it intersterility, micro-ecological isolation on host plants or even psychological.

Therefore the author maintains that the occurrence of *maculata* and *bispinosa* side by side on different food plants is a clear indication that they are distinct populations and since no intergrades have been found to indicate hybridization, prefers to treat them as species. At the same time, he feels certain that as more becomes known about both, this food plant isolation will be found not to be the primary factor in keeping the two separate.

Epicauta cinerea (Forst.)

Meloe cinereus Forster, 1771, Cat. Animals N. Am.: 62.

Lytta fissilabris LeConte, 1850, Agassiz Lake Superior
4: 232; 1853, Proc. Acad. Nat. Sci. Phila. 6: 339. (new
synonymy)

Epicauta fissilabris, Horn, 1873, Proc. Am. Phil. Soc.
13: 102. Werner, 1945, Bull. M.C.Z. 45: 456.

LeConte described *fissilabris* from Lake Superior and Hudson's Bay Territory and since the time of its description very few specimens have been taken. These, however, show that there is a close relationship between it and *cinerea*. The author was unable to distinguish between the two species at the time he wrote his revision of the genus, except on the basis of color. Subsequent specimens indicate from their distribution that *fissilabris* is a marginal form of *cinerea*. It has been taken at Aweme, Manitoba; Tokio, North Dakota; Hope, Arkansas and Smithville and Stillwater, Oklahoma. These localities coincide fairly well with the northern and western limits of *cinerea*. The Arkansas and Oklahoma specimens were taken in company with normal *cinerea*.

Epicauta pestifera nomen novum

Epicauta marginata auct., nec Fabricius (in part).

Epicauta cinerea auct., nec Forster (in part).

Epicauta solani Werner, 1945, Bull. M.C.Z. 45: 457, nec *Epicauta Koehleri* var. *solani* Denier, 1940, Rev. de la Soc. Ent. Argentina 10: 421.

It is hoped that at last our common margined blister beetle has a name that will stick with it.

Epicauta ficta sp. n.

This unicolorous grey species is most closely allied in our fauna to *cinerea* (Forst.), having similar antennæ but broad posterior tibial spurs. It differs from grey specimens of *pestifera* in its short, stout antennæ and from *brunnea* Werner by the broad posterior tibial spurs and unexpanded anterior tarsi in the male. It seems to be most closely related to *Epicauta obesa* from Vera Cruz on the Caribbean coast of Mexico.

Length: 9 to 12 mm. Black, densely clothed with decumbent cinereous to yellowish-cinereous pubescence. Antennæ short but of a form similar to those of *cinerea*.

Head subtriangular. Surface microreticulate, densely and rather deeply punctured. Midline very feebly impressed, usually not visible under low magnification. Antennal calluses small, slightly raised, denuded and

shallowly microreticulate. Eyes rather small, transverse, narrow, barely extending inwardly beyond the antennal sockets. Antennæ short, extending to just beyond the base of the elytra, twice as long as an anterior tibia. In the male the first segment is stout, the heaviest segment, reaching one-third across the eye; second slender, seventenths as long as first; third one-sixth longer than first, increasing gradually in thickness toward the apex where it is one and six-tenths times as wide as at the base. First two segments and base of third with cinereous pubescence. Fourth segment three-fifths as long as third; fifth and sixth equal to fourth in length, the apices of the third, fourth and fifth equal in thickness, wider than their bases. The length decreases gradually from the sixth to the tenth, which is five-sixths as long as the sixth. The sixth to the tenth are individually almost uniform in thickness. Last segment one and one-half times as long as tenth. The proportions are the same in the female except that the first and intermediate segments are not enlarged. Pronotum subquadrate, slightly longer than broad. Midline not impressed or denuded.

Elytra narrowly denuded and with a little black pubescence at the base where covered by the base of the pronotum. Outer margin of anterior tibiæ and top of anterior tarsi of male slightly denuded, the first tarsal segment slightly thickened. Posterior tibial spurs broadened, the outer slightly the broader and longer. In some of the males there is a small spot of black pubescence on the hind margin of the abdominal sternites and a mid-dorsal black line on the pygidium. This character is present in *obesa* and several other species in southern Mexico.

Holotype: ♂ Broken Bow, McCurtain Co., *Oklahoma* Aug. 27, 1931 M. L. Costner (M.C.Z. No. 28223).

Allotype: ♀ Smithville, Payne Co., Okl. Aug. 24, 1931 W. D. Davis (M.C.Z.).

Paratypes: Oklahoma: 3♂♂ eutopotypical; 3♂♂ Broken Bow Aug. 29, 1931 M. L. Costner; 1♀ Broken Bow Aug. 26, 1931 W. D. Davis; 1♂, 3♀♀ Smithville Aug. 24, 1931 W. D. Davis; 2♂♂ Idabel July 27, 1931 A. O. Elrod; 1♀ Stillwater Sept. 3, 1931 E. Hixon; 1♂ Stillwater Sept. 14,

1930 E. Hixon; 1♀ Stillwater Sept. 15, 1930 E. Hixon; 1♂ Stillwater Oct. 1, 1930 V. Laird; 1♀ Jay Jul. 5, 1931 M. L. Costner.

Paratypes deposited in the collections of the U.S.N.M., Cornell U., U. of Oklahoma and F. Werner.

Males with midventral spots on the abdominal sternites run to couplet 37 in the key but can be separated by the absence of scutellar and humeral spots on the elytra. The rest key to *solani* (*pestifera*) and can be separated by the short, heavy antennæ.

Epicauta senilis sp. n.

The combination of shaggy grey pubescence and pair of denuded callosities on the pronotum distinguish this species from all others in our fauna. Champion's *candidata* from Mexico has similar characters but has the outer posterior tibial spurs spoonshaped.

Length: 9 mm. Head broadly triangular, quite densely and moderately deeply punctured, with the intervals quite densely punctulate. Median impressed line distinct down to the level of the eyes, bordered by a narrow denuded area. Antennal calluses small, low. Eyes large, narrow, excavated next to the antennæ. Antennæ slender, twice as long as an anterior tibia. First segment slender, reaching three-fourths across the eye; second half as long as first; third just shorter than the first. The basal three segments with some short cinereous pubescence behind. Fourth and following segments two-thirds as long as third, gradually decreasing in thickness. Pronotum quadrate, conspicuously bulging on the disc. Median impressed line distinct, supplemented by a narrow denuded area. Basal impressed line distinct. With a pair of smooth, denuded callosities just before the middle, as in *callosa*. Surface similar to that of head. The pubescence on the pronotum is directed irregularly, giving a ragged appearance. Elytra black next to the scutellum and across the base where normally covered by the base of the pronotum. Anterior legs of male not modified. Anterior tibial spurs of both sexes rather stout, spiniform,

somewhat incurved. Posterior tibial spurs slender, the outer sticklike, the inner spiniform.

Holotype: ♂ Luna Co., *New Mexico*, 4000 ft. July 25, 1939, Rehn and Rehn (Acad. Nat. Sci. Phila.)

Allotype: ♀ Douglas, Arizona, July 23, 1929 W. W. Jones (Parker)

Paratypes: 1♂ Dragoon Mts., Arizona IX-10-47 D. J. & J. N. Knull (Ohio State); 1♂ Sierra Blanca, El Paso Co., Texas, Sep. 13-14, 1912 (USNM).

This species runs to *callosa* LeConte in my key but is distinguished by the long, shaggy pubescence of the prothorax and back of the head and heavy anterior tibial spurs. It goes to group BB in the table but does not seem to be very closely related to any known species.

Epicauta afoveata sp. n.

Length: 7 to 9 mm. Black, sparsely clothed with pale cinereous pubescence. Elytra with inconspicuous scutellar and humeral black spot. A member of the *caviceps*

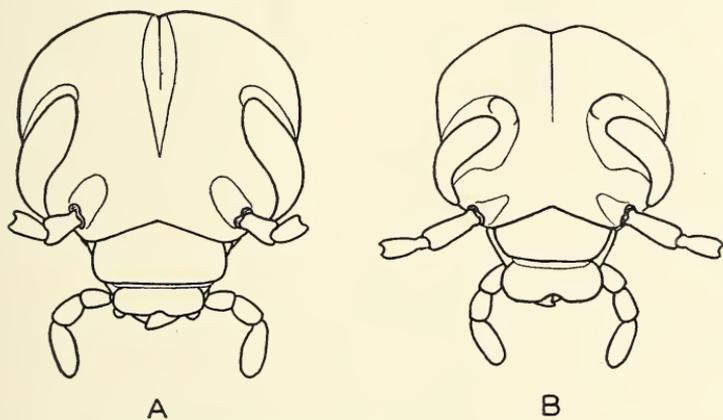


Fig. 2. A. Head of *Epicauta afoveata* sp. n. B. Head of *Epicauta impressifrons* V.D.

group, apparently most closely related to *impressifrons* Van Dyke, which it resembles in general appearances, differing mainly in the lack of occipital callosities, lack of a pit at the inner border of the eyes and by certain secondary sexual characters in the male. (Fig. 2.)

Head subtriangular, without occipital callosities or deeply impressed hind margin. Surface shiny, feebly microreticulate, moderately densely and deeply punctured except near the midline on the occiput, on the antennal calluses and on a narrow zone behind the eyes. Midline distinctly impressed to just below the upper level of the eyes. A narrow zone in the middle of the head often glabrous and without punctures, as in Fig. 2A. Antennal calluses small but denuded. Eyes oblique, narrow, rounded at the inner margin, bordered behind by a narrow, smooth, denuded zone one-fourth their greatest width. There is no trace of a pit at the inner edge of this denuded zone. Clypeus and labrum sculptured like rest of head. Antennæ almost uniform in thickness, reaching the basal third of the elytra, two and one-half times as long as an anterior tibia. First segment reaching one-third across the eye, moderately slender but nevertheless the thickest segment. There is often some cinereous pubescence on the dorsal and posterior surfaces. Second segment two-sevenths as long as first, moderately slender; third slender, a little more than twice as long as second; fourth three-fourths as long as third; the rest decreasing slightly in length and thickness.

Pronotum slightly broader than long, with the sides roughly parallel on the basal two-thirds, then converging at a forty-five degree angle. Surface more deeply punctured and microreticulate than that of head. Disc roughened, flattened on the basal two-thirds, with a feeble narrow median smooth area on the basal half. Basal impressed line deep; median suture absent or present only on the middle of the disc. Pubescence of the disc sparse, directed laterally in part and in a pair of small anterior whorls. Elytra with slightly denser pubescence than the head, with scutellar and humeral black spot, inconspicuous because of the sparseness of the pubescence. Pubescence of the underside denser than above, uniformly pale cinereous. Second to sixth abdominal sternites of male broadly denuded, the sixth strongly notched apically. Legs with pale cinereous pubescence except for the tips of the femora, tips of the tibiæ and outer edge of mid-

dle tibiæ and the tarsi, which are black. The first tarsal segments often have a few cinereous hairs dorsally at the base.

Male with two spurs on the anterior tibiæ and with posterior surface of trochanter, femur and tibia of middle and hind legs denuded, slightly flattened, with a dorsal fringe of long cinereous hairs. Posterior tibial spurs slender, sticklike.

Holotype: ♂ Borrego, San Diego Co., California Oct. 8, 1947 G. P. Mackenzie (M.C.Z. No. 28220)

Allotype: ♀ eutopotypical (M.C.Z.)

Paratypes: 11♂♂, 3♀♀ eutopotypical; 2♀♀ topotypical Oct. 28, 1939; 1♂, 1♀ topotypical Oct. 14, 1948. 5♂♂, 6♀♀ San Jacinto Mts., Riverside Co., California Oct. 7, 1947. 1♂ Vallecitos, San Diego Co., California Oct. 28, 1939. All collected by G. P. Mackenzie.

Paratypes are deposited in the collections of the U. S.N.M., Chicago Nat. Hist. Mus., Calif. Acad., G. P. Mackenzie and F. Werner.

Mr. Mackenzie, who kindly loaned this fine series for description, appends the following information on the localities: Borrego (sometimes spelled Borego), several miles south of the town; San Jacinto Mts., about fifteen miles west of Indio on Rt. 74, on the east slope of the mountains; Vallecitos, 20 miles south of Borrego. Elevation of all three places ca. 2500 ft. Vegetation of a desert type.

In my key the male runs to couplet 37, differing from *aspera* and *nigritarsis* by being black with sparse cinereous pubescence and in having the midventral abdominal black markings composed of denuded areas with at most scattered, very short pubescence, rather than of black pubescence which is as dense as on the rest of the abdomen in *aspera*. The female keys to couplet 67, but differs from *ingrata* and *longicollis* in its small size and uniform pubescence. Some females of *impressifrons* also key out here but can be distinguished by head form.

Epicauta impressifrons Van Dyke

1929, Bull. Br. Ent. Soc. 24: 12.

Several samples of *Epicauta* from near the type lo-

cality of *impressifrons* are composed of specimens which seem most closely related to that species but which differ in several characters ordinarily of importance in the group. The variation is continuous enough that all should be included in *impressifrons* but isolated samples often have a distinctly different aspect.

First there is a striking difference in size and more or less correlated with it a difference in pubescence, the larger specimens having it much denser. Also more or less correlated with the denser pubescence is the presence of the midventral, lateral and dorsal black abdominal markings and scutellar and humeral spots characteristic of the *caviceps* group to which *impressifrons* belongs.

One lot of eight specimens from Whitewater has midventral spots in both males and females. Another series of 25, from Morongo Valley, collected by G. P. Mackenzie, has these spots in the male but not in the female even though some are as large as the Whitewater females. This series has sparser pubescence than the Whitewater lot. Other smaller lots from several localities are similar to the Morongo Valley set.

The distribution of the species seems to follow a definite northwest-southeast line, from Cajon Pass in San Bernardino Co. to Fish Springs on the Salton Sea. It has been taken most abundantly in the vicinity of Palm Springs in Riverside Co., at Whitewater, Cabazon, Morongo Valley and Indio, all within twenty miles map distance from Palm Springs, in the Coachella Valley.

Epicauta occipitalis sp. n.

Length: 8 to 11 mm. Black, densely clothed with yellow-cinereous to light rufous pubescence, which is darker above than below. Disc of pronotum with dense short, erect pubescence, not denuded anteriorly as in *diversipubescens* Mayd. Elytra usually with a small black scutellar spot. Denuded spots on the midline of the abdominal sternites in the male. Middle and hind femora of male flattened behind, denuded and with a margin of long hairs above. Head bulging at the occiput, the bulge not split by a deepened midline.

Head suboval, widest just behind the eyes, broadly rounded behind, with the posterior margin straight in front view, excavated when seen from above. Seen in side view, the occiput appears bulged. Surface densely punctured except along the narrowly denuded midline. Antennal calluses small, denuded. Median impressed line distinct down to the level of the eyes. Eyes fairly prominent, rather narrow (.47 times as wide as long), transverse. Antennæ reaching to the middle of the elytra in the male, two and two-thirds as long as an anterior tibia, slightly shorter in the female, two and one-half times as long as an anterior tibia, slender, almost uniform in thickness, slightly thicker in the male than in the female. First segment reaching halfway across the eye, the stoutest segment; second .55 times as long as first; third as long as first; fourth and following subequal, three-fourths as long as third. The first three segments have some pubescence.

Pronotum broadly campanulate, slightly longer than broad, densely clothed on the disc with short erect pubescence. This pubescence is composed of short, swollen but pointed hairs which are circular in cross-section. *E. wheeleri* Horn has similar discal pubescence, *E. rileyi* and *E. rehni* similar but much more slender. The midline and an oblique area from the anterior angles to the middle somewhat elevated. Elytra with a small scutellar black spot which may be reduced to a few hairs. Abdominal sternites of male with a denuded spot on the midline posteriorly, with only a few short black hairs and setæ present on them. Middle and posterior trochanters, femora and tibiæ of male flattened and broadly denuded behind, fringed above with long pale pubescence. The corresponding edge of the anterior trochanters and femora also denuded but not fringed with long hairs. Anterior tibial spurs of male slightly shortened, the first tarsal segment a little thickened. Posterior tibial spurs slender, sticklike. Tips of femora and tibiæ and all but base of tarsi with black pubescence.

Holotype: ♂ 20 mi. N. of Mesquital, *Lower California*

IX-27-1941 Ross and Bohart (Calif. Acad. No. 6126)

Allotype: ♀ eutopotypical (Calif. Acad.)

Paratypes: 17♂♂, 10♀♀ eutopotypical. 1♂ El Arco, L. Calif. IX-28-1941.

Paratypes have been placed in the M.C.Z. collection (No. 28222), Chicago Nat. Hist. Mus., collections of F. H. Parker, G. P. Mackenzie and F. Werner.

The localities are in the Vizcaino Desert in the southern part of the northern district of Lower California. (See Proc. Calif. Acad. Sci. (4th ser.) 24: 8.)

This species belongs to the *caviceps* group and looks most like *diversipubescens* Mayd. but differs in its narrower head, bulging occiput and thickened erect hairs on the pronotum. The male keys to couplet 37, *aspera* but differs in the broadly denuded flattened surface of the femora. The female keys to part 2 of couplet 64 (with the addition of "or with a small scutellar spot") and thence to *rehni* in couplet 75. It differs from *rehni* in lacking the ridges on the head and from *uniforma* and *alpina* by the dense erect pubescence on the pronotal disc.

Epicauta lauta subsp. *rossi* subsp. nov.

Large series of *Epicauta lauta* from the United States show very little variation in color. One specimen from Lower California, the only representative of the species seen from there, shows a striking deviation from the usual uniform coloration. It has the pubescence the same as in *lauta* but the ground color is black, with the elytra tan. It looks more like the female of *polingi* than *lauta* but is structurally identical with the latter.

Holotype: ♂, 15 mi. S. of San Domingo, Lower California October 4, 1941. Ross and Bohart. (Calif. Acad. No. 6127).

Epicauta virgulata (Lec.)

Macrobasis virgulata LeConte, 1866, Smiths. Misc. Coll. 6: no. 167, 2nd ed.: 156.

Epicauta virgulata, Werner, 1945, Bull. M.C.Z. 45: 512 (in part).

A re-examination of material in this species shows that two species are present, *virgulata* being the Lower California species, extending to southwestern Arizona and *hirsutipubescens* (Mayd.) being found from western Texas to southeastern Arizona.

The description of *virgulata* in my revision need not be greatly changed except for addition of characters by which it differs from *hirsutipubescens*. The shape of the hind trochanters serve to separate it in both sexes (Fig. 3). In the male the first antennal segment reaches

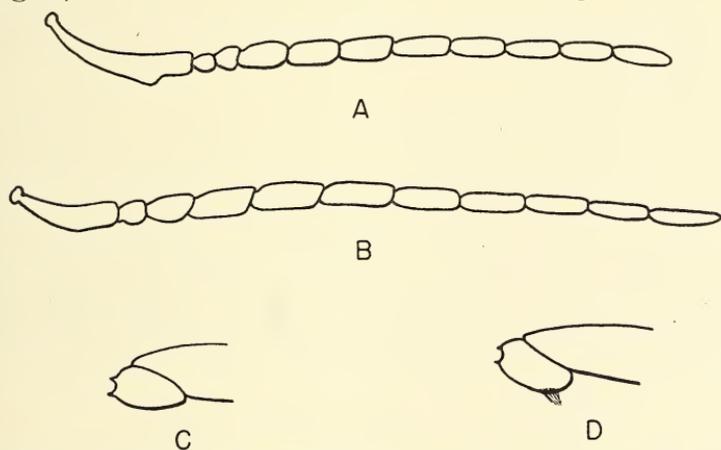


Fig. 3. A. Antenna of *Epicauta virgulata* (Lec.), male. B. Antenna of *Epicauta hirsutipubescens* Mayd., male. C. Metatrochanter of *Epicauta virgulata*, male. D. Metatrochanter of *Epicauta hirsutipubescens*, male.

nearly to the hind margin of the head and is equal to the following four in length. It is deeply excavated externally near the apex. Second segment small, two-thirds as long as third, which is also broader. The second to sixth segments are dorso-ventrally flattened, the ventral surface of the second to fourth smooth and apparently forming a clasping organ, opposing the antennal excavation. Middle femora and trochanters denuded behind, flattened and slightly excavated, margined ventrally with a few long hairs and also dorsally on the trochanters.

Specimens from Lower California have the body col-

or dark brown to black, the legs rufous. The Sinaloa and Arizona specimens have the legs of the same color but the body color paler so that the contrast is not as great. I can find no other differences. There is a slight variation in the width of the antennal segments but it occurs in the Lower California and Arizona specimens alike. The pubescence is composed of hairs which are brown at the base and cinereous apically. The brown zone may be up to two-thirds of the length of the hair or reduced to less than one-third, thus affecting the general color of the insect considerably. Lower California specimens in general have more brown than Arizona specimens.

Localities: Lower California: Comondu; 5 mi. So. of San Miguel, San Domingo; San Quentin; Coyote Cove, Conception Bay; Venancio; Triunfo; 10 mi. S. of Catavina; La Paz; Todos Santos; all in the southern district. Sinaloa: Los Mochis. Arizona: Ehrenburg, Yuma Co.; Cave Creek, Maricopa Co.; Gillespie Dam, Maricopa Co.; Florence, Pinal Co. I am very much indebted to the California Academy for permission to study the Lower California and Sinaloa specimens.

Epicauta hirsutipubescens (Mayd.)

Macrobasis hirsutipubescens Maydell, 1934, Trans. Am. Ent. Soc. 60: 334.

Epicauta virgulata, Werner, 1945, Bull. M.C.Z. 45: 512 (in part).

This species can be distinguished from *virgulata* by the shape of the hind trochanters (Fig. 3) and by the shorter first antennal segment and lack of long hairs on the middle femora of male. In the male the first antennal segment reaches the hind margin of the eye and is equal to or slightly shorter than the following three, and is not as deeply excavated as in *virgulata* (Fig. 3). The second to fifth segments are not flattened and expanded. The posterior trochanters of the male have a tuft of hairs on the posterior border as in the figure.

West Texas specimens are usually black, with grey pubescence (as in the type) or with tan pubescence, in

which the individual hairs are unicolorous. The discal stripe on the elytra is not as prominent as in *virgulata* and southeastern Arizona specimens. Arizona specimens, from the southeastern part of the state, have the ground color brown and the pubescence brown at the base and white at the apex, and with the discal stripe very distinct. There seems to be no morphological difference between the two groups and it must be presumed that the range is continuous in northern Chihuahua. Occasional specimens from Arizona have the pubescence very similar to western Texas specimens. The southeastern Arizona specimens tend to be a little stouter and shorter than the Texas series or southwestern Arizona *virgulata*.

Localities: Texas: Lozier Canyon, Terrell Co.; Tornilla Flat, Big Bend Nat. Pk.; Marathon; Culbertson Co.; Ft. Stockton; McNary, Hudspeth Co. New Mexico: Organ, Dona Ana Co.; Hope, Eddy Co.; Hot Springs, Sierra Co. Arizona: Benson; Huachuca Mts.; Sta. Rita Mts; Globe; Badger; Tubac; San Carlos; Tucson; Patagonia; Nogales; Calabasas Canyon, Tumacacori Mts; Arivaca, Pima Co.

A NEW LEPTOTHORAX COMMONLY INHABITING
THE CANYON LIVE OAK OF CALIFORNIA
(HYMENOPTERA: FORMICIDÆ)

BY MARION R. SMITH

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In the late nineteen thirties Arnold Mallis of the University of California sent me, for determination, a new species of *Leptothorax* which he and Jack Schwartz had collected at Devil's Gate Dam, Pasadena, California. Later the same ant was received for determination from Mrs. Wilda S. Ross of Santa Barbara, California, who had been given specimens of it by C. H. Muller. Dr. Muller's specimens were found nesting in an oak gall in the Figueroa Mountains of Santa Barbara County, California. Although recorded from a small number of California localities only, it is probable that the new ant has a much wider distribution, occurring wherever the canyon live oak is found or perhaps even beyond. Because of the commonness of this new species on canyon live oaks and its association with galls on these trees from near San Francisco to Los Angeles County, it seems desirable to describe the form.

Leptothorax (Leptothorax) gallæ, new species

Worker.—Length 3 mm.

Head measured through its greatest breadth and length, one and one-seventh times as long as broad, with approximately straight posterior border, rounded posterior corners and weakly convex, somewhat subparallel sides. Eye rather large, located at approximately the middle of the side of the head. Antenna 12-segmented; apex of scape failing by more than its greatest diameter to attain the posterior border of the head; funiculus with a 3-segmented club, which is scarcely longer than the re-

mainder of the funiculus, last segment of the club longer than the combined length of the two preceding segments. Frontal area present but not strongly defined. Middle of the anterior border of the clypeus with a distinct but weak impression or emargination. Mandible 5-toothed. Thorax slender, highest in the vicinity of the junction of the promesonotum, sloping both anteriorly and posteriorly from this region; from above, widest in the pronotum and narrowest at the base of the epinotal spines, with rounded humeri and obsolescent or missing dorsal thoracic sutures, also lacking the mesoepinotal impression. Epinotal spines fairly robust, not strongly divergent, longer than the distance between their bases. Femora and tibiae, especially the former, noticeably incrassated. Peduncle of petiole with a small but distinct anteroventral tooth. Petiolar node, in profile, angular, the anterior slope almost straight, the posterior slope shorter and more irregular than the anterior. Postpetiolar node, from above, about one and one-fourth times broader than long, with rounded humeri and subparallel sides, somewhat constricted in the posterior half. Gaster with distinct angles.

Mandibles striate, also punctate. Clypeus with about 7 to 9 prominent carinae, one of them median and the other lateral. Head densely and minutely punctate with the front bearing delicate longitudinal rugulae. Cheeks rugulose or rugulosepunctate. Thoracic dorsum rugulosepunctate, the rugulae most evident on the promesonotum; meso and metapleurae longitudinally rugulose punctate. Petiolar and postpetiolar nodes more minutely rugulosepunctate than the thorax.

Head, thorax, petiole and postpetiole subopaque; frontal area and gaster shining. In some lights the head is almost shining.

Body with moderately abundant, coarse, suberect to erect, pale yellowish or grayish hairs; those on the gaster more abundant than elsewhere. Antennae and legs hairless, bearing only appressed pubescence.

Brown; posterior part of gaster and much of head blackish.

Type locality.—Devil's Gate Dam, Pasadena, California.

Described from a holotype and 15 paratype workers collected by Arnold Mallis and Jack Schwartz at the type locality indicated above. Six of the specimens including the holotype are labeled 2-20-38, no. 1 and the remainder 2-26-38, no. 2. No information on their biology is available. The holotype and some of the paratype workers are in the United States National Museum collection under U. S. N. M. No. 59152.

The paratypes differ from the holotype especially in size, color and the degree of sculpturing. The largest paratype is 3.4 mm., the smallest 2.8 mm. Some specimens have the body a more uniform brown than others; in most specimens, however, the head is darker than the remainder of the body. The sculpturing on the head and thorax varies considerably with regard to coarseness and abundance but in general is of a similar nature.

Leptothorax gallæ appears to be related to *nevadensis rudis* Wheeler from which it especially differs in its more slender thorax, with more rounded humeri and less flattened dorsum; petiolar node, in profile, more sharply angular; postpetiolar node, from above, longer in proportion to its breadth; head darker, and usually with less satiny luster or shine. So far as I am aware, *gallæ* nests in trees, especially in galls that occur on trees, whereas *nevadensis rudis* has only been reported nesting in the soil beneath stones. Further collecting however, may prove that neither species is confined to the habitat indicated by observations thus far recorded.

Other localities in California where this ant has been collected:

Arroyo Seco in Pasadena; 2-6-37; Arnold Mallis and Jack Schwartz. Camp Baldy in Los Angeles County; 9-6-18; L. H. Weld; on *Quercus chrysolepis* Liebm., the canyon live oak; Hopkins U. S. No. 15611 b. Mill Valley, Marin County; Mch. 1947, Wilda S. Ross.

Los Gatos in Santa Clara County; different dates during 1918 and 1919; R. D. Hartman; on *Quercus chrysolepis* Liebm., the canyon live oak; Hopkins U. S. No. 15922 e, h.

Figueroa Mt., Santa Barbara County; 11-4-45; C. H. Muller; from an oak gall.

From these data it can be seen that the new ant is commonly found on the canyon live oak, *Quercus chrysolepis* Liebm., which is distributed along the California Coast Range and the western slopes of the Sierra Nevada. This oak however, is not confined to California, but occurs in southwestern Oregon, northern Mexico and Baja California, southwestern Utah and New Mexico, southeastern Nevada, and much of Arizona. At Los Gatos the species has been collected from twig galls made on the canyon live oak by cynipid wasps belonging to the following species: *Heteroecus pacificus* (Ashm.), *H. sanctæ-clarae* (Fullaway) and *Disholcaspis truckeensis* (Ashm.).

TRITOMA DISSIMULATOR CROTCH.—There seems to be no record of this species from either Maine or Mass. and it is listed as from "Ill.," which is the locality given by the describer. I took it at Paris, Me., June 15, 1910, and July 12, 1914, and in June, 1945. My records from Mass. are: Framingham, Oct. 10, 1915, under bark; Sherborn, June 8, 1913; Hopkinton, June 7, 1925; Berlin, July 5, 1936, in fungus. Other records in my collection are: Mt. Washington, N. H., June 24, 1913; Mont-real Id., Quebec, taken by G. Chagnon; Edmonton and Leduc, Alta., F. S. Carr; Victoria Beach, Man., June 17, 1923, C. S. Brooks. There are single records in both the New York and the New Jersey lists.—C. A. FROST, Framingham, Mass.

A NEW *GRUIMENOPON* (MALLOPHAGA—
MENOPONIDAE)¹

BY R. L. EDWARDS

Biological Laboratories, Harvard University

The genus *Gruimenopon*, typically parasitic on the bird family Gruidæ (cranes), has not been previously recorded from North America.

Gruimenopon canadensum, n. sp.

Plate 6

A relatively atypical member of the genus. 14 males averaged 1.94 mm. in length and 12 females averaged 2.29 mm. in length. Uncleared specimens superficially resemble species of the genus *Colpocephalum*, being light tan in color with large, dark ocular and cervical sclerotizations. Sexual dimorphism, excluding size, very slight.

Head broader than long, not as smoothly rounded anteriorly as in *G. longum*. Antennæ with terminal segment typically elongate-cylindrical (Fig. 4). Latero-posterior margin of temple with three very long, stout setæ. Thorax as in *longum*. Prothoracic tibia with fairly well developed comb. Meso- and metathoracic tibiæ with relatively thick patches of setæ distally. These patches consist of three or more almost comb-like rows of fine and coarse setæ. Metathoracic femora and fourth abdominal sternite with large brushes typical of genus. Terminal segments with very long, stout setæ directed posteriorly.

Female with only shallow, median indentation in eighth sternite.

Male genitalia characterized by large, hyaline, terminally squared prolongation of basal plate. Parameres hyaline, only slightly curved, each with single seta terminally. Preputial sac beset with numerous, small teeth. Other sclerotized structures connected with basal plate and preputial sac best indicated by figure 3.

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

Type host: *Grus c. canadensis* (Linn.), the little brown crane.

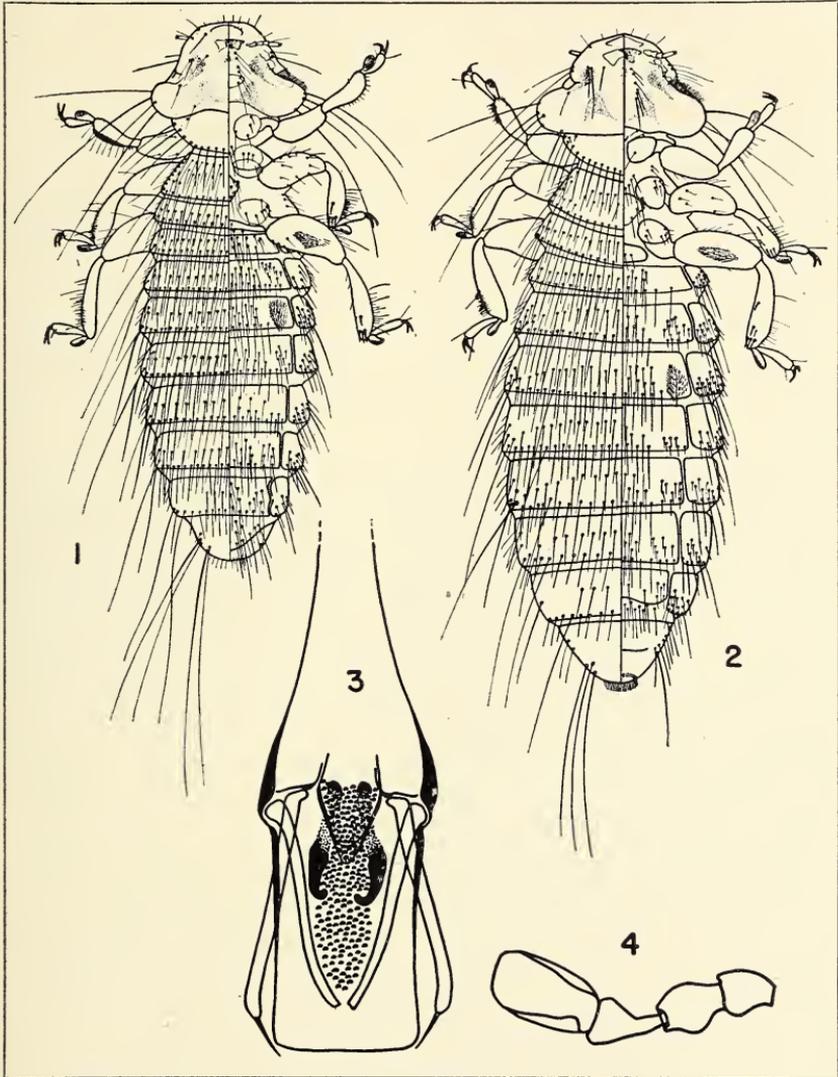
Type Material: Holotype male, allotype female, 13 paratype males and 12 paratype females. Material collected from skins in the Museum of Comparative Zoology as follows; skin #63187, collected by F. B. Armstrong, Refugio Co., Texas, December 11, 1912; and skin #252139, collected by F. S. Hersey, St. Micheal, Alaska, June 3, 1915. Holotype and allotype deposited in the Museum of Comparative Zoology. Paratypes will be distributed to United States National Museum, American Museum of Natural History, and British Museum of Natural History.

Discussion: This enigmatic species seems to be intermediate between *Gruimenopon* and *Heleonomus*. The ocular and cervical sclerotizations, the general head shape and the male genitalia all seem to be more closely allied to *Heleonomus*. In other features, such as shape and chaetotaxy of thorax and abdomen, it is like members of the genus *Gruimenopon*, in which genus it is retained because these features seem more significant generically.

EXPLANATION OF PLATE 6

All figures refer to *Gruimenopon canadensum*, n. sp.

- Fig. 1. Male, dorsal-ventral view.
- Fig. 2. Female, dorsal-ventral view.
- Fig. 3. Male genitalia.
- Fig. 4. Male antenna.



EDWARDS-GUIMENOPON

NEW AMERICAN SYRPHID FLIES OF THE
SUBFAMILY ERISTALINÆ

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A number of species of Syrphid flies from the Neotropical region have been studied by the author during the past year. This paper describes the members of the subfamily Eristalinæ. The types are in the author's collection.

Eristalis vera n. sp.

A large species related to *scutellaris* but distinguished by entirely black pile in front of the transverse mesonotal suture and by the polished black hind tibiæ. Length 13 mm.

Female. *Head*: face, front and cheeks shining black, the sides of the face with wide, thin, greyish white pollinose bands which reach to the epistoma. Facial pile white; frontal pile, vertical pile black. The greyish white pollen of the face proceeds narrowly up along the frontal eye margin for two-thirds the length of the front. The upper portion of the front has an opaque black band extending from margin to margin which is acutely produced forward in the middle of the front for a short distance. The anterior margin of the black spot tends to be bordered by white pollen. The lower part of the front above the preantennal callus is slightly raised and minutely punctate. The callus has diagonal, rugose furrows on either side. The antennæ are black; the arista is reddish sepia becoming a little lighter towards the base. Eyes bare. Facial concavity moderately deep above the tubercle. *Thorax*: mesonotum and scutellum entirely black pilose; only the notopleura and the ventral scutellar fringe are whitish pilose. There is an indistinct grey band in front of the transverse suture. The anterior margin of the transverse suture itself is obscurely margined with greyish white pollen. Behind the transverse

suture there is a broad band of opaque black followed by a wider band of shining bluish black. In front of the scutellum there is a medially rounded, transverse band of opaque black extending forward at the postcalli to include all of these structures. The pile of the postcalli is entirely black. The scutellum is clear, opaque yellow with the declivitous portion of the base and narrow lateral basal triangles black. The pleural pile is white but black on the pteropleura. Squamæ white on the outer lateral basal corners, the remainder black or dark brown with blackish border and fringe. *Legs*: black, the basal third of the anterior and middle tibiæ dark sepia brown but only when viewed anteriorly or posteriorly. Hind femora and tibiæ polished black, the former considerably thickened, especially in the middle, the latter with a low, short, apical, angular production. *Tarsi* black. *Wings*: not quite hyaline basally; they are heavily but diffusely tinged with dark brown beginning just before the end of the second basal cell and the beginning of the submarginal cell. The deep brown color extends a little beyond the anterior cross vein and includes the stigmal area. Remaining apical half of wing pale brownish grey, partly due to the thick villi. *Abdomen*: shining black; very faintly bluish. There is a large, medial, posterior, hollow-sided triangle on the apex of the second segment which in the middle extends broadly to the base of the segment but quite narrowly to the posterior corners. Third segment with a posterior, biconvex, medially notched, opaque band. Fourth segment similar, the band less convex and the medial notch minute. Fifth segment with a small, oval basal black spot on either side, the remainder shining. Abdomen elongate and characteristic of the species of the *scutellaris* group.

Holotype: Female, Nova Teutonia, Brazil, Fritz Plaumann. Jan. to April, 1948.

Eristalis cora n. sp.

A dull obscure species with opaque rusty brown scutellum. Distantly related to *obsoleta* Bigot. Length 10 mm.

Female. *Head*: Face and front black, largely shining, the former with a very large, rounded, shining tubercle leaving the face deeply concave above. Upper portion of the face and narrowly along the sides of the eye margin above the tubercle, together with a diagonal stripe from the lower eye margin to the epistoma all greyish white pubescent. Pile of face long and yellowish white. Lower frontal pile yellowish with some black hairs intermixed, the pile becoming entirely black on the upper part of the front and vertex. There is a narrow, complete band of pale brownish yellow to yellowish white pollen across the front before the anterior ocellus and a similar narrow band across the middle of the front. The intervening area is opaque black but the transverse margins of these pollinose bands are irregular. The front has a crescentic, transverse crease just above the low short callus. The antennæ are very dark sepia becoming blackish on the dorsal half of the quite large third antennal segment. Third segment dark reddish below. Arista dark red and bare. Eyes with sparse, pale brown pile. *Thorax*: mesonotum dull in color and largely obscure yellowish grey pollinose. There is a diffuse, obscure, blackish spot in front of the suture on either side of the mesonotum. There is a larger, subtriangular, similarly opaque black spot widely bordering the posterior margin of the suture; this spot is widely separated from the spot upon the other side of the mesonotum and each extends posteriorly for a short distance towards the corners of the scutellum. This opaque black spot is rounded posteriorly but tends to fade out and become indistinct. From the posterior view the transverse suture is conspicuously bordered by a linear, pale, yellow, pollinose stripe. Scutellum opaque reddish brown or rusty brown. Pile of mesonotum yellowish anteriorly becoming distinctly brownish red on the posterior half of the mesonotum. Scutellar pile abundant, rather long and yellow, postcollar pile entirely reddish. Pleural pile entirely yellow to reddish yellow. *Legs*: the femora are shining black with the narrow apex of the anterior and middle pairs brown. The hind femora are considerably thick-

ened in the middle and become obscurely reddish upon the outer fourth, but more clearly reddish towards the apex. The anterior tibiae are quite black except narrowly at the base where it is reddish brown to yellowish brown in color. The middle tibiae are yellowish brown becoming more reddish in color beyond the middle. The hind tibiae are somewhat flattened, slightly arcuate and entirely deep reddish brown; the apex is without spur, the anterior tarsi are blackish with the first and second segments narrowly brown at the apex. The middle and hind tarsi are light brownish red to yellowish brown except upon the last segment which is dark brown. *Wings*: tinged with pale brownish yellow throughout, the costal and subcostal and narrow posterior margin somewhat paler. There is a very strong stigmal cross vein present. *Abdomen*: black and almost entirely shining with strong brassy reflections especially upon the second, third and fourth segments. The first segment is opaque grey and there is in the middle of the base of the second segment a rather large, opaque black, diffusely margined triangle which is bordered laterally by a wide, diagonal stripe of opaque grey pollen fading out before reaching the apex of the segment. Posterior margins of third, fourth and fifth segments with quite narrow, laterally attenuate, linear, opaque black margins followed by even wider, opaque, pale yellow margins; the pale yellow margin on the fourth segment is especially wide and conspicuous. Fifth segment shining black and somewhat brassy but this reflection is less pronounced than upon previous segments.

Holotype: Female, Nova Teutonia, Brazil, Fritz Plau-
mann. Jan. to April, 1948.

Eristalis claripennis n. sp.

A small species with opaque rusty brown scutellum, the eyes of the male narrowly separated and densely blackish pilose above. Related distantly to *obsoleta* Bigot. Length 8 mm.

Male. *Head*: face and front black, largely shining, the sides of the face widely greyish yellow pubescent

with long, sparse, yellowish pile. The front is obscurely brownish yellow pollinose above; the eyes are separated by not quite twice the width of the anterior ocellus. Vertex opaque black, the pile of front and vertex long and black. The upper ocular pile is long, abundant and very dark brown to almost black; the lower pile is more sparse and yellowish in color. The antennæ are black, the third segment a little more elongate and perhaps from one and one-third to one and one-half times as long as wide. Arista dark reddish. The facial tubercle is well developed but most abrupt below leaving the face gently concave above. *Thorax*: mesonotum dull opaque black with faint traces of a pair of brownish grey, submedial vittæ anteriorly; the transverse suture is conspicuously bordered anteriorly by a linear band of yellowish white pollen. Behind the transverse suture the mesonotum is somewhat more obscurely opaque black fading away into very dark greyish black pollen. The mesonotal pile is yellowish on the anterior half becoming chiefly blackish posteriorly; the postcallar pile is almost entirely black with two or three yellow hairs. Scutellum opaque orange or rusty brown, the lateral corners narrowly blackish. The scutellar pile is long, erect and yellow except for a group of black hairs in each basal corner. Squamæ dark brown. *Legs*: the femora are blackish becoming obscurely yellowish brown near the apex; the apex of the hind femora is subapically reddish. The hind femora are considerably thickened, the point of greatest thickness lies just beyond the middle. The anterior tibiæ are blackish except the very narrow base which is yellowish brown. Middle tibiæ light yellowish brown throughout. Hind tibiæ slightly flattened with very little pile, the apex transverse, the base and apex light brownish red, the middle diffusely blackish but divided, except upon the narrow dorsal margin, by a conspicuous, light yellow triangle. Anterior tarsi blackish. The middle and hind tarsi upon the first three segments are brownish yellow but the medial margin of the hind basitarsi is dark brown; remaining segments of these tarsi dark brown. *Wings*: quite hyaline with a strong stigmal cross vein. *Abdo-*

men: black and largely shining, the first segment is chiefly opaque grey, the second is opaque black on the anterior and posterior margins and these fascia are joined in the middle. Third segment with a moderately large, opaque, black triangle resting on the base of the segment in the middle and connected to a wide, black, posterior fascia which occupies fully one half the length of the segment. Fourth segment with a minute, basal, medial triangle narrowly connected to the wide, black, posterior fascia. Hypopygium entirely shining. Posterior margins of second, third and fourth segments quite narrowly brownish yellow.

Holotype: male, Nova Teutonia, collected by Fritz Plaumann. Jan. to April, 1948.

Mallota intermedia n. sp.

An aberrant species covered with light reddish brown pile upon the thorax and abdomen. Abdomen shining black, slightly metallic. Mesonotum brownish orange pollinose with obscure darker vittæ. Length 12 mm.

Female. *Head*: the face, cheeks and front are shining black, the face has a band of sparse, greyish white pile rather narrowly encircling the low tubercle and then proceeding upward to the antennæ. There is a narrow, wedge-shaped triangle of similar pubescence proceeding from the eye margin opposite the antennæ towards the base of the antennæ. The lower eye margins are also bordered narrowly with similar pollen, which does not extend upward upon the front. However, most of the frontal eye margins are narrowly bordered with brownish yellow pollen and the upper third of the front is broadly dark brown pollinose; the lower part of the front is shining black and the vertex is shining black. The pile of the face is long, rather abundant and white. The frontal pile is long and black and white intermixed with a few yellow hairs along the eye margins and in front of the ocelli. The occipital pile is yellowish above with a few black hairs anteriorly along the eye margin. The occipital pile becomes almost white ventrally. The first

and second antennal segments are black, the third very dark brown with reddish base. The arista is slender, bare and yellowish brown with white apex. The third antennal segment is short oval. The eyes are rather thickly covered with shining yellowish white pile. *Thorax*: the mesonotum and humeri are black, feebly shining, heavily obscured with an orange brown pollen. There is a pair of submedial, rather wide, definite but indistinct, blackish vittæ which run about three-fourths the length of the mesonotum; there is also a large spot anterior to the transverse suture and another wedge-shaped spot posterior to the transverse suture. These spots and vittæ are also overlaid with brown pollen and they are only visible at certain angles. The scutellum is translucent, brownish orange with light brownish orange pile. The mesonotal pile is similar in color but seems to have less reddish tint and there are numerous fine black hairs interspersed upon the posterior half of the mesonotum. Pleura black, thinly yellowish pubescent on the posterior border of the mesopleura, the sternopleura and the anterior half of the hypopleura and all of the metapleura. Pleural pile orange above, nearly white below. Squamæ yellowish brown, the halteres yellow with brown stalk. *Legs*: black, the tarsal segments narrowly reddish brown in the middle of the apex. The hind femora are only moderately thickened, are long yellow pilose medially and dorsally with a few reddish hairs along the middle of the lateral surface and with black pile or bristles ventrally on the apical half. The hind tibiæ are arcuate and flattened; they are black pilose on the apical half, medially, ventrally and dorsally but yellow pilose throughout the entire length laterally. The pile of the anterior femora and tibiæ is almost entirely black but is narrowly yellow along the anterior margin of each and posteriorly along the basal half of the femora. The middle tarsi are chiefly reddish brown with diffuse, central blackish areas on these tarsi dorsally. *Wings*: distinctly tinged with yellowish or reddish brown over the middle of the wing, more dilutely in the costal cell

and throughout the entire marginal cell, subcostal cell and all of the submarginal cell. The stigmal cross vein is distinct and well formed. The marginal cell is widely open. *Abdomen*: black with a distinct metallic appearance ranging from brassy for the most part to patches of bluish or coppery color. The pile of the first segment is pale yellow; on the remainder of the abdomen the pile is long and thick and light reddish brown, and the ground color is not obscured. Along the lateral margins of the third and fourth segments the pile is pale yellow but along the lateral margin of the second segment and more widely towards the base there are numerous long black hairs and a few long black hairs on the lateral margin of the fifth segment. Sternites shining black with very long pale yellow hair.

Holotype: female, F. Sinchono District, Huanuco, Peru, Aug. 20, 1947, Jose Schunke.

Meromacrus matilda n. sp.

A dull black species with reduced quantity of yellow tomentum. Related to *brunneus* Hull, it is a smaller species and the anterior diagonal band of tomentum upon the thorax ends at the inner end of the humeri and the sutural band of similar tomentum extends the length of the suture. Length 10–11 mm.

Female. *Head*: face and cheeks black, the former with a wide band of pale yellowish white or grey pubescence which extends across beneath the antennæ. The pile of the face is pale yellow and extends together with the pubescence narrowly up the sides of the front. The front is black, shining on the lower half with extensive brown pollen across the upper half. The vertex is black, its pile and that of the front black except along the eye margins where the frontal pile is yellow. The antennæ are black; the third brown becoming paler apically, and is somewhat thickened. The eyes are bare, the occiput conspicuously covered with pale, creamy yellow tomentum extending to the vertex. *Thorax*: the mesonotum is black; there is a not very conspicuous, moderately wide band of pale yellow tomentum placed diagonally forward

to the anterior margin of the mesonotum. The transverse suture is bordered by a complete band of similar tomentum from its medial end to the edge of the mesopleura. There is a similar band, rather narrow just before the scutellum including the posterior border of the postcalli. This band is not wider in the middle. On the anterior half of the mesonotum there is a rather wide but not conspicuous, grey, medial, pollinose vittæ. It is bordered on either side by a faint but wider blackish stripe with faint, brown pollen and outside of these submedial vittæ there are large, triangular areas of a faint but still lighter pollen. The remaining lateral area of the mesonotum, the notopleura excluded, are dull, dead black. The pleura are black with pale yellowish grey pollen on the posterior border of the mesopleura. The pile of the pleura is yellowish white and not very long. Scutellum black becoming obscurely dark brown on the posterior third of the middle only. The scutellar pile is black and rather sparse. Squamæ subtranslucent greyish brown with narrow black border and brownish yellow fringe. Halteres orange. *Legs*: black with the ventral apical half of the hind femora very dark reddish brown; this reddish color includes the whole of the extreme apex of the hind femora. The hind tibiæ are very dark reddish brown throughout and while the anterior and middle tarsi are nearly or quite black, the hind tarsi are very dark brown. *Wings*: the entire anterior margin of the wings including the costal, subcostal cells and the stigmal areas are rather uniformly reddish brown. This color includes all of the submarginal cell, except the loop, and it extends into the upper basal corners of the first posterior cell, into nearly all of the first basal cell above the vena spuria, except the outer lower corners, and it includes the posterior basal half of the first basal cell and more dilutely the basal half of the second basal cell. *Abdomen*: entirely black with a thin, inconspicuous band of sparse, appressed, yellow tomentum in the middle of the posterior border of the first segment. The pile of the second segment is entirely black setate and appressed except upon the lateral margin and the an-

terior corners. Third segment appressed, black pilose except the lateral margins and except for an inconspicuous row of appressed yellow hairs on the extreme base of the margin. These yellow hairs are not tomentose. Fourth segment chiefly black pilose but an oblique view shows scattered, appressed, yellow hairs among the black ones. Fifth segment with sparse yellow hairs. The yellow pile upon the lateral margins of all of the segments is comparatively short and inconspicuous.

Holotype: female, Pucallpa, Peru, Nov. 8, 1947, Jose Schunke.

Meromacrus villosa n. sp.

A trim, black and yellow species, rather similar to *anna* Curran. Length 12 mm.

Male. *Head*: face and cheeks black, the cheeks with a broad band of pale yellow pubescence in which however there is a peculiar dark spot best viewed from the side. This pollen also extends beneath the antennæ. The pile of the face is pale yellow together with the pollen extending upon the sides of the front. Middle of front dully shining black with linear, medial depression; the frontal pile is entirely yellow except for one or two black hairs. The antennæ are entirely black; second segment longer than the first, the third elongate oval, gently arched dorsomedially but not truncate. The arista is but little thickened, is brownish basally, becoming pale at the immediate tip. The vertex is shining black with pale pollen in front of the ocelli, short black pile between the ocelli and yellow pile behind. The occiput has pale yellow tomentum which extends up to the vertex. The eyes are bare and narrowly touching. *Thorax*: mesonotum dull deep black with a fine, narrow, greyish white line of pollen medially which runs only a short distance beyond the transverse suture. There is a band of rather wide, thick, well developed, pale, creamy yellow tomentum running inside the humeri directly across the notopleura almost to the wing base and anteriorly it runs diagonally forward towards but not to the midline where it ends in a sharp medial point. The posterior margin

of this band is straight. There is a minute, narrow patch of similarly colored tomentum on the medial half of the transverse suture separated from the diagonal band by a distance equal to its own length. In an oblique light the anterior diagonal yellow band is bordered by a wide, extensive, jet black, opaque stripe which occupies the full width between this diagonal band and the slender, medial sutural band. There is a similar band of creamy yellow tomentum just in front of the suture covering the posterior ends of the postcalli and expanded medially but gradually until it is about twice as thick as laterally. The scutellum is deep black with short, dense, black pile and a few longer pale hairs. The extreme posterior margin of the scutellum is yellowish brown but this can scarcely be seen from above. Pleura black, the posterior margin of the mesopleura and all of the remaining pleura except the posteroventral half of the hypopleura thinly yellowish white pollinose. There is a vertical middle band of only moderately long but thick white pile on the pleura. Squamæ smoky brown in color with nearly white fringe and dark brown border. Halteres orange. *Legs*: all of the femora are black to the apex except the hind femora. On the hind femora the ventral apical third, half way up the sides, and at the extreme apex, is yellowish brown; this color diffusely merges into the black of the remainder. The anterior and middle tibiæ and their tarsi are entirely black. The hind tibiæ are black except upon the basal ventral half. The hind tarsi are black. Coxæ and the lower and basal portions of the hind femora with long, thick, crinkly pile, pale yellow except in the middle of the femora where it is brownish. The ventral apical third of the hind femora also is thickly beset with short, fine, black bristles. Pile of the hind tibiæ and their tarsi pale yellow except that in the middle of the hind tibiæ ventrally the yellow is mixed with considerable long, dark brown pile. *Wings*: mostly hyaline. The subcostal cell proximal to the stigmal cross vein, the basal half of the marginal cell and all of the submarginal cell, except the loop, are pale smoky brown in color. The anterior margin of the second longitudinal vein is nar-

rowly brownish. The greater part of the outer half of the marginal cell and all of the stigmal portion of the costal cell, except the apex, and all of the costal cell, are hyaline as is the remainder of the wing. There is some suggestion of two tones in the colored portion of the wing as the posterior margin of the second longitudinal vein seems to be slightly more yellowish and the area behind more blackish. *Abdomen*: dull black with prominent bands of pale creamy yellow tomentum as follows: the posterior margin of the first segment except the sides, the entire anterior margin of the third segment and fourth segment. The pile of the second segment is entirely dense, short, black setate except that the lateral margins are narrowly fringed with conspicuous, pale, brassy yellow pile. The third segment is entirely brassy yellow pilose although in some lights it appears to be blackish. The margin of this segment is likewise tinged with yellow pile. Fourth segment with longer and therefore more conspicuous brassy pile, subappressed throughout the segment except for the basal tomentum. Hypopygium thickly pale yellow pollinose with long, scattered, golden pile.

Holotype: male, Pucallpa, Peru, Dec. 8, 1947, Jose Schunke.

Meromacrus flavolinea n. sp.

A large black species in which the femora and coxæ are long pilose. Related to *brunneus* Hull. Length 14 mm.

Male. *Head*: face and cheeks shining black, the face with a broad stripe of pale yellow pubescence running from eye margin to the epistoma and continued beneath the antennæ and more narrowly up the sides of the front. The greater part of the front is shining black, becoming deep reddish black immediately in front of the antennæ. The pile of the face is pale yellow and that of the front of the same color with four or five black hairs intermixed. The vertex is black with black pile except in front of the anterior ocellus. The eyes are bare, touching for a short distance; the occiput is black with yellow tomentum ex-

tending up to the vertical triangle. The first and second segments of the antennæ are black; the third is black except at the extreme base which is slightly reddish; second segment longer than the first; the third segment is distinctly, obliquely truncate dorsoapically, with a single basal pore laterally and another medially. The arista is brownish yellow basally, paler distally and somewhat thickened, except that the apex is quite fine. *Thorax*: mesonotum dull black with a distinct, medial, yellowish grey pollinose vitta which becomes more narrow and is almost evanescent as it reaches the scutellum. There is a diagonal band of yellow tomentum on the inner border of the humeri which does not extend to the lateral margin and which becomes wider medially. It is not clearly bordered by opaque black except in an oblique light. The transverse suture is bordered with yellow tomentum rather widely and evenly from its medial end past the notopleura to the extreme lateral margin and there is a prescutellar band uniform in width of thickness equal to the one upon the transverse suture. The scutellum is black basally becoming diffusely brown posteriorly, the pile abundant and of varying length and black except for a few pale hairs on the margin. The pleura are black with the whole sternopleura, the anterior half of the hypopleura and the posterior border of the mesopleura densely pale yellow pubescent or pollinose and with a thick, vertical, middle band of long, fine, pale yellow pile with crinkled ends. This long yellow pile is situated on the posterior part of the mesopleura, the pteropleura and the upper sternopleura. Squamæ brown with dark sepia brown border and fringe. Halteres orange yellow. *Legs*: the femora are black, the hind pair greatly thickened and becoming diffusely reddish brown upon the outer third. The entire ventral surfaces of these femora are also reddish. The anterior tibiæ are dark reddish brown becoming black anteriorly and their tarsi are nearly black. The middle tibiæ are entirely reddish brown, their tarsi dark reddish brown and the hind tibiæ and tarsi also entirely brownish red. The pile of the hind tibiæ is golden in color, the dorsal

pile of their tarsi black. The coxæ and femora are long, thickly bushy pilose; the pile is pale golden yellow but the hind femora ventrally and apically have a tuft of fine, long, black hair. *Wings*: anterior border of the wings dark brown, extending almost to the apex of the first posterior cell leaving the loop of this cell entirely clear. The costal cell and the basal portion of the stigmal area and also the subcostal cell are more yellowish. *Abdomen*: black, the first segment with a posterior band of yellow tomentum; the second is entirely black pilose upon the posterior half with golden yellow pile anteriorly and laterally. The third segment has a prominent, narrow, basal margin of yellow tomentum, the remainder of its pile short setate and black, except medially on the posterior margin where it becomes reddish. Fourth segment with a similar band of yellow, basal tomentum, the remainder of its pile entirely golden red. Pile of the hypopygium yellow, the entire hypopygium greyish yellow pollinose.

Holotype: male and one paratype male, Pucallpa, Peru, Dec. 11, 1947 and Feb. 5, 1948, Jose Schunke.

Quichuana nigra n. sp.

A rather large black species which is related to *bezzi* Ceresa. It clearly lacks brown color below the spurious vein. From *parisii* Ceresa it differs in the quite black tibiae. Length about 12 mm.

Female. *Head*: the face is brownish black, the sides entirely pubescent without bare sublateral stripes. The tubercle and a short stripe above which reaches only to the bottom of the concavity are shining and bare. The facial pile is abundant and long and yellow. The front and upper part of the face are quite protuberant. The front is shining black with an obscure reddish line down the middle of the lower part; the frontal pile is abundant and except for two or three black hairs it is entirely brassy yellow but this pile nowhere obscures the ground color. Viewed from above there is an acute triangle of coarse yellow micropubescence on the upper part of the front a little way below the ocelli. This triangle is con-

fluent with the narrow and similarly pubescent eye margins. The pile on the anterior part of the raised ocellarium is black; upon the posterior portion it is yellow. The occipital pile is brassy yellow with some slender black hairs above lying anterior to the yellow ones. The ocular pile is slightly flattened, moderately abundant and brilliantly shining silvery with perhaps a faint yellowish cast. The first segment of the antenna is black, the second almost black; both are black pilose. The third segment is comparatively short compared to other species of this genus; it is distinctly wider basally and viewed from the outside this segment is about one and one-third times as long as its greatest width. The third segment is narrowly reddish basally but otherwise black; it has a large, medial, basal, ventral pore. The arista is light brownish yellow throughout; the apex quite fine. *Thorax*: mesonotum shining black with a pair of dull, rather well separated, brownish grey pollinose vittæ situated in the middle of the mesonotum which are distinct for only a short distance beyond the transverse suture. The humeri are a deep reddish brown with a large, rounded patch of dense, pale yellow pubescence upon the medial portion. This patch does not extend to the posterior part of the humeri. Between this patch of pubescence and the medial grey stripes there is an opaque black spot which fades out diffusely behind and which has a very short, diffuse, posterior extension bordering the grey vittæ and an equally obscure diffuse extension partially encircling the humeri. The scutellum and postcalli are very dark reddish brown and shining with short, erect yellow pile on each. The mesonotal pile is quite short and golden or brassy yellow but over the wing there is a wide dense patch of black setæ. The notopleura and a small spot behind the suture are covered with a dense tuft of curly yellow long pile. Pleura black with long curly yellow pile on the mesopleura and thick yellow pile and pubescence on the pteropleura, sternopleura and hypopleura. Squamæ nearly white with dark brown border and fringe. Halteres orange on both knob and stalk. *Legs*: the femora are black, the apices of the anterior

femora are yellowish brown, but those of the middle femora are darker and the hind pair are entirely black except at the acute basal union with the trochanters and a small yellow ventral apical spot. The pile of the femora is yellow with sharp black setæ ventrally upon the outer third of the hind pair. The hind femur is distinctly more enlarged and thickened than in most species of *Quichuana*. The anterior tibiæ are reddish brown, obscurely darker near the apex anteriorly and posteriorly. The middle tibiæ are similar. The hind tibiæ are unusually arcuate, quite flattened and nearly black from a lateral view; they are a little more reddish medially, their ventral margin black pilose, their medial pile yellow except apically where it becomes black or dark reddish brown. The anterior and middle tarsi are brownish black on the second, third and fourth segments, lighter on the remainder. All of the hind tarsi are quite black with black pile. *Wings*: with distinctly two shades of color in addition to the hyaline portion. The costal and first basal cell behind the spurious vein and the whole of the second basal cell are distinctly pale brownish yellow. The subcostal cell, marginal, all of the submarginal cell, except the loop, all of the first basal cell above the spurious vein and the antero-basal corners of the first posterior cell, are rather deep sepia brown. *Abdomen*: The first segment black and nearly opaque with only a few, posteriorly directed, fine, yellow hairs and an oval, medial patch of yellow pollen in the middle. There is yellow, laterally directed, matted hair only upon the sides and not entirely throughout the posterior half of the segment. The second segment is shining black with a distinct, rather large, nearly equilateral, rounded triangle of opaque black lying on the middle of the base of the segment and extending half the length of the segment. The pile of this segment is widely yellow upon the sides extending from the posterior corners diagonally but narrowly to the base of the segment in the midline, the remainder of the pile is black and also nearly erect. Third segment shining black with a narrow, basal band of brassy yellow pile of nearly uniform width but expanding close to the lateral margins to include the

whole lateral margin. Fourth segment similarly colored and pilose, the yellow pile expanding gradually immediately from the middle of the segment and running diagonally to the postero-lateral corner. The pile of all three of these segments, second, third and fourth, is thick and abundant but short. Pile of fifth segment scarcely longer, black down the middle narrowly and upon the posterior margin but widely yellow upon the remainder.

Holotype: female, Pucallpa, Peru, Feb. 5th, 1947; Jose Schunke.

Quichuana ursula n. sp.

This is a black species which traces to *picadoi* Knab from which it is immediately distinguished by the black hind tibiae and the dark brown anterior ones. Length 8 mm.

Male. *Head*: face yellowish white pubescent with brassy yellow pile and an indistinct, nearly bare sublateral stripe in addition to the shining medial stripe over the face. The front is shining black with a distinct tubercular swelling at the upper part of the front and a very slight, rounded elevation subapically below over which there is a medial crease. The frontal pile is quite long and sparse and chiefly black with a few yellow hairs along the sides and a thin line of yellow pubescence along the eye margins. The front and the upper part of the face are but slightly projecting and the facial concavity very low. The occiput is black with black pile in front and black and yellow pile behind; the yellow pile is more abundant. Extending throughout upon the occiput there is an anterior fringe of black hairs which is quite long upon the upper third of the occiput. The minute triangle in front of the ocelli is yellow pubescent. The antennae are comparatively short; the third segment is at least one and a half times as long as wide when viewed laterally, perhaps a little longer; its basal margin is reddish and the remainder black; the arista is light brownish red with fine apex; the first two segments are black with black pile. The eyes have moderately thick bright shining yellowish white pile. *Thorax*: mesonotum dully shining black with

a pair of brownish grey, well separated, submedial vittæ extending a short distance behind the transverse suture. The scutellum is almost black and might easily be mistaken for black. There is an elongate oval, posteriorly acute spot of dense, pale yellow pubescence inside of the black humeri and between this spot and the submedial vittæ there is a quite obscure, opaque black area which is not easily seen except from the rear; this opaque area extends obscurely for a short distance posteriorward and also sends an equally obscure band laterally behind the humeri. This pattern is quite distinct. The pile of the mesonotum is brassy yellow, abundant, longer than in *nigra*, still longer before the scutellum and longer upon the scutellum. There is a distinct, thick, wide patch of black setæ above the base of the wing and there is a patch of long, crinkled yellow tomentum upon the notopleura immediately behind it and down the posterior margin of the mesopleura. The sternopleura and pteropleura are yellow pilose and together with the hypopleura are thickly, densely pale yellow pubescent. The squamæ are pale brownish white with the posterior third blackish; their border is black with a pale yellow fringe. Halteres orange. *Legs*: femora quite black, the anterior and middle pair obscurely brown at the apex, the hind pair with a small yellowish spot ventrally near the apex. The hind pair are moderately thickened with yellow pile but short, stout black setæ ventrally upon the apical third. The anterior and middle tibiæ are very dark reddish brown throughout; the hind tibiæ are only slightly arcuate, moderately flattened and quite black, their ventral, dorsal and lateral pile black; their medial pile is pale yellow, becoming brownish red at the apex. The anterior tarsi are uniformly dark reddish brown and this is true of the middle tarsi which are perhaps only a very little paler on the first segment. The hind tarsi are very dark brownish black with black pile above and dark reddish brown pile below. *Wings*: The costal cell is perhaps faintly yellow throughout. The whole of the subcostal cell, the marginal cell and all of the submarginal cell except the loop are dark brown; the brown color extends on either side of the anterior cross vein to fill the upper basal angle of the first

posterior cell and the upper outer angle of the first basal cell and also connects with the central node of the spurious vein just below the base of the marginal cell, the remainder of these cells as well as the remainder of the wing hyaline. *Abdomen*: first segment black with sparse yellow pile throughout upon the posterior border which is tufted and matted but not conspicuously; it has a few hairs directed posteriorly in the middle. The second segment is dully shining black with a large, diffuse margined, opaque black, basal triangle which extends from close to the antero-basal corners to nearly two-thirds the length of the segment. The basal pile of the second segment is rather long, erect and yellow even on the basal triangles but near the middle of the segment it becomes black and the whole posterior margin of the segment is rather long, fine, erect black pilose except that there is none upon the lateral margins. The third segment has similar pile only a little shorter across the base of the segment which extends more or less diagonally down to include the posterior corners; the remainder of the pile is black, erect and scarcely shorter. On the fourth segment the pile is erect and yellow but sparse on the basal half; it becomes entirely black and suberect upon a large posterior triangular area of the segment which also excludes the lateral margins. Hypopygium quite shining and quite black with long fine yellow pile.

Holotype: male, Pucallpa, Peru; Dec. 4, 1947; Jose Schunke.

I would consider this to be the male of *nigra* because of its black color and similarly obscure thoracic pattern if there were not so many differences. The front is less protuberant, the antennæ slightly longer, the frontal pile predominantly black. There are semi-bare sublateral facial stripes and the hind femora of the male is slightly but distinctly less thick than in *nigra* which is a female; the hind tibiæ are much less arcuate, the squamæ have wide blackish borders, the scutellum is more blackish, the pile of the mesonotum and scutellum much longer and there are some differences upon the pattern of brown upon the wing besides still other differences.

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NEW SPECIES OF MECOPTERA FROM NORTHWEST CHINA¹

BY FUNG YING CHENG

Taiwan Agricultural Research Institute

The Mecoptera or scorpion flies described in the present paper were mostly collected by Prof. Io Chou, Mr. Tien Ho Hei and the writer in Sikang Province during the course of an insect pest survey for the scientific expedition of the Sino-British Committee in 1939. Other specimens were sent to me by Prof. Io Chou, Mr. Chuan Lung Lee and Mr. Chia Chu Tao, to whom I am deeply indebted. In this paper, seventeen new species are described, including one previously identified by Dr. Tjeder as *cornigera*.

In describing the new species, I have followed the terminology of R. E. Snodgrass in his "Principles of Insect Morphology" (1935) and F. M. Carpenter in his "Revision of the Nearctic Mecoptera" (Bull. Mus. Comp. Zool. 1931, 72: 205-277), viz., coxopodites ("basistyles"), harpagones ("dististyles"), hypandrium ("lower appendage"), hypovalvæ (branch of hypandrium), præepiproct ("upper appendage or epiandrium"), parameres ("ventral valves or tittilators") and ædeagus ("dorsal valves") for the males, and subgenital plate and internal skeleton for the females.

¹ Contribution from the Department of Economic Zoology, Taiwan Agricultural Research Institute, published with the approval of the Director of the Institute and with a grant from the Museum of Comparative Zoology at Harvard College.

I wish to express my sincere thanks to Prof. S. F. Chiu of National Peking University and Prof. S. Issiki of National Taiwan University for their encouragement during the course of my study; and to Prof. F. M. Carpenter of Harvard University for his kindness in reading over this paper.

FAMILY PANORPIDÆ

Genus *Panorpa* Linn.

This genus is represented in China (not including Formosa) by 17 species, which may be grouped into three categories on the structure of the 6th abdominal segment of the male, as shown by Carpenter. In the first or *centralis* group, with a single anal horn, we have *centralis* Tjeder and *flavipennis* Carpenter; in the second or *diceras* group, with the double anal horn, we have *diceras* McLachlan, *tjederi* Carpenter, *stotzneri* Esben-Petersen and *kimminsi* Carpenter; in the third or *davidi* group, without the anal horn, we have a great number of species, i.e., *davidi* Navas, *stigmalis* Navas, *cladocerca* Navas, *tetrazonia* Navas, *waongkehzeni* Navas, *tincta* Navas, *japonica* Thunberg, *curva* Carpenter and *difficilis* Carpenter. Two other species, *guttata* Navas and *bonis* Cheng are known only from the female, so that the position of these two species in the above grouping has yet to be determined.

Panorpa emarginata n. sp.

Figures 1, 11, 12, 24, 26, 29

Vertex entirely black; rostrum grayish brown anteriorly, yellowish brown laterally; thorax yellowish brown laterally, pronotum blackish brown, meso- and metanotum entirely pitchy black; the 1st to 6th abdominal segments pitchy black dorsally and ventrally, last few abdominal segments yellowish brown; 6th abdominal segment of male with a single anal horn, yellowish brown in color. Fore wing: length, 14 mm.; width, 3.5 mm.; membrane hyaline, without markings except for a slight suspicion of gray at the apex; pterostigma prominent, indi-

cated by light brown color; the distal hind margin of wings slightly emarginated. Hind wing: length, 12.5 mm.; width, 3.5 mm.; similar to fore wings. ♂ genitalia: genital bulb less rounded; coxopodites long, broadened towards its apex; harpagones short, the outer margin very slightly concave at the middle the inner margin with a median small triangular tooth and a large basal concave area; hypandrium inconspicuous; hypovalvæ long, with slightly concave median outer margins, extending nearly to the base of the harpagones; parameres simple and long, usually reaching to the distal part of harpagones, each consisting of a single stalk, which broadens at the middle, and each very long and sharp distally, bearing a series of long barbs at its distal inner margin; preëpi-proct narrow towards the apex, with nearly straight sides and a narrow U-shaped distal incision; ædeagus with very long apical processes and well prolonged lateral processes, the distal inner margin of the former usually jointed with a broad triangular plate. ♀ genitalia: subgenital plate elongated, emarginated posteriorly, the incision being very small; internal skeleton large, the plate concave at its median sides with a pair of sharp distal posterior arms and two pairs of small basal side plates, the axis straight, extending beyond the plate nearly one-fourth its length.

Holotype (♂): Mt. Hwa, Shensi; June, 1942; Io Chou; in the Museum of Comparative Zoology. *Allotype* (♀): Same collecting data as holotype; in my own collection. *Paratypes*: 3 ♂, 4 ♀, same collecting data as holotype; in National Northwest College of Agriculture, Wukung, Shensi.

This species, possessing a single anal horn, belongs to the *centralis*-group, with the wing membrane transparent as in *centralis* Tjeder. The wing apex of *centralis* Tjeder is colorless, whereas that of *emarginata* is maculated with a slight suspicion of gray. The male genitalia differ from those of *centralis* Tjeder by the less rounded genital bulb and the longer and sharper parameres.

Panorpa obtusa n. sp.

Figures 2, 25, 27, 30

Vertex entirely black; rostrum reddish brown, with weakly defined grayish stripe on each side; thorax reddish brown laterally, entirely black dorsally; the 1st to 6th abdominal segments black dorsally and ventrally, last few abdominal segments of male reddish brown, the hind border of the third tergite of male prolonged into a small semicircular process, 6th abdominal segment furnished with a single anal horn, reddish brown in color. Fore wing: length, 14 mm.; width, 3.55 mm.; membrane light grayish brown, without markings except for a slight suspicion of grayish brown at the apex; pterostigma prominent, indicated by grayish brown color; the wing apex obtuse, broader than in the preceding species. Hind wing: length, 13 mm.; width, 3.5 mm.; similar to fore wing. ♂ genitalia: genital bulb rounded, coxopodites long; harpagones short and stout, the outer margin smoothly curved, the inner margin with a greatly reduced median tooth which cannot be seen from ventral view and a large basal concave area; hypandrium inconspicuous; hypovalvæ rather straight, reaching nearly to the base of the harpagones; parameres simple and stout, usually not extending beyond the tips of coxopodites, each consisting of a single spindle-shaped stalk, formed by the outer strongly sclerotized part; the distal inner margins of parameres furnished with a series of long barbs; preëpiproct slightly narrow towards the apex, with a wide U-shaped distal incision; aedeagus with small lateral processes and a pair of long apical processes, the inner margins of the latter nearly parallel to each other.

♀ unknown.

Holotype (♂): Mt. Taipai, Shensi; July 14, 1943; Chuan Lung Lee; in my own collection.

This species belongs to the *centralis* group, having the same wing marking as the preceding species, but the body color and the structure of male genitalia, especially the short parameres, make its recognition easy.

***Panorpa typicoides* n. sp.**

Figures 3, 13, 14, 28, 31

Body mostly black; vertex black anteriorly, brown posteriorly; rostrum entirely brown; thorax black dorsally, yellowish brown laterally, meso- and meta-notum as a rule with a broad brown median band; 1st to 6th abdominal segments of male black dorsally and ventrally, last few abdominal segments reddish brown, anal horn absent; the hind border of third tergite slightly prolonged behind, and in contact with the small, sharp conical production on the median axis of the fourth tergite; abdominal segments of female entirely black. Fore wing: length, 12.5 mm.; width, 3 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete, with a broad basal branch and a separated narrow apical branch; basal band interrupted, represented by two large spots; apical band broad, with a large hyaline spot posteriorly; basal spot very small; marginal spot large, not extending beyond the vein R₁; pterostigma brown, very prominent. Hind wing: length, 11.5 mm.; width, 3.3 mm.; similar to fore wings, except that the basal spot and the anterior part of the basal band are entirely lacking. ♂ genitalia: genital bulb rounded; coxopodites long, U-shaped, furnished with a series of long hairs at the distal inner portions; harpagones slender, the outer margin slightly concave at the middle, the inner margin with a median angle and a small basal concave area; hypandrium inconspicuous; hypovalvæ rather long, reaching to the base of the harpagones; parameres simple and slender, each consisting of a single stalk, which is distinctly twisted and pointed at its apex; preëpiproct slender, slightly narrow towards apex, with a deep U-shaped distal incision; ædeagus with finger-shaped apical processes and slightly prolonged lateral processes, the distal inner margins of the former usually produced inwards to form a small nipple-shaped plate. ♀ genitalia: subgenital plate elongated, broadened at the middle; internal skeleton long, the plate narrow towards its base with a pair of sharp posterior arms, the axis very

long, extending nearly two-thirds its length beyond the plate.

Holotype (♂): Tachienlu, 5000–8500 ft., Sikang; Aug. 27, 1939; F. Y. Cheng, Io Chou and Tein Ho Hei; in the Museum of Comparative Zoology. *Allotype* (♀): Same collecting data as holotype, in my own collection. *Paratype*: 1 ♂, same collecting data as holotype, in my own collection.

This species, belonging to the *dauidi* group, is a very interesting one, superficially resembling the common European species *communis*; but the peculiar shape of the genital segments both in male and female makes it easily recognized as a distinct species.

Panorpa fructa n. sp.

Figures 5, 6, 7,

Body mostly sooty black, last few abdominal segments of male reddish brown, vertex black anteriorly, deeply reddish brown posteriorly; rostrum uniformly reddish brown. Fore wing: length, 11.5 mm.; width, 3 mm.; membrane hyaline, markings light brown, ill-defined, fragmentary; pterostigmal band incomplete, with a spot-like basal branch; basal band represented by two spots; apical band appears as a light suspicion of brown at the apex; basal spot very small; marginal spots large; pterostigma not very prominent. Hind wing: length, unknown; width, 3 mm.; similar to fore wing, except that basal band and basal spot are entirely absent. ♂ genitalia: genital bulb very rounded; coxopodites long, stout, with four spine-like hairs and a series of short hairs in its distal inner portions; harpagones slender, the outer margin rather straight, the inner margin with a median angle and a rather large basal concave area; hypandrium inconspicuous; hypovalvæ shorter than in the preceding species, far from reaching to the base of the harpagones; parameres simple, long and twisted, the distal half well-developed, with rounded apex furnished with a short spine-like tip; preëpiproct rather short, broad at the base, narrow towards apex, with a broad U-shaped distal incision;

ædeagus with long apical processes and long lateral processes, the former with rather straight inner margins and double sinuous outer margins.

♀ unknown.

Holotype (♂): Wakiakeng, 50 miles west of Tachienlu, Sikang; Sept. 9, 1939; F. Y. Cheng, Io Chou and Tein Ho Hei; in my own collection.

This species belongs to the *davidi* group, and resembles that species superficially, but differs in the broader genital bulb and especially in the well-developed distal part of the parameres and in the shape of the ædeagus.

Panorpa sexspinosa n. sp.

Figures 4, 8, 9, 15, 16

Vertex yellowish brown, with four dark spots on its anterior region, one small spot enclosing the median ocelli anteriorly, one around the other two ocelli posteriorly, the other two are on both sides of the former two spots; rostrum uniformly yellowish brown; thorax blackish brown dorsally, light yellow laterally, meso- and meta-notum as a rule with broad median light yellowish streaks; abdominal segments dark brown dorsally, light brown ventrally, hind part of 6th abdominal segment of male and its last few abdominal segments yellowish brown, the hind border of the third tergite with a band-like prolongation. Fore wing: length, 12 mm.; width, 3 mm.; membrane hyaline, markings darkish brown; pterostigmal band complete, with a broad basal branch and a narrow apical branch; basal band unusually broad; apical band complete, with a hyaline spot; basal spot very small; pterostigma not very prominent. Hind wing: length, 10.8 mm.; width, 3 mm.; similar to fore wing, except that the small basal spot is lacking. ♂ genitalia: genital bulb rounded; coxopodites long, with six spines on its distal inner margins; harpagones slender, the outer margin smoothly curved, the inner margin with a reduced median angle and a large basal concave area; hypandrium inconspicuous; hypovalvæ rather short, not nearly reaching to the base of the harpagones; parameres narrow and

slender, each consisting of a single stalk which is somewhat twisted and pointed at its tip; preëpiproct slender, the distal incision being almost quadrate; apical processes of ædeagus somewhat prolonged on its distal outer margins, lateral processes well-developed. ♀ genitalia: subgenital plate elongated, slightly emarginate posteriorly; internal skeleton large, the plate distinctly concave at its base, with a pair of sharp posterior arms and a pair of anterior side plates; axis well-developed, extending beyond the plate for nearly one-third its length.

Holotype (♂): Mt. Taipai, Shensi, June, 1942; Io Chou; in my own collection. *Allotype* (♀): Same collecting data as holotype; in the Museum of Comparative Zoology. *Paratype*: 1 ♀, same collecting data as holotype; in my own collection.

This species, belonging to the *davidi* group, differs from the others in its wing markings; the basal band is as broad as in *cladocerca* Navas, but its pterostigmal band is quite different. The structure of male genitalia, especially the six spines on the distal coxopodites, makes its recognition easy.

***Panorpa semifasciata* n. sp.**

Figures 19, 20, 21, 53

Body entirely sooty black; vertex black; rostrum uniformly black; the middle part of 8th abdominal tergite slightly prolonged into a band-like prolongation, the 9th abdominal tergite very broad, its lateral borders bent ventrad to embrace the posterior part of subgenital plate in ventral view. Fore wing: length, 14 mm.; width, 3.5 mm.; membrane light yellow, markings sooty brown; pterostigmal band incomplete, with an interrupted narrow basal branch; apical band small, with two hyaline spots; pterostigma prominent. Hind wing: length, 12.8 mm.; width, 3 mm.; similar to fore wing, except that the basal branch of pterostigmal band is greatly reduced. ♀ genitalia: subgenital plate broad, with strongly sclerotized median part and less sclerotized lateral borders, apex of subgenital plate rounded, less sclerotized, fur-

nished with several long hairs; internal skeleton flattened, the plate very small, less sclerotized, the posterior arms of the internal skeleton very long, sharp and strongly sclerotized, axis flattened, jointed with posterior arms and extending a little beyond the plate.

♂ unknown.

Holotype (♀): Jihti, 30 miles east of Tachienlu, Sikang; Sept. 1, 1939; F. Y. Cheng, Io Chou and Tein Ho Hei; in my own collection.

This species differs from all the formerly described species by its body color, reduced wing markings and the peculiar shape of the genital segment of female. The position of this species in the above grouping is not determined.

Panorpa leei n. sp.

Figures 17, 18, 54

Vertex black; rostrum reddish brown, with a short and deep brown stripe on each side of its upper portion; thorax black dorsally, yellowish brown laterally; 1st to 6th abdominal segments black dorsally and ventrally, the 7th to 9th abdominal segments very small, reddish brown. Fore wing: length, 14 mm.; width, 4 mm.; membrane hyaline, markings sooty brown; pterostigmal band broad, with a complete basal branch, and a greatly reduced spot-shaped apical branch; apical band small, including a prominent narrow band and some faintly smoky spots; pterostigma prominent. Hind wing: length, 13 mm.; width, 3.55 mm.; similar to fore wing, except that the basal branch of pterostigmal band is greatly reduced. ♀ genitalia: subgenital plate small, narrowed posteriorly, apex rounded; internal skeleton long, the plate abruptly narrow at the base, with a pair of sharp posterior arms, the axis extending for nearly half its length beyond the plate.

♂ unknown.

Holotype (♀): Mt. Taipai, Shensi; July 14, 1943; Chuan Lung Lee; in the Museum of Comparative Zoology. *Para-*

type: 1 ♀ same collecting data as holotype; in my own collection.

The material was collected by Chuan Lung Lee, in honour of whom I name the species.

This species differs from all the formerly described species by its wing markings and the peculiar shape of the genital segment of the female. The position of this species in the above grouping is not determined.

Panorpa statura n. sp.

Figures 32, 33, 34, 57

Vertex dark brown anteriorly, with a black mark within the ocelli, light brown posteriorly, with a median and a pair of longitudinal bands; rostrum uniformly reddish brown; thorax entirely brown laterally, prothorax dark brown dorsally, meso- and meta-notum uniformly blackish brown; the 1st to 4th abdominal segments of the female blackish brown dorsally; brown ventrally, last few abdominal segments entirely brown. Fore wing: length, 16.5 mm.; width, 4.55 mm.; membrane yellowish brown, markings deep brown; pterostigmal band complete, with a broad basal branch and a broad apical branch; basal band interrupted; apical band large with a hyaline spot; marginal spot very small; pterostigma not very prominent. Hind wing: length, 15 mm.; width, 4.2 mm.; similar to fore wing, except that the small marginal spot is lacking. ♀ genitalia: subgenital plate elongated, narrowed posteriorly, shallowly emarginated at its apex, its lateral borders bent laterad to form a narrow lateral portion; internal skeleton long, the plate concave on its median sides with a pair of short tooth-like posterior arms, the axis long, extending beyond the plate for exactly half its length.

♂ unknown.

Holotype (♀): Mt. Taipai, Shensi; July 14, 1943; Chuan Lung Lee, in my own collection.

This species, having a yellowish brown wing membrane, differs from *flavipennis* Carpenter by its very long wing and the markings of the apical band. The peculiar shape

of the genital segment of the female enables its easy recognition. The position of this species in the above grouping is not determined.

Panorpa pusilla n. sp.

Figures 37, 38, 52

Vertex yellow anteriorly with a black spot enclosing ocelli, sooty brown posteriorly with a median quadrangular plate; rostrum uniformly yellow; thorax brownish yellow dorsally, yellow laterally, meso- and meta-notum with sooty brown markings on each side; abdominal segments sooty brown dorsally, yellow laterally and ventrally. Fore wing: length, 1.8 mm.; width, 0.28 mm.; membrane yellow, markings sooty brown; pterostigmal band complete, with a complete basal branch and a separated apical branch; basal band complete; apical band represented by two prominent bands, the inner one narrow, being parallel to the pterostigmal band, the outer one including the wing apex; basal spot situated on the hind margin of wing; marginal spot very large; pterostigma not very prominent. Hind wing: length, 0.95 mm.; width, 0.28 mm.; similar to fore wing, except that the basal spot on the hind margin of wing is entirely lacking. ♀ genitalia: subgenital plate elliptical, with a slightly distal emargination; the plate of internal skeleton small, the posterior arms of the plate large, twisted at the middle, the axis short and slender, not extending beyond the plate.

♂ unknown.

Holotype (♀): Mt. Taipai, Shensi, June, 1942; Io Chou; in the Museum of Comparative Zoology. *Paratype*: 1 ♀, same collecting data as holotype; in my own collection.

This species, having yellowish wing membrane differs, from the other described species by its very small body size, wing markings and the peculiar shape of the genital segment of the female. The position of this species in the above grouping is not determined.

Panorpa bonis n. sp.

Panorpa cornigera Tjeder (nec McLachlan) Ark. Zool., Bd. 27A, no. 33, p. 7 (1935).

The female of this species, which has been well described and figured by Tjeder, resembles *cornigera*, but I am convinced that it is a distinct species. This is also the opinion of Dr. Issiki, who has collected many individuals of the true *cornigera* in Korea and East Siberia. I am, therefore, describing here as new the species identified as *cornigera* by Tjeder.

The "additional side plates" of 7th–8th abdominal segments of this species are not so slender as those of *cornigera*. The subgenital plate is pointed at its posterior part, and shallowly emarginate at its apex, while that of *cornigera* is rounded and not emarginate. The internal skeleton of this species is quite distinct from that of *cornigera*: the plate of the former is slender with a small proximal part and short blunt posterior arms; while that of the latter is broad, with a well-developed oval proximal part and long pointed posterior arms. The axis of this species extending beyond the plate is less than half the length of the whole axis, while that of *cornigera* usually extends beyond the plate more than half its length.

♂ unknown.

Holotype (♀): Lupasze, at River Tao Ho, South Kansu, about 2,750 m.; July 11, 1930; Dr. D. Hummel; in the Stockholm Museum.

The position of this species in the above grouping is not determined.

Genus *Neopanorpa* Weele

This genus has heretofore been represented in China (not including Formosa) by ten species, of which *apicata*, *caveleriei*, *dimidiata*, *lacunaris*, *pielina* and *brisi* were described by Navas; and *claripennis*, *nigritis*, *chelata* and *banksi* by Carpenter.

In this paper six species are described as new, of which *validipennis* and *taoi* have undeveloped parameres,

and *choui* bears a large internal skeleton with a well-developed axis.

Neopanorpa choui n. sp.

Figures 22, 23, 43, 44, 45, 62

Body light brown, the middle part of the thoracic notum sooty brown; vertex entirely black; rostrum yellowish brown; median process of third abdominal tergite of male extraordinarily long (measuring up to 4.2 mm.) apparently divided into two portions and bearing a series of dense, short stiff hairs on its ventral surface; the fourth tergite extremely long, almost covering the following abdominal segments, somewhat elevated, and furnished with many short stiff hairs on its surface. Fore wing: length, 3.5 mm.; width, 3 mm.; membrane light yellowish brown, markings light brown, very indistinct; pterostigmal band incomplete, usually represented only by the faint basal branch and apical branch; basal band represented only by two small spots on the hind margin; apical band large; pterostigma brown, very prominent. Hind wing: length, 12 mm.; width, 3 mm.; similar to fore wing, except that the pterostigmal band and the basal are entirely lacking. ♂ genitalia: genital bulb slender; coxopodite long, with truncated apex; harpagones slender, the outer margin concave at the middle, inner margin with a triangular angle and a large basal lobe; hypandrium short and broad; hypovalvæ broad and less sclerotized, with an abruptly narrow apex, extending beyond the base of the harpagones; parameres modified into a pair of sclerotized rods, greatly swollen distally and with an incised apex and fused with the basal part of ædeagus basally; preëpiproct narrow distally with truncated and slightly concave apex. Ædeagus rather small, the two apical processes united together; lateral process extending upward with tooth-like apex. ♀ genitalia: subgenital plate broad basally, narrow towards apex and with a narrow U-shaped incision distally; internal skeleton large, the plate little sclerotized, very small, its posterior arms

narrow and slender, sword-shaped, the axis very stout with abruptly curved hook-shaped basal ends.

Holotype (♂): Mt. Chowkung, Yaan, Sikang; July 14, 1939; F. Y. Cheng, Io Chou and Tein Ho Hei; in my own collection. *Allotype* (♀): Same collecting data as holotype; in my own collection. *Paratypes*: 1 ♀, same collecting data as holotype; in the Museum of Comparative Zoology; 2 ♀, same collecting data as holotype; in my own collection.

I take the liberty of naming this species in honour of Prof. Io Chou, of the National Northwest College of Agriculture, who was so kind to me during our expedition.

This species differs from other described *Neopanorpa* by its very long median process of the third abdominal segment and the peculiar structures of both male and female genitalia.

Neopanorpa heii n. sp.

Figures 35, 36, 49, 50, 51

Vertex entirely black; rostrum uniformly brown; thorax sooty brown dorsally, deep brown laterally; the 1st to 5th abdominal segments of male sooty brown dorsally, deep brown laterally and ventrally, 6th abdominal segment twice the length of 5th segment, sooty brown in color, last three abdominal segments also very long, deep brown in color; median process of the third tergite short, never extending to the middle of the fourth tergite, and in contact with the conical projection on the median axis of the fourth tergite; abdominal segments of female sooty brown dorsally, deep brown laterally and ventrally. Fore wing: length, ♂ 12.8 mm.; ♀ 13.5 mm.; width, ♂ 3.2 mm.; ♀ 3 mm.; membrane slightly brown, markings sooty brown; pterostigmal band complete, with a broad basal branch and a greatly reduced and separated apical branch; basal band represented by a reduced marking on the hind margin; apical band well-developed; basal spot very small; marginal spot consisting of two reduced spots; pterostigma prominent. Hind wing: length, ♂ 11.5 mm.; ♀ 12.2 mm.; width, ♂ 3.2 mm.; ♀ 3 mm.; simi-

lar to fore wing, except that apical branch of pterostigmal band, basal band, basal spot and marginal spot are entirely lacking. ♂ genitalia: genital bulb slender; coxopodites rather long, with a projecting apex; harpagones very slender, the outer margin slightly concave at the middle, inner margin with a smooth angle and a true basal lobe; hypandrium rather long; hypovalvæ not flattened, broadened towards the apex, the basal portion wide apart, the median inner parts greatly prolonged upward and overlapping each other; parameres apparently absent; preëpiproct slightly narrow towards the apex, the distal portion bent laterad and caudad so as to embrace the proctiger; ædeagus very small, both the apical and the lateral processes tooth-like, the basal part usually covered by a pair of elliptical membranous plates. ♀ genitalia: subgenital plate broad, with a wide U-shaped distal incision; internal skeleton small, the plate being band-shaped, transversely elongated, the posterior arms of the internal skeleton lanceolate, extending laterad and reaching to the side margins of the subgenital plate, the axis small, fork-shaped, the distal portions of the forks jointed with the basal posterior arms closely.

Holotype (♂): Mt. Chowkung, Yaan, Sikang; July 29, 1939, F. Y. Cheng, Io Chou and Tein Ho Hei; in my own collection. *Allotype* (♀): Same collecting data as holotype, in my own collection.

I take the liberty of naming this species in honour of Mr. Tein Ho Hei, who was so kind to me during our expedition.

This species superficially resembles *caveleriei* Navas in wing markings, but it can be distinguished by the greatly reduced apical branch of the pterostigmal band in the fore wing and the entire lack of this band in the hind wing. Another difference is the unforked R2a of this species as compared with the forked R2a in the re-described figure of *caveleriei* Navas by Esben-Petersen (1921, p. 83). However, the specific characteristics cannot be determined for certain until the structure of the 9th abdominal segment has been studied. This species

also resembles *chelata* Carp. in wing markings but these two species are at once distinguished by the forms of both male and female genitalia.

Neopanorpa validipennis n. sp.

Figures 46, 47, 48, 64, 65

Vertex entirely black; rostrum deep brown, with a median longitudinal light brown streak; thorax sooty brown dorsally, brown laterally, the 1st to 5th abdominal segments of male dark brown dorsally, reddish brown ventrally, 6th segment long, sooty brown, 7th segment reddish brown, 8th segment reddish brown anteriorly, sooty brown posteriorly, both the 7th and 8th segments broaden towards apex, the posterior end of the pleural regions of 7th segment protruding posteriorly to form two small processes, median process of the third tergite rather long, extending nearly to the hind border of the fourth tergite, pointed at the apex when seen dorsally. Under this median process, there is another reddish small process, and on both sides of this median process is a pair of small tooth-like prolongations, the median axis of the fourth tergite slightly protruding upward. Fore wing: length, 14.5 mm.; width, 3.5 mm.; membrane grayish brown, no markings present; veins very stout, R2a usually forked into R2a1 and R2a2; pterostigma not very prominent. Hind wing: length, 13.5 mm.; width, 3.5 mm.; similar to fore wing. ♂ genitalia: genital bulb slender; coxopodites very long, abruptly narrow distally, bearing a number of long hairs on the distal inner margins; harpagones short and slender, the outer margin slightly concave at the middle, furnished with a series of short barbs at the basal half, inner margin with a large lobe basally; hypandrium long, slightly narrow towards apex; hypovalvæ with slender basal stalks, wide apart basally, overlapping each other, the outer borders extending laterad and concave near its middle; parameres club-shaped with rounded apex; præpiproct slender with rounded apex, the distal outer portion extended laterad to embrace the proctiger, and forming distal tooth-like

processes; ædeagus very small, the two apical processes nearly united, lateral processes extended posteriorly, sharp and tooth-like.

♀ unknown.

Holotype (♂): Jihti, 30 miles east of Tachienlu, Sikiang; Sept. 2, 1939; F. Y. Cheng, Io Chou and Tein Ho Hei; in my own collection.

This species resembles *claripennis* Carp. and *nigritis* Carp. in lacking color markings of wings, but the form of the male genitalia makes its recognition easy.

Neopanorpa taoi n. sp.

Figures 10, 58, 66, 68

Body light brown; vertex entirely black; rostrum light brown with sooty brown stripe on each side; pronotum sooty brown, meso- and meta-notum sooty brown on the median portion; the 1st to 5th abdominal segments of male sooty brown dorsally, last few abdominal segments brown in color, median process of third abdominal tergite short with swollen and truncated apex, not extending beyond the middle of the fourth tergite. Under this process, there is a small median process and a pair of lateral processes; the fourth tergite is provided with a concave area on its anterior portion. Fore wing: length, 0.7 mm.; width, 3.8 mm.; membrane light gray, no markings present, R2a usually forked into R2a1 and R2a2; pterostigma prominent. Hind wing: length, 15.8 mm.; width, 3.8 mm.; similar to fore wing. ♂ genitalia: genital bulb slender; coxopodites long, narrow distally, bearing many long hairs; harpagones rather short, the outer margin convex basally, furnished with a series of short barbs at the middle, inner margin with a large basal lobe with two tooth-like processes, hypandrium broad, hypovalvæ wide apart basally, slightly overlapping each other distally, the basal outer margins greatly convex and strongly sclerotized, parameres simple, lanceolate; præpiproct slender, with median concaved margins, the distal outer portions extended laterad, forming large, distal, tooth-like processes; ædeagus rather small, both apical proc-

esses and lateral processes tooth-like, extending the same direction and having nearly the same size.

♀ unknown.

Holotype (♂): Mt. Lo, Sichang; June 10, 1944, Chia Chu Tao; in my own collection.

The species is named in honour of Chia Chu Tao. It differs from the preceding one by the broadened apex of the median process of the 3rd abdominal segment and also by the structure of the male genitalia.

Neopanorpa latipennis n. sp.

Figures 39, 40, 55

Body deep brown, black above, vertex black anteriorly, brown posteriorly, with a sooty brown marking on the median portion; rostrum brown, with a sooty brown median stripe on its lower portion. Fore wing: length, 14 mm.; width, 3.53 mm.; membrane hyaline, markings sooty brown; pterostigmal band very broad, with broad basal branch and narrow apical branch, basal band not very prominent, extending to the median portion of the fore wing, apical band very large, represented by a big marking and an inner small Y-shaped band; marginal spots small; pterostigma prominent; the wing apex rather broad. Hind wing: length, 12.55 mm.; width, 3.5 mm.; similar to fore wing, except that the apical branch of pterostigmal band, the inner small Y-shaped band of apical band and the basal band are greatly reduced. ♀ genitalia: subgenital plate abruptly narrow posteriorly, with a wide U-shaped distal incision; internal skeleton small, being U-shaped, with a small stalk at its base, the axis apparently absent.

♂ unknown.

Holotype (♀): Moupin, Sikang; July 29, 1941; Chuan Lung Lee; in my own collection.

This species differs from described *Neopanorpa* by its additional small Y-shaped band between the pterostigmal and apical bands in the fore wings. The stalk bearing U-shaped internal skeleton of the female enables its easy recognition.

***Neopanorpa varia* n. sp.**

Figures 41, 42, 56

Body light brown, black above, last few abdominal segments brown, vertex entirely black; rostrum light brown with black stripe on each side. Fore wing: length, 14 mm.; width, 3.2 mm.; membrane slightly brown, markings sooty brown; pterostigmal band complete, with a separated basal branch and a narrow apical branch; apical band complete; pterostigma prominent. Hind wing: length, 13 mm.; width, 3.3 mm.; similar to fore wing, except that the basal band is represented by a small marking on the hind margin. ♀ genitalia: subgenital plate broad, with a U-shaped distal incision; internal skeleton large, U-shaped, posterior arms rather long, obtuse distally, very large basally, with a narrow sclerotized bridge and a rounded membranous portion between them, axis apparently absent.

♂ unknown.

Holotype (♀): Heierhwan, 100 miles south of Tachienlu, Sikang; Sept. 20, 1939; F. Y. Cheng, Io Chou and Tein Ho Hei; in my own collection. *Paratypes*: 1 ♀ Jihti, 20 miles east of Tachienlu, Sikang; Sept. 2, 1939; 1 ♀ Tienwan, 30 miles south of Tachienlu, Sikang; Sept. 9, 1939; 1 ♀ Wantung, 50 miles south of Tachienlu, Sikang; Sept. 17, 1939; F. Y. Cheng, Io Chou and Tien Ho Hei; in my own collection.

This species is somewhat variable with regard to the markings of the wings; in my collection, there is one individual collected in Wantung, Sikang, with a greatly reduced pterostigmal band on both fore and hind wings and without the basal band on the hind wing.

This species resembles *chelata* Carp. in wing markings, but differs greatly in the structure of the female genitalia. The internal skeleton of this species resembles *banksi* Carp. superficially, but differs in its basal structure as compared with the three well-developed plates which appear on the base of the internal skeleton of *banksi* Carp. The wings of this species differ from

those of *caveleriei* Navas by the absence of a transverse marking which joins the pterostigmal and apical bands at the anterior margin of the wing. The wings of this species resemble those of *dimidiata* Navas, but the body color differs very much. However, the specific characteristics cannot be determined with certainty until the structure of the 9th abdominal segment has been studied.

FAMILY BITTACIDÆ

Genus *Bittacus* Latr.

This genus has been represented in China (not including Formosa) by four species, of which *sinensis* was described by Walker, *pieli* by Navas, and *triangularis* and *sinicus* by Issiki.

Bittacus planus n. sp.

Figures 59, 60, 61, 63, 67

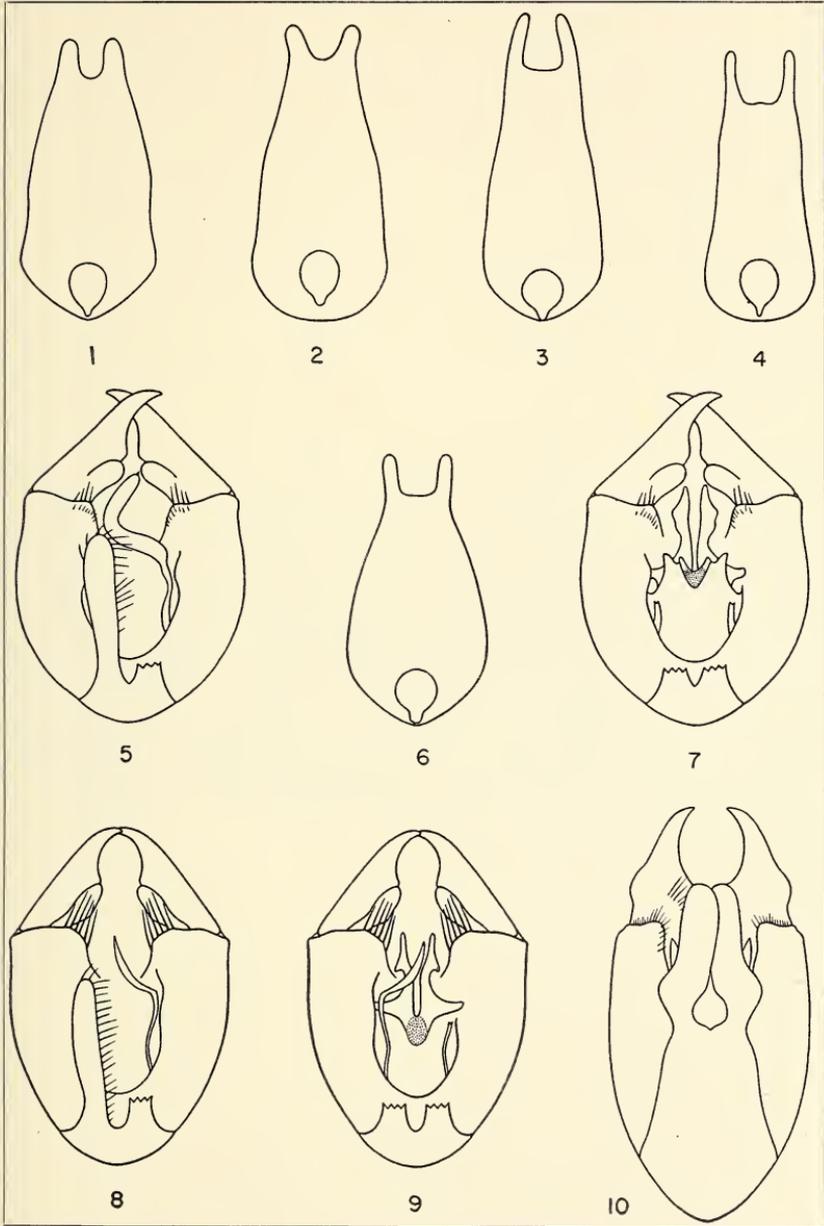
Body light brown, vertex brown, with sooty brown marking enclosing ocelli; rostrum brown; meso-thorax with two sooty brown spots on each side dorsally. Fore wing: length, 20.2 mm.; width, 5.2 mm.; the wing apex broad, obtuse; membrane light brown without markings, veins brown, cross veins slightly emarginated; pterostigma not very prominent, apical cross vein in the area between Cu2 and 1A absent. Hind wing: length, 17.5 mm.; width, 4.2 mm.; similar to fore wing, except that there is only one cross vein between the pterostigma and R2. ♂ genitalia: preëpiproct with V-shaped inner margins, when seen from above, with truncated apex, the apical margins being slightly concave, furnished with a series of short black bristles on its interior sides; caudal end of coxopodites produced upward rather long with smooth apex; harpagones broad basally, very narrow and slender distally, with prominent inner process; ædeagus lobes on each side of the base of filum broaden towards apex with truncated tips; proctiger narrow towards apex, furnished with a bundle of short hairs; the lower process very long, pointed towards its apex.

Holotype (♂): Mt. Taipai, Shensi, June, 1942; Io Chou; in my own collection. *Paratypes*: 1 ♂, 1 ♀, same collecting data as holotype; in the Museum of Comparative Zoology. 2 ♂, 3 ♀, same collecting data as holotype; in National Northwest College of Agriculture, Wukung, Shensi.

This species differs from the previously described species by the peculiar shape of the preëpiproct in lateral view, the slender harpagones and the broadened apex of the ædeagus lobes.

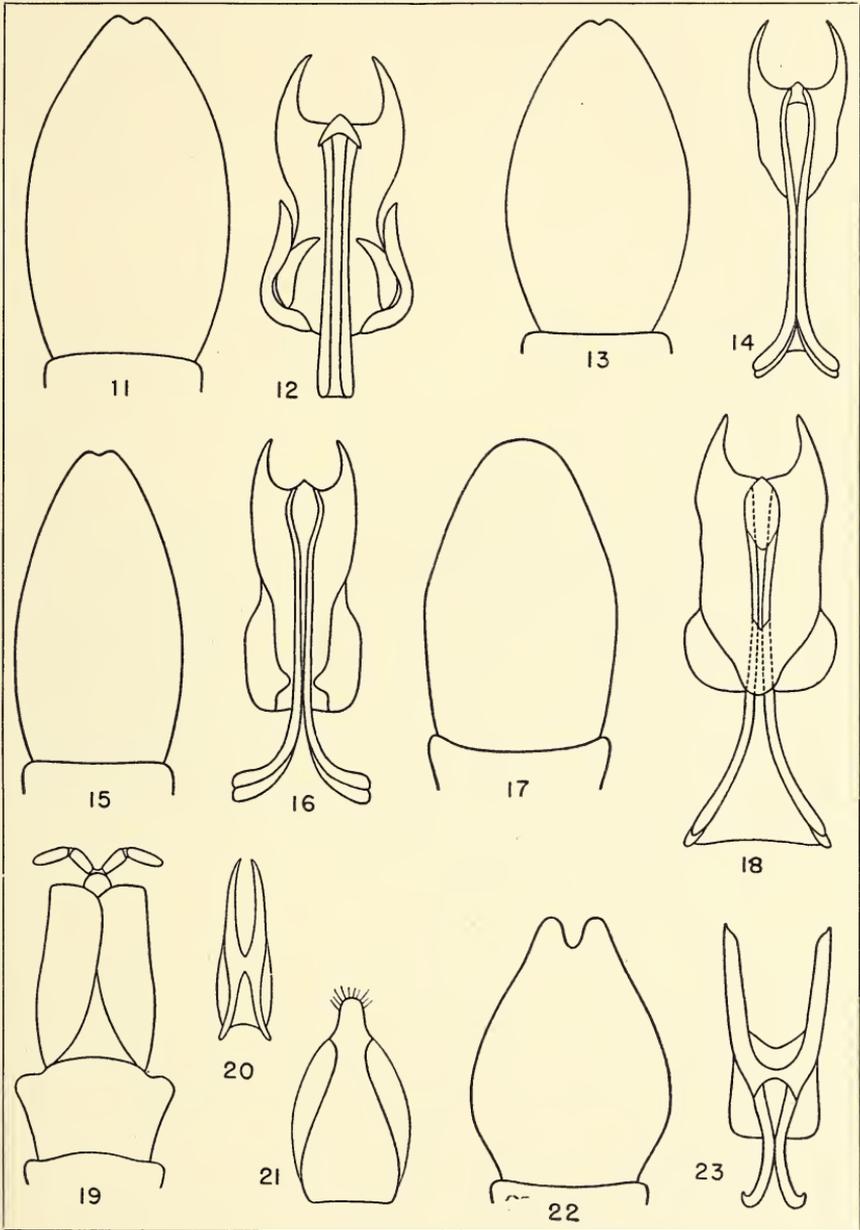
EXPLANATION OF PLATE 7

- Fig. 1. *Panorpa emarginata* n. sp., preëpiproct of ♂. (Holotype).
Fig. 2. *Panorpa obtusa* n. sp., preëpiproct of ♂. (Holotype).
Fig. 3. *Panorpa typicoides* n. sp., preëpiproct of ♂. (Holotype).
Fig. 4. *Panorpa sexspinosa* n. sp., preëpiproct of ♂. (Holotype).
Fig. 5. *Panorpa fructa* n. sp., ventral view of ♂ genital bulb. (Holotype).
Fig. 6. *Panorpa fructa* n. sp., preëpiproct of ♂. (Holotype).
Fig. 7. *Panorpa fructa* n. sp., ventral view of ♂ genital bulb. (Holotype).
Fig. 8. *Panorpa sexspinosa* n. sp., ventral view of ♂ genital bulb. (Holotype).
Fig. 9. *Panorpa sexspinosa* n. sp., ventral view of ♂ genital bulb, showing ædeagus. (Holotype).
Fig. 10. *Neopanorpa taoi* n. sp., ventral view of ♂ genital bulb. (Holotype).



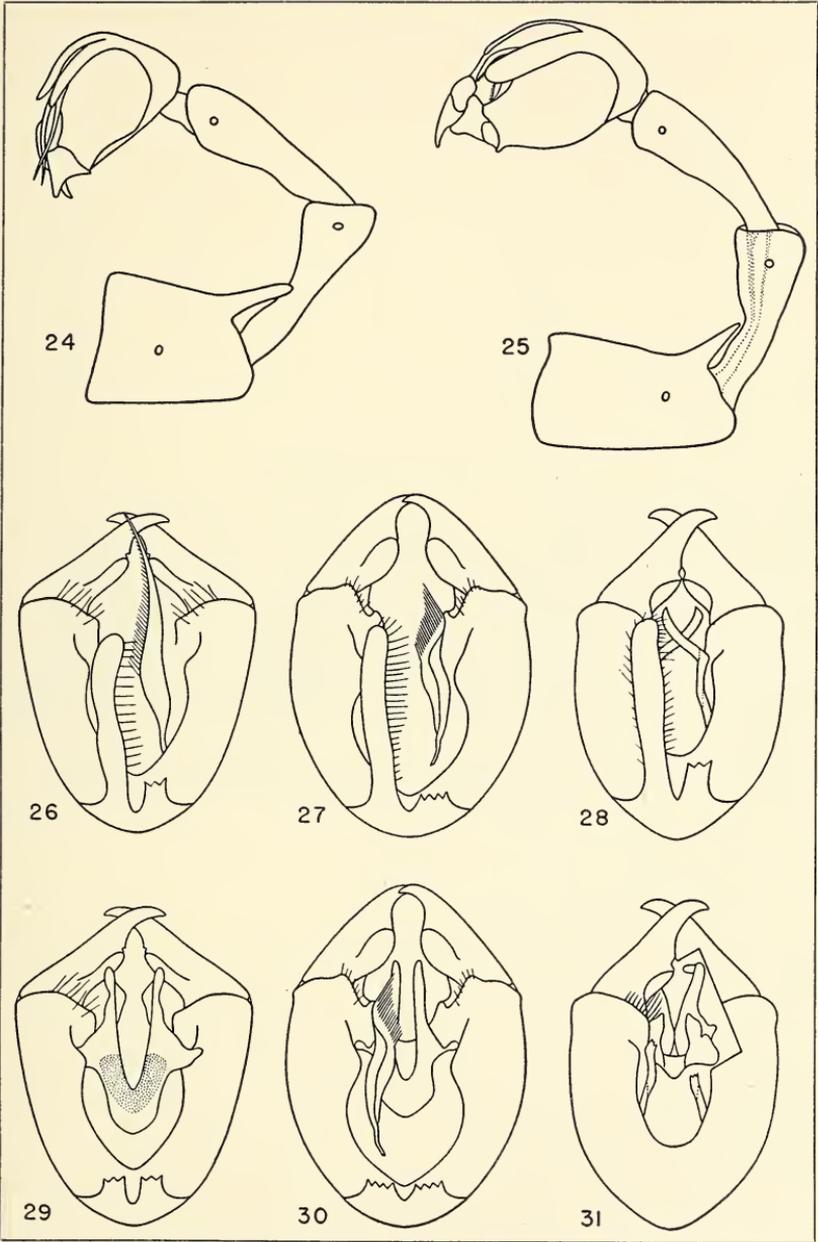
EXPLANATION OF PLATE 8

- Fig. 11. *Panorpa emarginata* n. sp., subgenital plate of ♀. (Allotype).
Fig. 12. *Panorpa emarginata* n. sp., internal skeleton of ♀. (Allotype).
Fig. 13. *Panorpa typicoides* n. sp., subgenital plate of ♀. (Allotype).
Fig. 14. *Panorpa typicoides* n. sp., internal skeleton of ♀. (Allotype).
Fig. 15. *Panorpa sexspinosa* n. sp., subgenital plate of ♀. (Allotype).
Fig. 16. *Panorpa sexspinosa* n. sp., internal skeleton of ♀. (Allotype).
Fig. 17. *Panorpa leei* n. sp., subgenital plate of ♀. (Holotype).
Fig. 18. *Panorpa leei* n. sp., internal skeleton of ♀. (Holotype).
Fig. 19. *Panorpa semifasciata* n. sp., ventral view of ♀ last few abdominal segments. (Holotype).
Fig. 20. *Panorpa semifasciata* n. sp., internal skeleton of ♀. (Holotype).
Fig. 21. *Panorpa semifasciata* n. sp., subgenital plate of ♀. (Holotype).
Fig. 22. *Neopanorpa choui* n. sp., subgenital plate of ♀. (Allotype).
Fig. 23. *Neopanorpa choui* n. sp., internal skeleton of ♀. (Allotype).



EXPLANATION OF PLATE 9

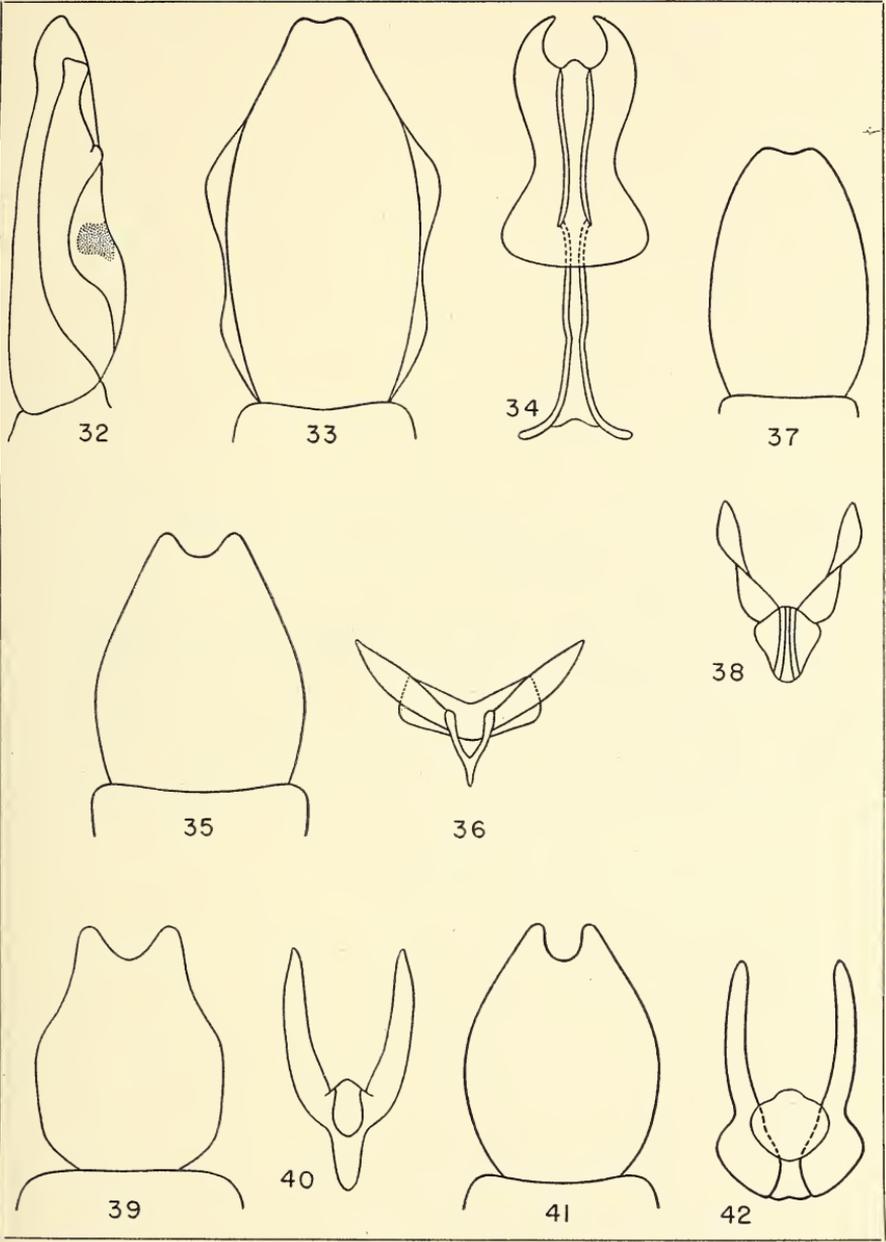
- Fig. 24. *Panorpa emarginata* n. sp., lateral view of ♂ last few abdominal segments. (Holotype).
- Fig. 25. *Panorpa obtusa* n. sp., lateral view of ♂ last few abdominal segments. (Holotype).
- Fig. 26. *Panorpa emarginata* n. sp., ventral view of ♂ genital bulb. (Holotype).
- Fig. 27. *Panorpa obtusa* n. sp., ventral view of ♂ genital bulb. (Holotype).
- Fig. 28. *Panorpa typicoides* n. sp., ventral view of ♂ genital bulb. (Holotype).
- Fig. 29. *Panorpa emarginata* n. sp., ventral view of ♂ genital bulb, showing ædeagus. (Holotype).
- Fig. 30. *Panorpa obtusa* n. sp., ventral view of ♂ genital bulb, showing ædeagus. (Holotype).
- Fig. 31. *Panorpa typicoides* n. sp., ventral view of ♂ genital bulb, showing ædeagus. (Holotype).



CHENG—MECOPTERA

EXPLANATION OF PLATE 10

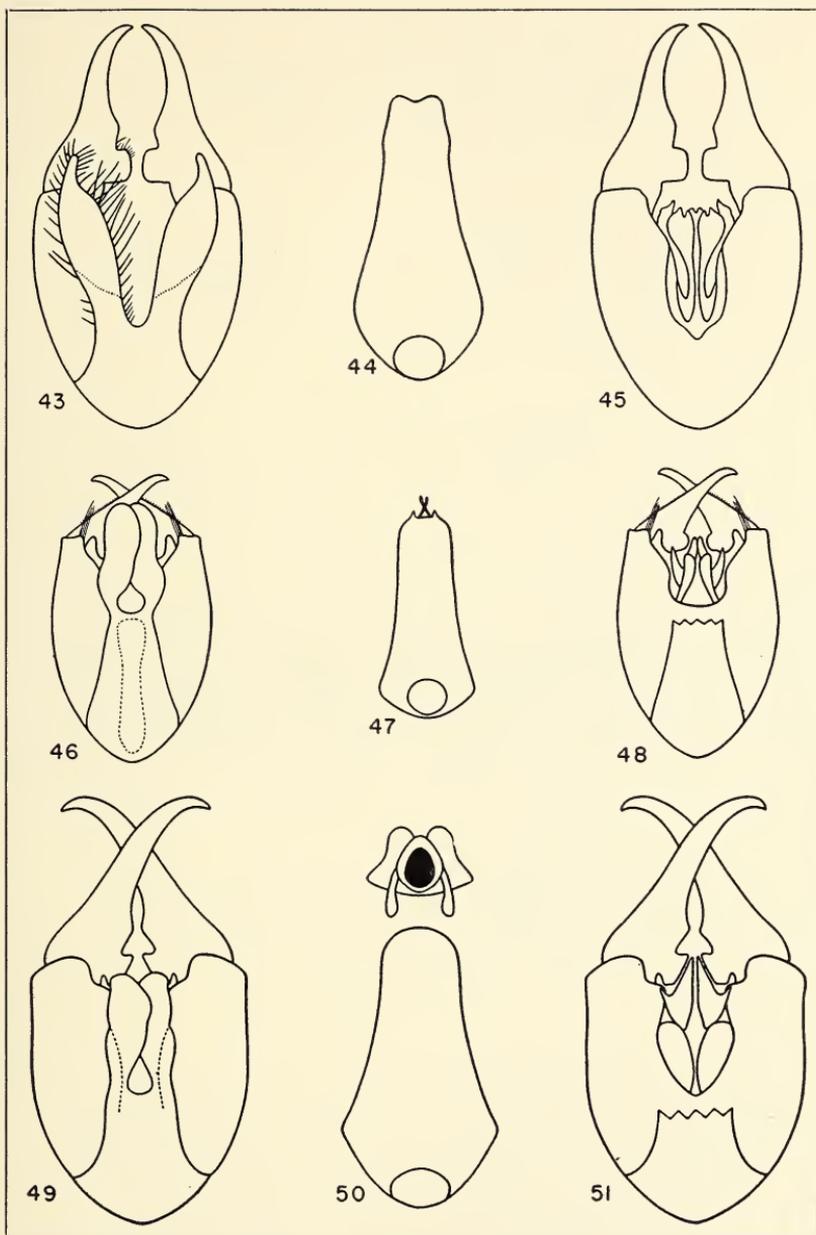
- Fig. 32. *Panorpa statura* n. sp., lateral view of subgenital plate of ♀. (Holotype).
- Fig. 33. *Panorpa statura* n. sp., subgenital plate of ♀. (Holotype).
- Fig. 34. *Panorpa statura* n. sp., internal skeleton of ♀. (Holotype).
- Fig. 35. *Neopanorpa heii* n. sp., subgenital plate of ♀. (Allotype).
- Fig. 36. *Neopanorpa heii* n. sp., internal skeleton of ♀. (Allotype).
- Fig. 37. *Panorpa pusilla* n. sp., subgenital plate of ♀. (Holotype).
- Fig. 38. *Panorpa pusilla* n. sp., internal skeleton of ♀. (Holotype).
- Fig. 39. *Neopanorpa latipennis* n. sp., subgenital plate of ♀. (Holotype).
- Fig. 40. *Neopanorpa latipennis* n. sp., internal skeleton of ♀. (Holotype).
- Fig. 41. *Neopanorpa varia* n. sp., subgenital plate of ♀. (Holotype).
- Fig. 42. *Neopanorpa varia* n. sp., internal skeleton of ♀. (Holotype).



CHENG—MECOPTERA

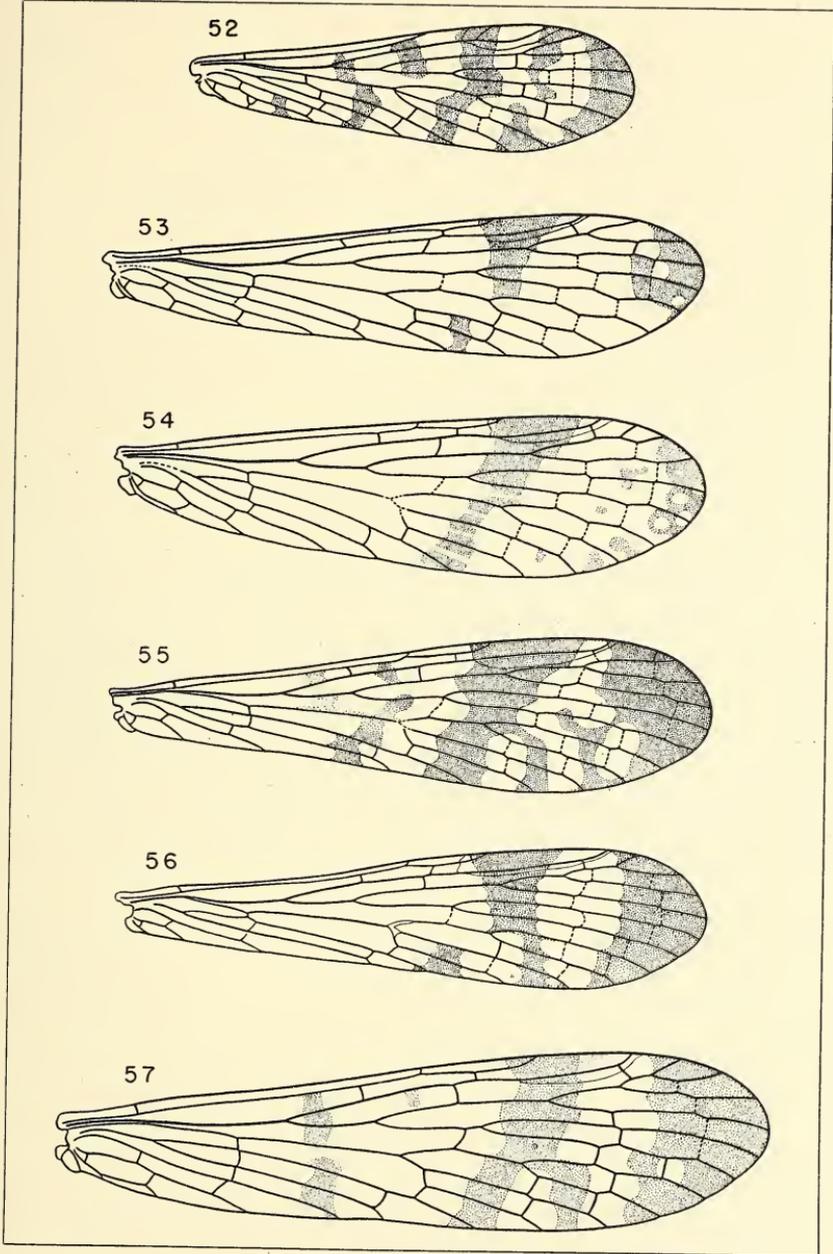
EXPLANATION OF PLATE 11

- Fig. 43. *Neopanorpa choui* n. sp., ventral view of ♂ genital bulb. (Holotype).
- Fig. 44. *Neopanorpa choui* n. sp., preëpiproct of ♂. (Holotype).
- Fig. 45. *Neopanorpa choui* n. sp., ventral view of genital bulb, showing ædeagus. (Holotype).
- Fig. 46. *Neopanorpa validipennis* n. sp., ventral view of ♂ genital bulb, (Holotype).
- Fig. 47. *Neopanorpa validipennis* n. sp., preëpiproct of ♂. (Holotype).
- Fig. 48. *Neopanorpa validipennis* n. sp., ventral view of ♂ genital bulb, showing ædeagus. (Holotype).
- Fig. 49. *Neopanorpa heii* n. sp., ventral view of ♂ genital bulb. (Holotype).
- Fig. 50. *Neopanorpa heii* n. sp., preëpiproct of ♂. (Holotype).
- Fig. 51. *Neopanorpa heii* n. sp., ventral view of ♂ genital bulb, showing ædeagus. (Holotype).



EXPLANATION OF PLATE 12

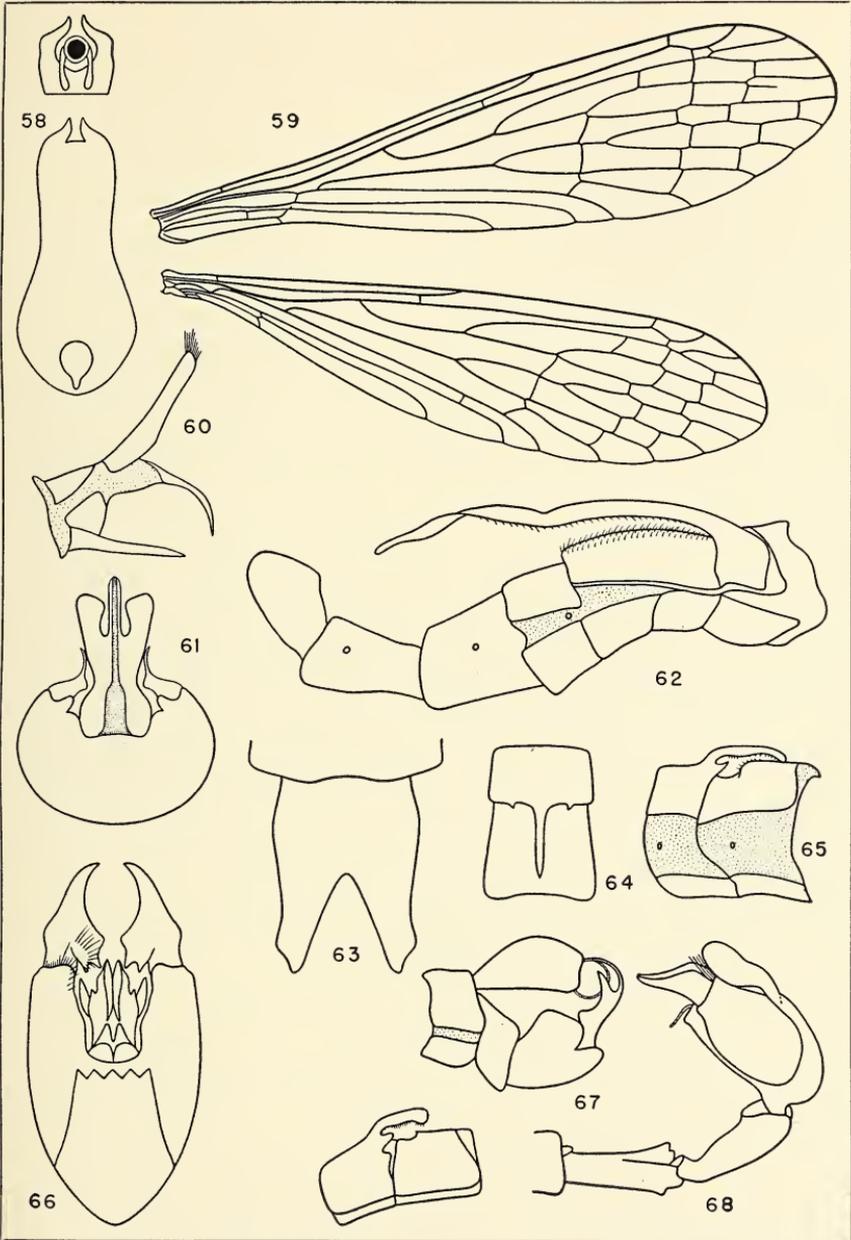
- Fig. 52. *Panorpa pusilla* n. sp., fore wing of ♀. (Holotype).
Fig. 53. *Panorpa semifasciata* n. sp., fore wing of ♀. (Holotype).
Fig. 54. *Panorpa leei* n. sp., fore wing of ♀. (Holotype).
Fig. 55. *Neopanorpa latipennis* n. sp., fore wing of ♀. (Holotype).
Fig. 56. *Neopanorpa varia* n. sp., fore wing of ♀. (Holotype).
Fig. 57. *Panorpa statura* n. sp., fore wing of ♀. (Holotype).



CHENG—MECOPTERA

EXPLANATION OF PLATE 13

- Fig. 58. *Neopanorpa taoi* n. sp., preëpiproct of ♂. (Holotype).
Fig. 59. *Bittacus planus* n. sp., wings of ♂. (Holotype).
Fig. 60. *Bittacus planus* n. sp., terminal abdominal appendages, lateral view of the proctiger. (Holotype).
Fig. 61. *Bittacus planus* n. sp., terminal abdominal appendages, dorsal view. (Holotype).
Fig. 62. *Neopanorpa choui* n. sp., lateral view of ♂ abdominal segments, showing long median process. (Holotype).
Fig. 63. *Bittacus planus* n. sp., terminal abdominal appendages, caudal view. (Holotype).
Fig. 64. *Neopanorpa validipennis* n. sp., dorsal view of the median process of ♂. (Holotype).
Fig. 65. *Neopanorpa validipennis* n. sp., lateral view of the median process of ♂. (Holotype).
Fig. 66. *Neopanorpa taoi* n. sp., ventral view of ♂ genital bulb, showing aedeagus. (Holotype).
Fig. 67. *Bittacus planus* n. sp., terminal ♂ abdominal appendages, lateral view. (Holotype).
Fig. 68. *Neopanorpa taoi* n. sp., lateral view of abdominal segments of ♂. (Holotype).



CHENG—MECOPTERA

SEVENTY-FIFTH ANNIVERSARY OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.—As this issue of *Psyche* goes to press, plans are being made for a 75th anniversary meeting of the Cambridge Entomological Club, on December 20, 1949. The Club was formed on January 9, 1874, by thirteen local entomologists, who met at Dr. Hagen's house. In addition to Hagen the group included Samuel Scudder, A. S. Packard, Samuel Henshaw, Edward Burgess, George Dimmock, J. H. Emerton, E. Schwarz, E. P. Austin, B. P. Mann, J. C. Munro, G. R. Crotch and H. R. Morrison. The first scientific communication of that evening was a discussion by Dr. Hagen of an amber insect from Maryland. At the fourth meeting, on April 10, 1874, the members voted to publish a monthly journal, named *Psyche*. Five hundred printed copies of the first issue were brought to the next meeting, on May 8. Within the next few years many well-known entomologists joined the Club, among them being H. R. Grote, Baron Osten-Sacken, Samuel Williston, J. L. Leconte, C. V. Riley, J. A. Lintner and W. H. Edwards. The Club was incorporated on February 9, 1877. Most of the early meetings were held at Scudder's house, on Brattle St., Cambridge. After 1900 the group met at either the Boston Society of Natural History building or the Appalachian Mountain Club rooms. Subsequent to the appointment of W. M. Wheeler at Harvard University in 1910, the meetings have been held at one of the University's buildings—the Bussey Institution until 1931, and the Biological Laboratories from then until the present time. The 75th Anniversary Meeting will be the 647th meeting since the formation of the Club. *Psyche* is now in its 56th volume.—F. M. CARPENTER.

ACANTHEPEIRA VENUSTA (BANKS)
(ARANEÆ)¹

BY ELIZABETH B. BRYANT

Museum of Comparative Zoology

Among the collection of spiders in the Museum of Comparative Zoology, several specimens including both sexes of *Acanthepeira venusta* (Banks), from various localities in Florida, were identified. The male has never been recognized before, and as the original description was based on a female, a more complete description of both sexes with figures seems desirable.

The genus *Acanthepeira* appears in the list of Arachnida by Marx in Howard's "List of the Invertebrate Fauna of South Carolina" 1883, used for the species *Epeira stellata* Walck., 1805. As Howard's list is quite rare, it is not surprising that the Marx genus has been overlooked. In 1892, McCook proposed the genus *Marxia* for the same species, *Epeira stellata* Walck. The generic description lists few structural characters and is based largely on the marginal tubercles of the abdomen and the width of the clypeus, characters that are shared by other genera of the family. So in 1904, F.O.P.—Cambridge redescribed the genus using more definite characters. This definition has been generally accepted. In 1941, Archer reinstated the generic name, *Acanthepeira* and it has also been recently used by Kaston in the "Spiders of Connecticut," 1948.

Acanthepeira venusta (Banks)

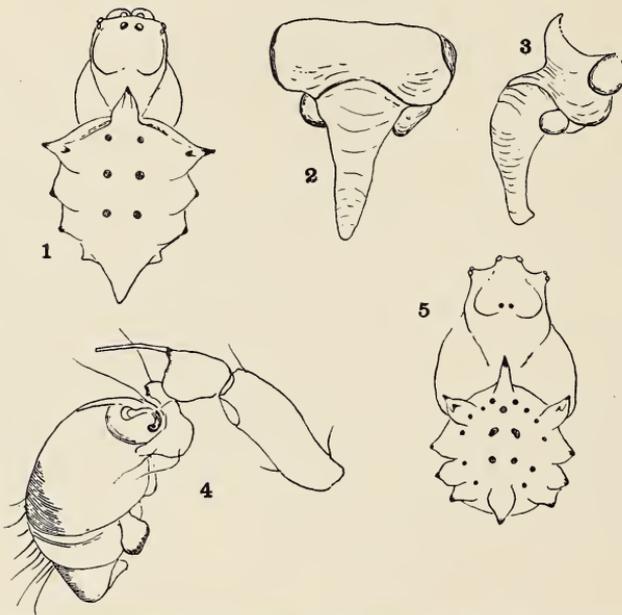
Figures 1-5

Plectana venusta Banks, 1896, p. 69. "♀ Florida; Punta Gorda."

Female. Length, 6.0 mm., ceph. 3.0 mm. long, 2.2 mm. wide, abd. 4.2 mm. long without the anterior and posterior tubercles, 4.0 mm. wide.

¹ Published with a grant from the Museum of Comparative Zoology at Harvard College.

Cephalothorax brown, cephalic portion pale and covered with white hairs, a pair of large circular elevations directly posterior to the eyes, anterior margin wide and truncate; *eyes* in three groups, seen from the front, the anterior row procurved, median eyes carried forward on a small lobe, a.m.e. smaller than the p.m.e., separated by about two diameters, p.m.e. separated by a diameter, lateral eyes subequal on a distinct tubercle at the extreme angle of the carapace; *quadrangle* higher than wide and as wide in front as behind; *clypeus* below the a.m.e. as high as the quadrangle: *mandibles* brown, vertical, fang



Figs. 1-5. *Acanthepeira venusta* (Banks). Fig. 1. Female, dorsal, (type); fig. 2. Epigynum, ventral; fig. 3. Epigynum, lateral; fig. 4. Left palp, retrolateral; fig. 5. Male, dorsal.

groove oblique, upper margin with a row of black bristles followed by three teeth, lower margin with four subequal, contiguous teeth, fang short; *labium* wider than long, basal half dark, tip pale; *sternum* lateral margins dark, triangular, one and a half times as long as broad, fourth coxæ touching; *abdomen* pale, with a vague folium on the

posterior half, with ten tubercles on the margin, each with a corneous tip, the pointed anterior median tubercle extends well over the cephalothorax, the posterior median tubercle blunt and hairy, and the tip darker, as wide at the base as it is long, extends well over the spinnerets, four pairs of graduated lateral tubercles, the largest at the lateral angles, bifid at the tip, the posterior pair very small and not in line with the other pairs, venter infusate with a pale transverse bar posterior to the epigynum; *legs*, 1-2-4-3, rather short, brown, with darker brown rings, more distinct on the ventral side, spines shorter than the diameter of the joint, no ventral spines on the femora, a dorsal basal spine on III and IV tibiae; *epigynum*, area longer than wide, a narrow chitinized base, from which projects a slender, graduated fleshy scape, fully twice as long as the chitinized base, tip curled inward, each side of the base a circular opening, with a second smaller opening at the base of the scape.

Male. Length, 6.2 mm., ceph. 4.0 mm. long, 3.4 mm. wide, abd. 3.0 mm. long, 2.9 mm. wide.

Cephalothorax dark brown, broader than in the female and the anterior margin much narrower, many pale hairs in the ocular area, the circular elevations posterior to the eyes more distinct than in the female, with a pair of dark dots close together as figured; *eyes*, median eyes carried forward on a lobe, lateral eyes on distinct tubercles; *mouth parts* and *sternum* as in the female; *abdomen* with the tubercular pattern as in the female, except that the anterior median tubercle is more slender, and the posterior median tubercle is cone-shaped and extends upward at almost right angles to the abdomen, not a longitudinal extension, the muscle spots large and chitinized with numerous small chitinized flecks on the dorsum; *legs*, 1-2-4-3, brown, with darker rings on all joints, legs longer than in the female, with no hook on the first and second coxae, a coniform spur on the fourth coxa, second tibia not incrassate, nor with any specialized spines, spines longer than in the female, a retrolateral row of spines on the fourth femur, with two short chitinized

spurs on tubercles near the base; *palpus* not as long as the cephalothorax, patella with one long stout bristle at the tip, tibia not as long as the patella, swollen ventrally, with a long pale, retrolateral process extending dorsally with several long colorless bristles near the tip, paracymbium in two parts, the ventral section small, of the typical form, dark and strongly chitinized and almost touching the tip of the ventral process, the dorsal portion pale, larger, with a recurved tip, the basal part of the cymbium depressed, cymbium not covering all parts, embolus an obscure process near the tip.

Holotype ♀ Florida; Punta Gorda, Banks Coll., no. B.0183. Allotype (by present designation) ♂ Florida; Royal Palm Park, 25-30 March 1927, (Blatchley).

Additional material, not types: 2 ♂s Georgia; Waycross, August 1903, (Morse), Emerton Coll.; ♀ Florida; Coconut Grove, July 1929, (Fairchild); ♂ ♀ Florida; Royal Palm Park, 25-30 March 1927; ♂ ♀ 1-18 April 1927; ♀ 5-17 December 1927, (Blatchley); ♂ ♀ Florida; Dade Co., Paradise Key, from a nest of mud dauber, 23 May 1927 (Dow).

Cambridge had but one species of *Marxia* from Central America when he defined the genus and he states that the species identified as *stellata* from Mexico and Guatemala may not be the same species as figured by Emerton in the Epeiridæ of New England, 1884.

Acanthepeira venusta differs from the generic description as given by Cambridge in three structural characters. The p.m.e. are larger than the a.m.e.; the quadrangle is as wide behind as in front, and it is distinctly longer than wide; the lower margin of the fang groove has four teeth.

The males of *A. venusta* can be separated from *A. stellata* by the narrower abdomen with the terminal tubercle turned upward, the much narrower ventral apophysis on the tibia of the palpus and the paracymbium. The females can be separated from *A. stellata* by the narrower abdomen and the epigynum.

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FURTHER DESCRIPTION OF *POLYPLAX*
ALASKENSIS EWING (ANOPLURA)¹

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Polyplax alaskensis was first described by H. E. Ewing (1927, Proc. Ent. Soc. Wash., 29: 118-121) from a single male taken from a mouse, *Microtus* sp., in Alaska. No subsequent collecting records of this species have been found in the literature. During the summer of 1948 a large series of individuals of both sexes was secured from mice, *Microtus o. operarius* (Nelson), collected on the Seward Peninsula by the writer. Since the original description is brief and unfigured, I am including here a further description of the species based on the numerous specimens now at hand.

Acknowledgments are made to J. C. Bequaert of the Museum of Comparative Zoology and to Floyd G. Werner of the Harvard Biological Laboratories for aid and advice. I am also very grateful to C. F. W. Muesebeck of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, for corroborating the identification by comparing a specimen from my series with the type.

FEMALE (Fig. 1, A). Length 1.2-1.4 mm. *Head* almost as broad as long and generally similar to that of *spinulosa*; first antenna joint much longer than the others and set close to the anterior margin. *Thorax* dorsally similar to that of *spinulosa*; ventrally, the sternal plate is longer than it is broad; the anterior lateral margins are nearly parallel; the posterior lateral margins are concave and slope to a blunt point; the legs, of usual form, are of increasing size posteriorly.

Pleural plates: (Fig. 2, B) first pleurite elongate, faintly if at all chitinized medially and usually with three

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setæ anteriorly on the ventral lobe, and one anteriorly on the dorsal lobe; the ventral marginal seta of the first pleurite is usually more than twice the length of the dorsal seta and may approach the length of the pleurite itself; second pleurite, elongate and attenuated anteriorly, the ventral marginal seta exceeds the dorsal in length and is usually about half the length of the pleurite; third pleurite, elongate and attenuated anteriorly, with the spiracle barely inclosed by the ventral margin, and with the dorsal marginal seta the same length as that of the second pleu-

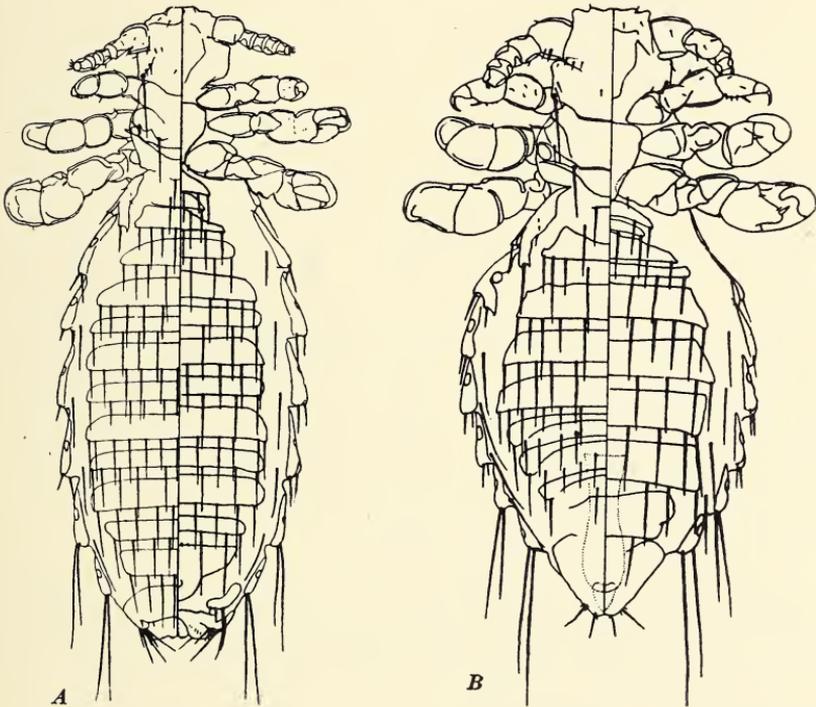


Figure 1. *Polyplax alaskensis*. A. Female. B. Male.

rite but longer than the ventral marginal seta of its own pleurite; the spiracles of the third to seventh pleurites are uniformly large and are progressively more centrally

located; pleurites four and five are less elongate and are progressively less attenuated anteriorly, the dorsal marginal setæ are longer than the ventral; pleurite six is narrow and tapers anteriorly; the seventh pleurite is narrow and very blunt anteriorly; in the sixth and seventh pleurites the chitinized area at the base of the marginal setæ is progressively more isolated from the anterior and major portion of the pleurite, and the marginal setæ are greatly elongated, the ventral ones being somewhat longer than the dorsal.

Tergal and *sternal* plates of the abdomen are well chitinized and cover most of the surface area, the anterior plate of each segment tending to be larger than the posterior; on their posterior margins most of the tergites have from eight to thirteen setæ and most of the sternites have from six to ten; however, there is considerable variation in these numbers. The first abdominal sternite is much wider than the second, is pointed anteriorly and concave posteriorly; the second abdominal sternite is almost a half circle; the third is more than twice the width of the second and has a pointed anterior margin. Between the ends of the posterior plate and the corresponding pleurite on the fourth to seventh segments dorsally and the third to seventh ventrally, there is a single seta of moderate length. Ventral to and parallel with the posterior margin of the seventh pleurite, a small plate, bearing three setæ on the posterior margin, has a lobe directed anteriorly from its lateral half.

MALE (Fig. 1, B). Length 0.8–1.0 mm. As described by Ewing, except for the following modifications and additions. Sternum usually longer than it is broad and may sometimes overlap the second and third coxæ.

Tergal and sternal plates of the abdomen are well developed. The first large tergite is usually strongly concave and irregular along its anterior border; the second, third, and fourth tergites progressively increase in length and are convex anteriorly; the fifth, sixth, and seventh tergites are progressively reduced in size and only in a narrow zone near their anterior margins are they strongly

chitinized. First three sternites are strongly convex anteriorly and are quite long; the third is much longer than the other two and the central area of its anterior margin is produced into a pointed lobe limited laterally by the base of a large seta; the greatest length of the third sternite distinctly exceeds that of the fourth and is about half that of the following four sternites; all five have roughly parallel and straight anterior and posterior borders.

Genitalia (Fig. 2, A) as described by Ewing and figured here.

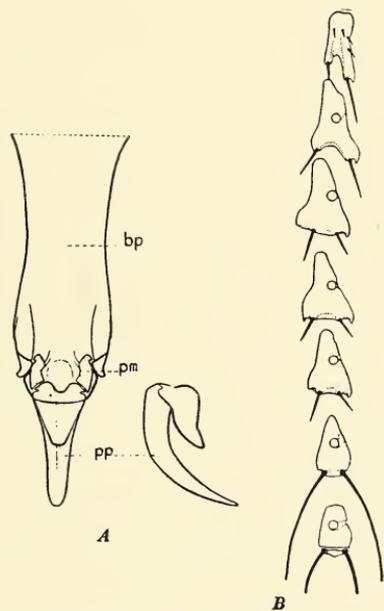


Figure 2. *Polyplax alaskensis*. A. Genitalia of males: bp, basal plate; pm, parameres; pp, pseudopenis (also shown in oblique view). B. Pleural plates of female (setae of the sixth and seventh are abbreviated).

Specimens examined: twenty-four of both sexes and different ages, collected at Cloud Lake (near Asses Ears), Seward Peninsula, Alaska, July 27, 1948. Representative specimens have been deposited in the collections of the Museum of Comparative Zoology and the National Museum.

A NEW AFRICAN MILLIPED OBSERVED IN MIGRATION

BY RALPH V. CHAMBERLIN

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The mass migration of millipeds is a phenomenon that has been observed in species of various families of Julida, Spirobolida and Polydesmida. The phenomenon has never been adequately studied or explained. To the list of those observed in such migration may now be added an African member of the Spirostreptida, herein first named and described. Dr. Neal A. Weber, who collected specimens and submitted them to me for identification, supplies the following on the occurrence and behavior of this form as he noted them in the field:

“The animals were discovered Mar. 2, 1948 at the junction of the Vele and Bomokandi Rivers, Lat. 3°38" N. and Long. 26°8" E. There were thousands milling about at the river's edge and many had crawled into the river and drowned. There were at least 500 millipeds in one place hanging on a nearly vertical slope of the river bank. In an area of a hundred square meters there were at least 5,000 or that order of magnitude and they were spread over about 150 meters along the river's edge. The air temperature was 89.5° F. Eight kilometers away a few of the same animals were to be found as well as smaller numbers between that point and the river. This was the time approaching the end of the dry season, and it may well be that the population had gradually built up to this peak and migration ensued. There were no animals preying on these and no obvious cause impelling their migration in this direction and into the river where they drowned. The land was not flooded back of this area.”

Zantekius, new genus

A genus of the Spirostreptidæ related to *Mardonius* and *Eumekius* of Central Africa and Madagascar. Spiracles beginning on the sixth segment. Metazonites without trace of longitudinal keels, being smooth above and striate

below. Anal valves not spined. In the posterior gonopods of the male the coxa without trace of spines and set off distinctly from the telopodite; telopodite long and slender, not at all laminate and entirely without lobes or branches. The inner lamina of the anterior gonopods much produced distad, presenting on the outside at level of the gonocoel a lobe directed proximad and on mesal side near distal end a large T-shaped lobe with one arm directed distad and the other proximad.

Generotype: *Zantekius weberi*, new species.

This genus differs from *Mardonius* in lacking a femoral lobe or spine on the posterior gonopod and from *Eumekius* in having an ectal cone or lobe on the median lamella of the anterior gonopod as well as in having the conspicuous mesal lobe.

Zantekius weberi, new species

Metazonites black about caudal borders, anteriorly more grayish, the last segment entirely gray or grayish brown. Head with face below level of antennæ reddish. Legs and antennæ red, contrasting sharply with the dark body.

Labral excavation very shallow. Labral pits 2-2, the front of head elsewhere smooth, wholly without rugæ. Eyes with inner angles extending mesad a little beyond base of antennæ, the two separated by somewhat more than their transverse length; individual ocelli convex and distinct. Median sulcus across vertex fine, ending in a slightly depressed pit at level of inner angles of eyes. No interocular sulcus evident except faintly for a short distance each side of end of vertigial sulcus. Antennæ reaching to third segment.

Collum moderately narrowing on each side from level of eye ventrad; in the male produced forward at lower anterior corner, with three deep sulci in addition to the margining sulcus as shown in the accompanying figure (Fig. 1A); not produced in the female.

Encircling striæ of prozonites of the other segments fine, mostly about six in number. The surface of the metazonites above and laterally entirely smooth and shin-

ing. Each somite with diameter greatest at caudal border, decreasing gradually forward excepting for the moderate depression between prozonite and metazonite. Segmental sulcus fine but sharply defined throughout.



Fig. 1, A. Left side of collum of male. B. Left gonopod of male, with sternite, anterior view.

The usual sharply impressed longitudinal sulci across the metazonite below, the series ending considerably below level of repugnatorial pore. Each pore located well in front of middle of metazonite.

Dorsal line of anal tergite as seen in profile nearly straight. Anal valves distinctly exceeding the tergite; mesal borders strongly elevated. Caudal margin of anal scale weakly obtusely angular.

Ventral pads present on penult and antepenult segments of most of the legs, these pads produced into a short lappet at their distal end beneath the succeeding joint.

The distinctive features of the anterior and posterior gonopods are shown in fig. 1, B.

Type locality: Africa: Belgian Congo, near Bembi, at junction of Vele and Bomokandi Rivers. Mar. 2, 1948. Many specimens collected by Dr. Neal A. Weber.

SOME AMERICAN SALDIDÆ (HEMIPTERA)¹

BY CARL J. DRAKE

Ames, Iowa

The present paper is based largely upon Saldidæ in the Museum of Comparative Zoology, Harvard University. Some records from the author's private collection are also included. The disposition of types is given beneath the descriptions of new species.

Miracanthia pusilla Van Duzee

Lake Tahoe, Calif., 1 specimen, Aug. 8, 1937, C. J. Drake and Floyd Andre; Ft. Collins, Colo., 1 specimen, May 5, 1898, E. D. Ball; Georgetown, Colo., 7 specimens, July 27, 1898, W. J. Gerhard; Provo, Utah, Aug. 10, 1930, E. D. Ball.

Pentacora bruesi, sp. n.

Plate 14

Small, broadly ovate, blackish, slightly shining, with yellowish brown markings along exterior margins of hemelytra. Head rather broad, black, a narrow crescentic streak along inner margin of each eye and head in front (including callosities) flavous, the ocelli amber; eyes dark, rather large. Antennæ moderately long, moderately hairy; segment I stout, flavous; with a few scattered setæ; II yellowish brown; III and IV dark brown, the last three segments with some scattered long hairs; proportions: I, 20; II, 38; III, 28; IV, 32. Rostrum yellowish brown, extending to hind coxæ. Legs testaceous, sparsely hairy, with scattered brown spots; coxæ becoming dark basally, the front coxal plates largely whitish. Body beneath black, the venter brownish black, the pubescence pale, reclining posteriorly.

Pronotum broad, moderately narrowed anteriorly, three times as wide as long, broadly excavated behind, the

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lateral margins a little rounded, with a few short hairs along the edges; front margin rather wide, extending laterally a little beyond the middle of each eye, pubescence yellowish, reclining; callus large, shining, moderately convex, not extending on lateral margins, extending posteriorly beyond middle of pronotum, with large discal impression and a smaller one on each side, the discal impression with deep furrow leading posteriorly to the end of sulcus; transverse sinuate impression separating lobes not very deep, not conspicuously pitted at the bottom; hind lobe indistinctly rugulose, about one-fourth the length of the frontal; sides of pronotum narrowly embrowned along the margins, the sides beneath widely flavous. Scutellum black, slightly shining, slightly rugulose, the transverse impression placed slightly before the middle. Hemelytra brownish black, with six or seven rounded, bluish, sericeous spots on each side, the pubescence yellowish, moderately long, somewhat decumbent, yellowish; clavus dull, grayish black, with a sericeous, yellowish spot before the apex; corium within concolorous with clavus, the rest largely black-fuscous, with five or six pale sericeous spots; embolium, save base, narrowly margined with flavous, the flavous color wider near base and before apex, there extending a little into corium; membrane largely whitish, black within at base, with five cells (only four on right wing, the outer vein being absent) each cell with a small spot before apex, the spots forming together a transverse fuscous streak, the veins dark brown to dark fuscous.

Length, 3.65 mm.; width, 2.00 mm.

Type, female, Matucana, 7,300 ft. elevation, Peru, taken by C. T. Brues, Museum Comparative Zoology No. 28266.

Resembles *Saldula reperta* Uhler in size, color and markings, but stouter and with broader pronotum. *Reperta* has only four cells in membrane. *Salda rubromaculata* Heidemann from Albemarle Island off the coast of Peru has five cells in the membrane and is herewith transferred to the genus *Pentacora* Reuter. The clavus and corium are largely yellow in *rubromaculata*.

The following is a list of the species of the genus *Pen-*

tacora (Reuter, 1912; genotype, *Acanthia signoreti* Guerin) of the Americas:

1. *angusta* Drake, 1948 Argentina
2. *bruesi* Drake², 1949 Peru
3. *hirta* (Say), 1932 Ind., Iowa, Mass., Conn., Me.,
syn. *pellita* (Uhler), Mass., N. Y., Penna., Md., N. C.,
1877 Miss., Ala., Miss., Tex., Canada
(Quebec).
4. *ligata* (Say) 1832 Me., Mass., N. H., Conn., N. Y.,
syn. *variegata* (Prov.), Md., N. J., N. Y., Penna., Ohio,
1872 Iowa, Ind., Minn., Nebr., Minn.,
Ill., Canada (Man., Ont., Que.).
5. *rubromaculata* (Heide-
mann)², 1901 Galapagos (Albemarle Is.).
6. *signoreti* (Guerin),
1856 Mo., Kan., Colo., Calif., N. H.,
Mass., N. Y., Md., N. J., Ga.,
Iowa, Tex., Ala., N. Mex., N. C.,
S. C., Fla., Mexico, Cuba, Cat
and Long Is. (Bahamas), Haiti,
Porto Rico, Dom. Rep.
7. *sphacelata* (Uhler),
1877 Mass., Conn., N. J., N. Y., Md.,
Mo., Miss., Tex., Calif., Cat. Is.
(Bahamas), Dom. Rep., Cuba.

Saldula sulcata (Barber)

Originally described as *Micracanthia sulcate* Barber, but belongs to the genus *Saldula* Van Duzee. In addition to a paratype from Porto Rico, specimens are at hand from Camp Perrin, British Guiana; Trinidad, B. W. I., Oct. 27, C. J. Drake; Pto. Plata, Dom. Rep., June, 1938, Darlington.

Saldula elongata (Uhler)

Corvallis, Oregon, male, June 26, 1926, C. J. Drake. Distinctly elongate and of a similar color as female, but much smaller in size.

² The generic position of *P. bruesi* and *P. rubromaculata* (Heidemann) will be discussed in a subsequent paper.

***Saldula bassingeri*, sp. n.**

Small, obovate, clothed with short golden pubescence, blackish, scarcely shining, the hemelytra conspicuously marked with large whitish spots or areas. Tylus and juga yellowish white, ocelli amber. Rostrum dark rufous, reaching hind coxae. Antennae shortly hairy, brownish black, the basal segment (save large elliptical fuscous spot beneath) and apical portion of second segment yellowish white; proportions: I, 14; II, 26; III, 20; IV, 18. Legs shortly hairy, testaceous; coxæ black-fuscous, shining; femora beneath (save apices) black-fuscous, somewhat shining, above usually with scattered fuscous spots; tibiæ above dark; tarsi darker at tips. Body beneath blackish, the pubescence pale.

Pronotum black, moderately shining, densely clothed with golden, decumbent pubescence, a little narrower in front than eyes, two and a half times as wide as long, deeply excavated behind, the lateral margins moderately rounded; callus only moderately convex, not reaching lateral margins, with large discal impression; lobes separated by transverse, sinuate impression, pitted at bottom of depression, the front lobe twice as long as posterior. Scutellum moderately convex, moderately shining, subequal in length and width, the pubescence as on pronotum. Hemelytra rather densely clothed with reclining pubescence, with large yellowish or flavous markings on corium, the pubescence reclining; membrane pale, semitransparent, with four cells, the base and an elongate spot in each cell brown, the veins darker brown; clavus blackish, with subapical yellowish spot; inner clavus largely blackish, with three spots along lower edge (one subbasal, one near middle and other apical) yellowish white or yellowish; outer corium largely yellowish or yellowish white, the base, a small spot near middle, a quadrate spot beyond middle and an apical spot blackish; the amount of yellowish white or size or dark spots varies somewhat in different specimens.

Length, 2.90–3.20 mm.; width 1.30–1.50 mm.

Type (male), allotype (female) and 50 paratypes,

Riverside, California, Aug. 16, 1937, A. J. Basinger, C. J. Drake and Floyd Andre. Paratypes, San Francisco, 4 specimens, Aug. 11, 1937, collected by Drake and Andre; 2 specimens, Dolores, Colorado, Aug. 16, 1935, C. J. Drake.

Separated from other western *Saldula* Van Duzee by its smaller size and prominent hemelytron markings. When the pubescence is rubbed off, the pronotum is quite shining.

Saldula fernaldi, sp. n.

Moderately large, broad, black, slightly shining, with some brownish markings on hemelytra, the pubescence very short, moderately dense, reclining, golden. Head broad, black, apex and callosities brownish or flavous; ocelli amber. Rostrum dark fuscous, shining, extending to hind coxæ. Antennæ blackish, shortly pilose; largely flavous above, the rest dark fuscous and shining; II brownish apically; proportions: I, 20; II, 40; III, 24; IV, 22. Body beneath black, the pubescence grayish. Legs testaceous, the femora with some dark brown spots.

Pronotum broad, black, slightly shining, broadly roundly excavated behind, moderately narrowed anteriorly, in front a little narrower than head and eyes together, nearly four times as wide as long, the exterior margin slightly rounded; callus moderately raised, not extending on lateral margins, deeply impressed on disc, a little longer than hind lobe; transverse impression behind callus sinuate, moderately deep, pitted at bottom; hind lobe one half as long as frontal. Scutellum black, slightly shining, as wide as long, indistinctly rugulose, the transverse impression near middle. Hemelytra broad, brownish black, dull; clavus with small, brownish subapical spot; corium more or less variable in brownish markings; inner corium with two brownish streaks above middle, a large elongate, circular mark (center dark) in front of middle along lower margin and two or three streaks apically brownish, some times with a very long, narrow, marginal streak, which arises a little behind the base; membrane yellowish brown, basally within and a

long streak in each cell dark fuscous, the lighter areas subhyaline, the veins dark.

Length, 4.25 mm.; width, 2.45 mm.

Type (male) and allotype (female), Flower's cove, Newfoundland, Aug. 17, Dr. Fernald. Paratypes, 5 specimens, taken with type. Type, in Mus. Comp. Zool. No. 28267.

This species is much shorter and not as dull as *S. major* (Prov.). It is much broader and differently colored than *S. pallipes* (Fabr.)

Saldula franciscana, sp. n.

Elongate-ovate, black, shining, with short, rather sparse, golden pubescence, each hemelytron with one (sometimes two) subapical flavous spot. Head polished, with a yellowish spot posteriorly between each ocellus and eye; tylus fuscous-black, polished. Rostrum dark fuscous, reaching to hind coxæ. Antennæ black, moderately stout, shortly pilose, the last two segments with scattered long hairs, second segment above and apical portion of second brownish,—porportions, I, 22; II, 48; III, 30; IV, 32. Body beneath black, with pale pubescence. Leg shortly pilose, mostly brown, or fuscous; coxæ black, polished; femora of fore and middle legs often dark fuscous, all femora towards apex and beneath at base becoming testaceous; tibiæ yellowish to brown, darker basally and apically; tarsi dark apically; middle and hind legs often brown above, beneath on basal half yellowish.

Pronotum highly polished, behind roundly excavated, narrowed anteriorly, the sides practically straight (slightly rounded); callus raised, prominent, with deep, large, discal impression, not extending to lateral margins; lobes divided by a deep, sinuate impression, pitted at bottom of depression, the hind lobe about half as long as frontal; pronotum two and one-half times as wide as long, the callus occupying most of fore lobe. Scutellum moderately convex, subequal in length and width, polished, the transverse impression near the middle. Hemelytra only slightly polished, brownish black, not as black or as polished as pronotum and scutellum, with a moderately large

yellowish-white spot on each side a little before the apex of outer corium, the inner corium sometimes with rather indistinct brownish patches; clavus entirely black, without subapical spot; membrane distinct, slightly fumose, hyaline, with four cells, each cell with a brown spot near its middle, the veins dark brown.

Length, 4.00 mm.; width, 1.80 mm.

Type (male) and 3 paratypes, San Francisco, Calif., collected on rocks in a small stream north of the city, Aug. 11, 1937, by C. J. Drake and Floyd Andre. Female is unknown.

This species has a stouter antennæ than the other American members of the genus. The hemelytra are darker in some examples than others. In one paratype, the hemelytra have two spots on each side. *S. franciscana*, sp. n. is much more slender and more shining than *S. lucuosa* Stål. It also lacks the hairy clothing.



Pentacora bruesi Drake

PSYCHE

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No. 1

NOTE ON THE METHOD OF COLONY FOUNDATION
OF THE PONERINE ANT *BRACHYPONERA*
(*EUPONERA*) *LUTEA* MAYR

CARYL P. HASKINS and EDNA F. HASKINS
Union College, Schenectady, N. Y.

Introduction

The methods of colony foundation among the Ponerinae are of peculiar interest to students of the phylogeny of the Formicidae, for, as emphasized elsewhere, (Wheeler, 1900a, 1900b, 1906, 1932, 1933, Haskins, 1928, 1930, 1941, Haskins and Enzmann, 1938, Haskins and Haskins, 1950a, 1950b) careful study of this most elementary stage of social development in the socially most primitive subfamily of ants may well shed very considerable light on the manner of origin and of subsequent evolution of the social mode of living in the Formicidae. In this connection, it is of particular interest that the observations of Clark (1925, 1934a, 1938), of Wheeler (1932, 1933), and of Haskins and Haskins (1950a, 1950b) on perhaps the two most archaic and socially generalized tribes of the Ponerinae, the Myrmeciini and the Amblyoponini, have indicated that in both of them, despite wide differences in morphology, physiology, and general habitus, the methods of colony foundation are closely similar, and are of a cruder and less specialized character than in any other known ants. In both cases the young female dealates herself, before or after fertilization, secretes herself in a chamber excavated in the soil, and then leaves this chamber at more or less frequent intervals to forage in the open for nourishment to sustain first herself and later her develop-

ing brood. The brood, when mature, comprises a few workers of the smallest form of the species. The workers and the adult female continue to forage in common until the colony is well developed.

This pattern of colony foundation suggests rather forcefully the nature of social organization of the earliest semi-social ants, which must long since have become extinct, and suggests further that the development of the social habit in the Formicidae, while strikingly similar to that well understood among the social wasps and bees and attested in those groups by the existence today of contemporaneous living intermediate forms, occurred independently in evolution, and probably at a much more remote period of time. It contrasts very strongly with the evidently derived pattern of claustral colony foundation which is common among the higher ants, in which the sexual female and the workers commonly differ greatly in stature, and in which a complicated physiological mechanism has been developed leading to the deterioration of the wing musculature shortly after dealation and, probably, to the conversion of this bulky protein reserve to a suitable form to assist in the sustenance of the queen, and to provide food reserves for the developing brood. These females, which are typical in such well-known genera as *Lasius* and *Camponotus*, after flight and dealation commonly isolate themselves in closed cells, from which they never emerge to forage. Eggs are laid, larvae are reared on a diet consisting entirely of ingluvial food administered by mouth, and at maturity the young workers, and they alone, break open the cell, emerge to forage, and bring back provender to restore the depleted fat-body of the sedentary queen, which never emerges into the open air again, except occasionally very briefly under unusual circumstances connected with a shift of the nesting site.

This specialized method of colony foundation common to so many Myrmicine and Formicine ants presents obvious selectional advantages over the primitive pattern as exemplified in *Myrmecia*. The young founding female, being amply supplied with reserve food material, is far less at the mercy of seasonal and environmental hazards than is the female of *Myrmecia*. The female of *Myrmecia*, forced to forage in the open every day or two for nectar or for living prey, is constantly exposed

to dangers from predators from which the female of *Lasius* or *Camponotus* is permanently protected as soon as its first cell is constructed. Finally, even if the young queen of *Myrmecia* succeeds in overcoming the numerous environmental hazards of drought or excessive moisture, of scarcity of food-sources, and of reptilian, avian, and mammalian predators during the difficult days of colony foundation, it is quite likely to become lost or otherwise permanently separated from its nest and its first brood in the course of its extensive wanderings.

Before this advantageous specialization can have taken place in the course of Formicid evolution, however, several concomitant physiological specializations must have occurred in whole or in part, and have been at least partially perfected. One of them is the ability of the individual to regurgitate ingluvial food for the larvae, thus precluding the necessity of supplying the larvae entirely with solid nourishment which must be brought in from outside. This power of regurgitation seems to be wholly lacking in both the Myrmeciini and the Amblyoponini. A second specialization which, while not essential to the development of the claustral method of colony foundation, is exceedingly helpful to it, is the faculty of breakdown of wing-muscle tissue to form a reserve of nutriment for the female. Work is in progress to determine whether there is any indication of such a development in *Myrmecia* or in *Amblyopone*. If present at all, it is certainly not nearly so conspicuous as among the higher ants. Third, it must have been essential, before the claustral method of colony foundation could be fully established, that a considerable difference of size should have been developed between the queen and the worker forms of a given species, so that several of the latter, pupating prematurely, could be sustained from the much greater bulk of the queen, with its specialized reserve of fat-body and perhaps of transformed wing-muscle tissues.

It is clear that none of these specializations occurred suddenly in evolution, and that they must all have been closely interrelated. Concomitantly, it would be expected that the development of the claustral mode of colony foundation would have occurred gradually, as these physiological specializations progressed, manifesting itself as a growing reliance of the queen on the sustaining powers of her own tissues, and an increasing

tendency to limit foraging to more and more lengthy intervals, feeding the larvae less and less upon insect prey and more and more upon ingluvial food, until, at last, the habit of foraging disappeared altogether.

The higher tribes among the Ponerinae, especially the Ectatommini, the Odontomachini, and the Ponerini are of peculiar interest in this connection. Here two of the three requisite physiological specializations, at least, seem to be moderately developed in certain species. Considerable discrepancy of stature between the perfect female and the first-brood workers is notable in a number of species of all these tribes. The power of regurgitation, though feebly developed, has been reported for the Brazilian *Odontomachus affinis* by Borgmeier (1920), for *Ectatomma tuberculatum* by Cook (1904-5) and has been observed in *Euponera gilva harnedi* by Haskins (1931). It might be supposed, therefore, that among these higher Ponerinae, examples could be found in which the females, unusually capable of fasting, tended to supply the first-brood larvae at least partially with ingluvial salivary or regurgitated substances and only in part with captured insect food, and to forage much less frequently than the fertile females of *Myrmecia* or *Amblyopone*.

A very definite suggestion of this intermediate situation was obtained in the course of the present study with *Odontomachus haematoda*. A young female, taken immediately after the nuptial flight and dealation, isolated itself in the artificial nest in a closed cell in the typical manner reported by a number of students of this genus. In this case, however, all opportunities to obtain nourishment outside the nest were withdrawn, so that the young queen was thrown entirely on its own resources. Under these conditions, this *Odontomachus* female produced numerous eggs, hatched them, and evidently fed the resulting larvae with ingluvial food (although the process was difficult to observe) since they developed rapidly. They remained healthy for some time but, when somewhat less than one-half mature, declined slowly and eventually perished. Shortly after this, the female perished also. It had been captured on December 9, 1947, and died on March 3, 1948. Thus, although it had been unable to bring its young larvae to maturity or to establish a permanent formicary without outside nourishment, it had raised a good-sized brood through almost half the period of growth on nour-

ishment supplied by its own body and had itself survived for ninety days without food. This represented a much closer approach to the claustral condition than could be achieved among the lower Ponerinae, and it was clear that the question of the intermediate evolutionary stages in colony formation exhibited among the higher Ponerinae merited further investigation.

Perhaps the most interesting of all Ponerine ants for studies of this kind is the Australian species *Brachyponera lutea*, because of the great disparity of size and differentiation of bodily structure between the perfect females and workers, in which it is unique among the Ponerines but approaches rather closely the condition among higher ants. It might be expected that in this species, above others, a close approach to the claustral mode of colony foundation might be achieved. Accordingly, observations were undertaken in the field and in the artificial nest which are recorded herewith.

Brachyponera lutea

The genus *Brachyponera* was considered by Emery (*Genera Insectorum*) as a subgenus of *Euponera*, and exhibits close affinities with that group, and with the genus *Ponera s. str.* in many respects of structure and behavior. As in *Euponera*, it is composed of active ants of wide distribution, showing a remarkable degree of variability and of plasticity of habit for a Ponerine group. In the majority of forms of *Brachyponera*, as in *Euponera*, the stature of the perfect females and of the workers is rather similar. In two species, however, *B. sennaarensis* Mayr of tropical Africa and *B. lutea* Mayr of Australia, the workers are very much smaller than either sexual form. In *B. lutea* this differentiation reaches an extreme both qualitatively and quantitatively, the workers averaging but 4–5 mm. in length and being of a pale yellow to brownish coloration, while the queens attain dimensions of 10–11.5 mm., are of brownish black pigmentation, and carry so much fat-body that their form is very different from that of the workers as, indeed, from the typical form of *Ponera* or *Euponera*.

The species was first described by Mayr (1868, 1876). The extraordinary difference in stature and appearance between queens and workers caused Crawley (1918) to call the conspecificity of the described types into question. The conspecificity

has, however, been thoroughly established by studies of Clark, Wheeler, and many others.

Brachyponera lutea is nearly ubiquitous in Australia, extending from the tropics almost into the coldest areas of the continent, and from the very moist soils of the extreme southwest into comparatively dry dune or rocky regions far from the coast. In some areas it is very common. It forms rambling meshes of galleries interwoven in a complex fashion, and probably often extending well underground. These galleries are excavated by preference underneath flat stones or fallen logs, but may occasionally show open craters. The colonies are unusually populous for a Ponerine, and fully developed communities may well comprise over two thousand individuals. There seems to be good evidence that the species feeds extensively on termites, and probably also on the larvae of other ants. Frequently, but not always, it nests close to or within the mounds of various species of termites, or near other ants, not excluding *Myrmecia*. It is very probable that it commonly behaves as a facultative, primitive thief ant.

The habits of *B. lutea* have been described by Clark (1925, 1938) and particularly by Wheeler (1933) who studied the method of colony foundation in the field. During November and December of 1914 and 1931 numerous recently fecundated females were taken by Wheeler in many localities in Australia including Queensland, New South Wales, and southwestern West Australia. All of them were isolated in cells under stones and logs, and in all cases these cells, unlike those typical of *Myrmecia* females, were located so far from the edges of the overlying cover that, in Wheeler's view, it would have been difficult for the occupants to excavate galleries to the outside permitting them to emerge periodically to forage, after the manner of *Myrmecia* and *Amblyopone*. From this evidence, together with the great relative stature and the voluminous fat-body of the queen, Wheeler concluded that colony foundation occurred in the claustral fashion typical of higher ants. Since none of the females observed by him in the field had produced eggs by the end of December, however, he was unable to confirm this conjecture. In the present study, it has been possible to observe the process of colony foundation in *Brachyponera lutea* in the arti-

ficial nest from its inception until the maturation of the first brood of workers.

On January 15, 16, and 17, 1948, three isolated fertile females of *Brachyponera lutea* were taken in closed cells excavated in nearly pure sand under stones in a typical Hawkesbury sandstone area near Sydney, N. S. W. These chambers were essentially as described by Wheeler, but one of the three queens had two small worker cocoons, evidently recently spun, and a second had several nearly grown larvae in the chamber. The third was without brood. The existing brood of the two females was destroyed in order to stimulate a recapitulation of the founding process, and all three insects were isolated in artificial nests. Here they soon excavated typical closed cells, which they showed no tendency to reopen. One of the three females was lost. The other two shortly produced further eggs, which were formed into packets and carefully tended.

Drops of a dilute solution of honey were proffered to these females from time to time, and were greedily accepted when thrust within the brood-chamber, but the females did not emerge to hunt for them. No solid food was made available. As the eggs hatched, the young were fed entirely by regurgitation, and developed rapidly. At maturity, the larvae were banked with earth in the usual fashion, the cocoons were spun, were cleaned by the female, and continued to be attentively cared for. By March 15, one of the females had brought to maturity three exceedingly small cocoons and had several young larvae, while several nearly mature (though still small) larvae were present in the other cell. By the end of the month the first cocoon was hatched, the extremely small and very callow young worker being much assisted by the female in eclosion. A second cocoon was successfully hatched by the female on April 11. The young workers remained for some time in the parent chamber, which was still tightly closed, before essaying to forage for food. No assistance was given by the queen in this process, just as the queens had shown no tendency to emerge to forage during the period of growth of the young.

These observations would seem to indicate fairly conclusively the correctness of the conjectures of Wheeler, first, that feeding by ingluvial regurgitated food is the commonest if not the only method by which the young queen of *B. lutea* nourishes the first-

brood workers, in contrast to the lower Ponerines, and second, that the colony may be formed in a perfectly claustral manner in this Ponerine, as among the higher ants.

There is some indication, however, that although such perfectly claustral colony foundation can and perhaps usually does occur in *B. lutea*, the pattern may not be as firmly established as among the Formicinae or the Myrmicinae. Thus five mature but virgin females, taken from adult nests near Sydney, when artificially dealated in Lubbock nests, behaved somewhat more typically of the lower Ponerines. All of them formed cells of the usual type, and all shortly produced eggs which were kept in compact packets and carefully tended. The cells, however, were not completely closed in this series. They were, in fact, frequently opened to permit the queens to emerge and forage. These queens, in sharp contrast to those described above, excavated extensive galleries, and, although they spent considerable periods quiescent within the brood-chambers, they also spent much time foraging, and eagerly accepted both nectar and insects, taking workers of *Reticulitermes flavipes* with especial avidity. At times, the females left the nests altogether to wander for periods in the open air before returning to the galleries and eventually to the brood chambers. Although these queens persisted until June, the infertile eggs failed to hatch, and no colonies were established. This was very probably abnormal behavior, based on the infertility of the females. It is of some interest, however, since the pattern so closely approximated that of the normal pattern of the fertile females of other Ponerine species.

It may be concluded, then, that the fertile females of *Brachyponera lutea* are capable of founding their colonies in the typically claustral fashion of higher ants, isolating themselves in permanently closed cells and bringing a few very small workers to maturity on ingluvial food probably derived entirely from their own tissues. At the same time, this remarkably advanced behavior-pattern may be more labile than among the higher ants. It is evident that the females of *B. lutea* retain the capacity to actively forage under certain conditions, and, it is quite likely, may do so normally if an unusually rich supply of insect

food is present, as it might be, for example, in a termite mound. This matter remains to be confirmed.

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A NEW GENUS OF FLEA-BEETLES FROM THE WEST INDIES*

BY DORIS H. BLAKE

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In 1868 Suffrian¹ described two species of small flea-beetles from Cuba which he placed under his section "h" of *Haltica* with a suggestion that the legs were similar to those in the genus *Aphthona* of Chevrolat (which, incidentally, is not true). In the DeJean Catalogue² are listed under *Podagrira* three names for one species from Santo Domingo, all nomina nuda, some of which names I have seen on old labels on specimens of this group in the Bowditch collection. In both cases the genus to which these beetles were more or less tentatively assigned was doubtless a matter of convenience, since they do not bear more than a superficial resemblance to the other species in either genus.

In addition to the two species carefully described by Suffrian from Cuba, and the ones named in the DeJean Catalogue from Santo Domingo, there exists an untold number of species of this group scattered on the various islands of the West Indies. Since they are all similarly colored, being yellowish or reddish with violaceous or blue-green elytra, and are minute beetles from 2-4 mm. long, up to the present they have been divided simply into two species—a bigger one (*compressa*) and a smaller one (*auripennis*) as described by Suffrian. Possibly it would be simpler to leave them as such, in the light of what dissection reveals.

As might be expected, there are certain resemblances to be found in the aedeagi of some of these beetles. A similar but somewhat different sort of aedeagus appears in some beetles on each island. Sometimes there are several very similar ones on the same island. This sort of similarity occurs in three groups composed of three or four species each. Besides these, there are

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¹ Suffrian, *Archiv für Naturgesch.*, vol. 34, 1868, p. 211.

² DeJean Catalogue, 1837, p. 418.

a number of other beetles with aedeagi that are widely unlike any other and that cannot be grouped with the rest or with each other. When I consider the relatively small number of specimens I have before me and the possibilities in the way of those that may be collected later in the West Indies, I realize how small a contribution to the genus I am able to give in my analysis of the few species (17) that I have studied. No one can distinguish these beetles from mere outward examination. Furthermore, it is not possible at present to identify Suffrian's two species with any degree of certainty. Even if the types are still in existence in the Museum at Halle, there is no certainty that any males are in the lot. Since the Gundlach collection of insects in Cuba, which contains specimens identified by Suffrian, is kept strictly under glass, little can be learned from it.

Maulik writes of *Aphthona*, "the genus being artificial is very difficult to define." Possibly he means that so many diverse species from all over the world are included under *Aphthona* that of necessity the group is far from homogeneous. It is true that the American species pigeon-holed with *Aphthona* do not altogether fit into the description of the European or Asiatic ones. For one thing, the elytra in many are striately punctate instead of confusedly punctate. Crotch described *insolita* Melsh., which is now referred to *Aphthona*, under the genus *Cerataltica*, as subquadrate in shape and striate-punctate. On the other hand, some of the species of *Aphthona* that Jacoby described from Central America seem closer to Jacoby's genus *Palaeothona*, which he described as "rather depressed, elongate and posteriorly widened," and with longer antennae and more transverse thorax. All these species need more study in order to determine their proper relationships. The West Indian group is unlike any of those that I have examined from the North American continent. In shape the beetles are generally broader and more convex than in *Palaeothona* and not at all subquadrate nor with striately punctate elytra as in the species related to *insolita* Melsh. The hind tibia, contrary to Suffrian's statement, is not like that in the European species of *Aphthona*, being rounded, not flat, and having a spur at the tip in the middle, not on the outside, and the claws are appendiculate, not

simple. Since this group appears to be a sizable as well as homogeneous one and confined to the West Indies, I am proposing for it the generic name *Homoschema*, from ὁμός *the same*, and σχῆμα (το) *outward appearance*. The type of the genus is *H. ornatum*.

Description of the Genus

From 2–4 mm. in length, oblong oval, widened posteriorly in female, moderately convex, often impunctate and at most very finely and confusedly punctate, lustrous reddish or yellowish with violaceous or blue-green elytra.

Antennae longer than half the body, always pale, rather stout; first joint long, 2nd short, both swollen, 3rd longer than 2nd, 4th longer than 3rd, the rest more or less subequal, gradually shortening a little. Head with distinctly marked frontal tubercles and an impressed line of punctures running up to the large fovea near the upper part of eye, a few scattered punctures usually in the space between eye and antennal sockets. Space between antennal sockets variable, in some narrower species a slightly elevated line gradually vanishing in the lower front, in other wider species, a broad, more convex carina that spreads out down the lower front with a depression on either side below the antennal sockets, this interantennal area very useful in identification as to the group but not to the species of the genus. Thorax considerably wider than long but never twice as wide, with curved and margined sides, and oblique angles anteriorly and almost straight basal margin; moderately convex without depressions, except in one species; surface usually mirror-smooth, sometimes very finely punctate. Scutellum large, triangular, and usually but not in all species, palely conspicuous in the dark violaceous elytra. The elytra often mirror-smooth or very finely and confusedly punctate, wider than the prothorax, convex, with a transverse depression below the humeri, the female usually slightly wider posteriorly. Beneath, the epipleura wide but disappearing at the apical angle. Body beneath usually pale, in a few species the breast and abdomen, and, in these cases, the scutellum too, dark. Legs and antennae always pale. Anterior coxal cavities open. Legs rather

short and stout with the hind femora well developed. Tibiae not channelled or flat but rounded and with a short spur in the middle at the end of the hind tibiae. In the male the first joint of anterior tarsi enlarged and also in one species the first joint of the hind tarsi. In all, the first tarsal joint of the hind legs moderately long, in one species about equal to the following joints together. Claws appendiculate.

Key to the Species of *Homoschema*

1. Prothorax with a slight depression on either side near base; elytra deep violaceous with a pale yellowish tip. Haiti *H. leucurum* n. sp.
Prothorax not at all depressed on either side near base; elytra dark without pale yellowish tip. 2
2. First tarsal joint of hind legs in male swollen, aedeagus long with a flat, roundish tip. Puerto Rico
H. latitarsum n. sp.
First tarsal joint of hind legs in male not swollen. . . . 3
3. Scutellum usually, and breast and abdomen always, dark 4
Scutellum, breast and abdomen pale. 6
4. Aedeagus with a long attenuated tip. Haiti
H. hoffmani n. sp.
Aedeagus with a broad point at tip. 5
5. Aedeagus widened to approximately twice the width of tip behind the tip. Puerto Rico, St. Thomas, St. Croix. *H. nigriventre* n. sp.
Aedeagus widened less than twice the width of tip behind the apex. Puerto Rico. *H. fraternum* n. sp.
6. Beetles larger (3–4 mm.) and broadly convex; aedeagus broad with a short, acute tip. 7
Beetles not so large, aedeagus not so broad and not with a short acute tip. 9
7. Aedeagus in dorsal view widened in a smooth curve behind the tip. Cuba. *H. latum* n. sp.
Aedeagus in dorsal view widened in a sinuous curve behind the tip. 8

Homoschema hoffmani n. sp.

Fig. 10

From 2.5–3.2 mm. in length, 1.5–1.8 mm. in width, moderately convex, thorax and elytra smooth with fine punctation seen only under high magnification; antennae, head, thorax and legs reddish yellow, breast and abdomen dark, scutellum often dark, elytra violaceous. Area between antennal sockets moderately broad and convex, and extending down the short lower front, with a depression on either side below the antennal sockets.

Type.—Male, and 2 paratypes, U. S. N. M. Cat. No. 59192.

Type locality.—Bizoton, Haiti, Nov., 1925, collected on *Stigmatophyllum lingulatum*, by W. A. Hoffman.

Other localities.—Camp Perrin, W. A. Hoffman, 1925; Mt. Trou d'Eau, Nov., 1934, P. J. Darlington; Manneville, Nov. 16–17, 1934, P. J. Darlington; Cape Haitien, W. M. Mann; Port au Prince, all Haiti.

Remarks.—The distinguishing characters of this species are the dark coloring of the undersurface and the exceedingly long narrow point at the tip of the aedeagus, the latter unlike any other known in the genus.

Homoschema leucurum n. sp.

Fig. 12

From 2.7–3 mm. in length, 1.4–1.7 mm. in width, prothorax with a slight depression on either side at base; very faintly and finely punctate, reddish yellow with deep violaceous elytra having a pale apex. Head with a short elevated area between antennal sockets, lower front flattish.

Type.—Male, and 5 paratypes, U. S. N. M. Cat. No. 59193; 1 paratype in Museum of Comparative Zoology, Type No. 28238.

Type locality.—La Vanneau, Haiti, June, 1925, collected by W. A. Hoffman, on *Bunchosia glandulosa*.

Remarks.—This is the only one of the genus with a pale tip on the elytra. Another unusual feature is a slight depression on either side at the base of the prothorax.

Homoschema latitarsum n. sp.

Fig. 15

From 3–3.5 mm. in length, 2.5 mm. in width, broad, convex, very lustrous, not visibly punctate, reddish yellow with deep violaceous elytra, sometimes deep bronzy purple. Head with a narrow interantennal elevation extending from between antennal sockets halfway down to labrum. First tarsal joint of hind leg in the male broadened as is usually the case in the first tarsal joints of the anterior legs.

Type.—Male, and 1 paratype, Museum of Comparative Zoology Type No. 28237.

Type locality.—Maricao Forest, 2000–3000 ft. alt., Puerto Rico, collected May 31–June 2, 1938, by P. J. Darlington.

Other localities.—Yauco, June, 1934, by C. M. Matos, (Stuart T. Danforth coll.); Adjuntas, July, 1933 and June, 1934, by R. G. Oakley, both Puerto Rico.

Remarks.—The unusual feature about this species is the enlarged first tarsal joint of the hind leg in the male. The long aedeagus with the flat, rounded tip is also unlike any other in the genus.

Homoschema ornatum n. sp.

Fig. 1

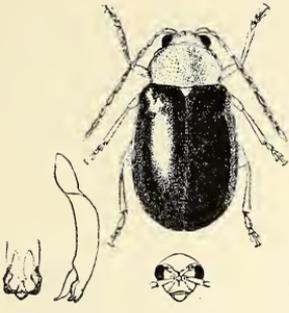
From 2–3 mm. in length, 1.2–1.5 mm. in width, not very convex, finely punctate, reddish or yellowish with deep violaceous elytra. Head with a narrow elevation between antennal sockets and a short line from it down lower front. Lower front unusually long and flattish.

Type.—Male, and 5 paratypes, U. S. N. M. Cat. No. 59194, 2 paratypes in Museum of Comparative Zoology, Type No. 28242.

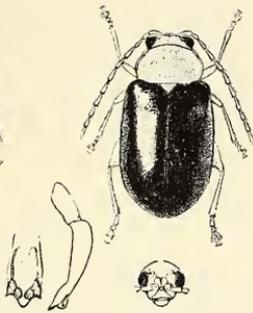
Type locality.—Cayamas, Cuba, collected by E. A. Schwarz in February and March, also by C. F. Baker and George Dimmock in April.

EXPLANATION OF PLATE I

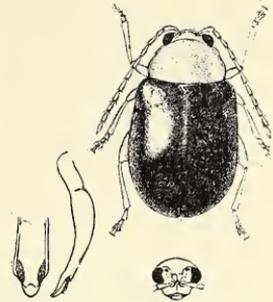
Fig. 1. *Homoschema ornatum* n. sp. Fig. 2. *Homoschema felis* n. sp. Fig. 3. *Homoschema nigriventre* n. sp. Fig. 4. *Homoschema fraternum* n. sp. Fig. 5. *Homoschema jamaicense* n. sp. Fig. 6. *Homoschema androsense* n. sp. Fig. 7. *Homoschema darlingtoni* n. sp. Fig. 8. *Homoschema manni* n. sp. Fig. 9. *Homoschema orientense* n. sp.



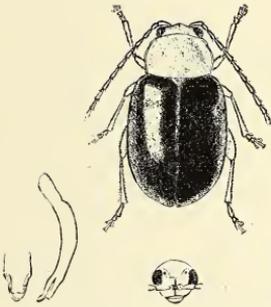
1. *Homoschema ornatum*



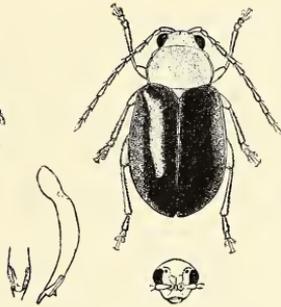
2. *H. felis*



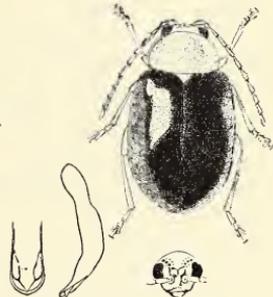
3. *H. nigriventra*



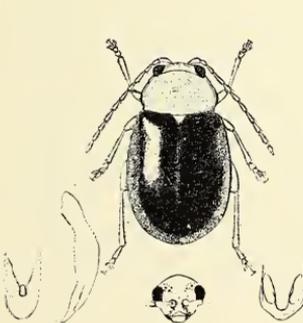
4. *H. fraternum*



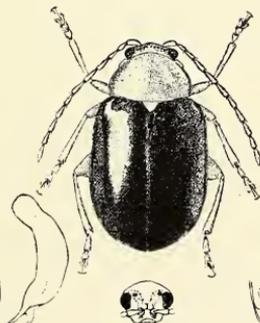
5. *H. jamaicense*



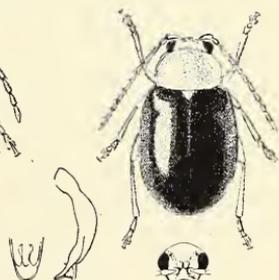
6. *H. androsense*



7. *H. darlingtoni*



8. *H. manni*



9. *H. horientense*

Remarks.—The relatively flat and distinctly punctate upper surface and the narrow aedeagus with a complex structure at the tip in the way of orificial plate distinguish this species. It belongs to a group that is represented in several other islands of the West Indies.

***Homoschema felis* n. sp.**

Fig. 2

About 2.5 mm. in length, 1.2 mm. in width, not very convex, finely punctate, reddish yellow with green elytra; head with a short, narrow elevation between antennal sockets and a line from it down lower front, lower front flat.

Type.—Male, Museum of Comparative Zoology Type No. 28243.

Type locality.—Arthurs Town, Cat Island, Bahamas, collected July 10, 1935, by W. J. Clench.

Remarks.—This species is very closely related to *H. ornatum*, showing only a slight difference in the orificial plate of the aedeagus.

***Homoschema nigriventre* n. sp.**

Fig. 3

From 2.5–3 mm. in length, 1.5 mm. in width, moderately convex, finely punctate, reddish yellow with violaceous elytra and dark breast and abdomen. Head with a slight narrow elevation between antennal sockets and a line proceeding from this down lower front, lower front flattish.

Type.—Male, and 5 paratypes, U. S. N. M. Cat. No. 59195.

Type locality.—Ponce, Puerto Rico, collected Aug. 11, 1933, by R. G. Oakley.

Other localities.—Algarrobo, Feb., 1931, San German, Oct. 11, 1937, Mayaguez, Sept., 1930, all in the Stuart T. Danforth collection; Parguera, Sept., 1933, on *Colubrina*; La Sardinera, June, 1939, W. A. Hoffman; Mona Island, April, 1940, on young shoot of *Clusia rosea*, L. F. Martorell; Rio Piedras, April, 1912, D. L. Van Dine; Manati, Feb., 1933, on leaf of *Crotalaria*: all Puerto Rico.

Remarks.—The dark breast and abdomen as well as its greater convexity separate this species from its close relatives, *H. ornatum* and *H. felis*. The head is not so long either. It has a

similarly shaped aedeagus but with a less complex orificial plate. I am unable to separate a series of specimens taken on St. Croix by H. A. Beatty and another series taken on St. Thomas, V. I. collected in January, 1937, in the Stuart T. Danforth collection, from this Puerto Rico species.

***Homoschema fraternum* n. sp.**

Fig. 4

About 2.5 mm. in length, 1.3 mm. in width, not very convex, finely punctate, reddish yellow with violaceous elytra and dark breast and abdomen. Head with a slight narrow elevation between antennal sockets and a line running down the lower front, lower front flat.

Type.—Male, U. S. N. M. Cat. No. 59196.

Type locality.—San Juan, Puerto Rico, collected Oct. 13, 1932, by R. G. Oakley.

Remarks.—This single specimen differs from the others from Puerto Rico in having a narrower aedeagus with considerably less widening behind the tip. It belongs to the same group as *H. ornatum* and *H. nigri ventre*, and like the latter is dark below.

***Homoschema jamaicense* n. sp.**

Fig. 5

From 2.4–3 mm. in length, 1.5 mm. in width, not very convex, elytra very finely punctate, yellow or reddish with violaceous elytra; head with a very narrow and short elevation between antennal sockets, and a line extending down in the lower front. Lower front flattish.

Type.—Male, and 7 paratypes, U. S. N. M. Cat. No. 59197; 1 paratype in Museum of Comparative Zoology, Type No. 28236.

Type locality.—Bath, parish of St. Thomas, Jamaica, collected Feb. 8, 1937, by E. A. Chapin and R. E. Blackwelder.

Other localities.—Kingston, Balaclava, Jamaica, Feb. 13, collected by E. A. Chapin and R. E. Blackwelder.

Remarks.—This is the only Jamaican species thus far collected, and is a small, rather flat species with an aedeagus that

is suggestive of that of *H. nigri ventre*. It probably belongs to that group of species.

Homoschema buscki n. sp.

Fig. 11

From 2.5–3.2 mm. in length, 1.7–2 mm. in width, convex, elytra very finely punctate; yellowish or reddish with violaceous elytra; interantennal area narrowly elevated and extending down a little in lower front, lower front flattish.

Type.—Male, and 6 paratypes, U. S. N. M. Cat. No. 59198.

Type locality.—S. Francisco Mts., Dominican Republic, collected Sept. 4–14, 1905, by August Busck.

Other localities.—Blanton mine, north of San Cristobal, Dominican Republic, July 26, 1917, Harold Morrison, collector.

Remarks.—The convex elytra and the long, gradually acuminate aedeagus unlike any other in this group, distinguish this species. It is not closely related to the group that follows, which is also composed of large convex species.

Homoschema latum n. sp.

Fig. 16

About 3 mm. in length, 1.6 mm. in width, convex, elytra very faintly and finely punctate, reddish or yellowish with violaceous elytra. Head with interantennal area convex and extending down in lower front, a depression on either side below antennal sockets.

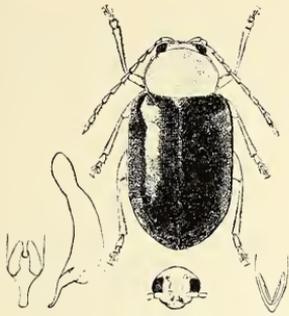
Type.—Male, U. S. N. M. Cat. No. 59199.

Type locality.—Upper Yara Valley, Cuba, collected Oct. 18, 1928, on weeds and grasses by L. C. Scaramuzza.

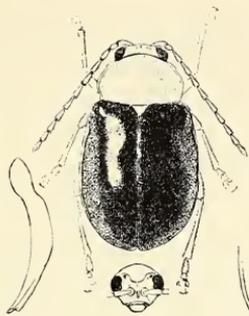
Remarks.—The broad, convex elytra and the short, wide aedeagus distinguish this species. It is closely related to the three following species from Haiti, Puerto Rico and St. Croix,

EXPLANATION OF PLATE 2

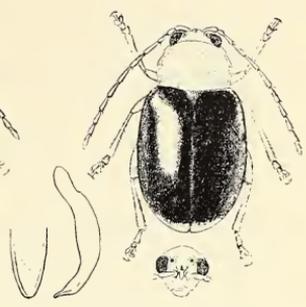
Fig. 10. *Homoschema hoffmani* n. sp. Fig. 11. *Homoschema buscki* n. sp.
 Fig. 12. *Homoschema leucurum* n. sp. Fig. 13. *Homoschema pingue* n. sp.
 Fig. 14. *Homoschema opimum* n. sp. Fig. 15. *Homoschema latitarsum* n. sp.
 Fig. 16. *Homoschema latum* n. sp. Fig. 17. *Homoschema obesum* n. sp.



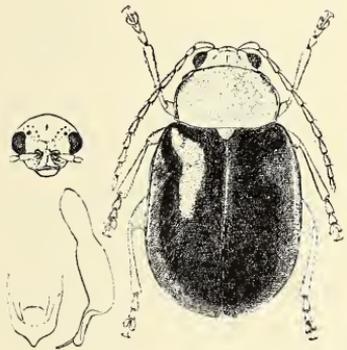
10 *H. hoffmani*



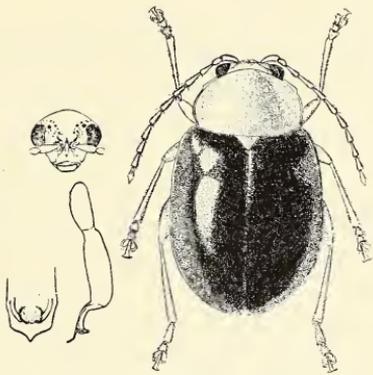
11. *H. buscki*



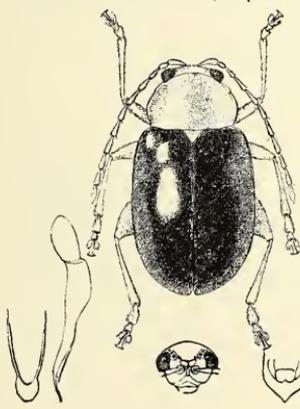
12 *H. leucurum*



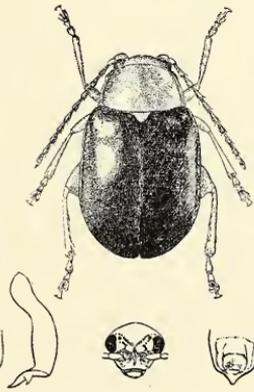
13. *H. pinque*



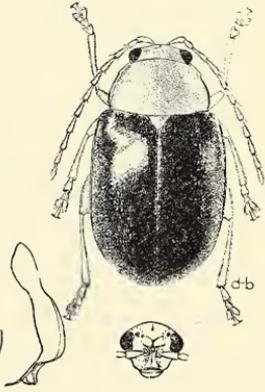
14. *H. opimum*



15. *H. latitarsum*



16. *H. latum*



17. *H. obesum*

BLAKE—FLEA BEETLES

but not so closely to them as they are to each other. From the one specimen seen, it would seem to be slightly smaller and has a differently shaped apex on the aedeagus.

Homoschema obesum n. sp.

Fig. 17

From 3.2–4 mm. in length, 2–2.8 mm. in width, convex, elytra very faintly and finely punctate, reddish or yellowish with violaceous elytra. Head with an interantennal area broadly convex and extending down the lower front, depressed below the antennal sockets.

Type.—Male, and 8 paratypes, U. S. N. M. Cat. No. 59200; 1 paratype in Museum of Comparative Zoology, Type No. 28239.

Type locality.—El Vigia, Ponce, Puerto Rico, collected on a vine by R. G. Oakley, July 26, 1934.

Other localities.—Yauco, March 28, 1929, Mayaguez, Feb. 24, 1925, Algarrobo, Feb. 27, 1931, Boqueron, April 18, 1924, all from Puerto Rico, in the Stuart T. Danforth collection.

Remarks.—This is one of the largest species of the genus and very closely related to the two following from St. Croix and Haiti. It has a short broad aedeagus very similar to that of *H. latum* but with a more sinuate apex.

Homoschema pingue n. sp.

Fig. 13

From 3.2–4 mm. in length, 2–2.8 mm. in width, convex, very faintly and finely punctate, reddish or yellowish with violaceous elytra; head with a broad median convex area from between antennal sockets extending down lower front with a depression below antennal sockets.

Type.—Male, and 1 paratype Museum of Comparative Zoology Type No. 28240; 1 paratype in U. S. N. M. Cat. No. 59201.

Type locality.—St. Croix, V. I., H. A. Beatty collector, also collected there by H. Morrison June 14, 1917.

Remarks.—This is very closely related to *H. obesum* from

Puerto Rico, showing only a slight difference in the tip of the aedeagus.

Homoschema opimum n. sp.

Fig. 14

From 3.3–4 mm. in length, 2.1–2.4 mm. in width, convex, very faintly and finely punctate, reddish or yellowish with violaceous sometimes even deep bronzy purple elytra; head with a broad median interantennal convexity extending down front and a depression on either side below antennal sockets.

Type.—Male, and 2 paratypes, Museum of Comparative Zoology Type No. 28241.

Type locality.—San Jose de las Matas, Dominican Republic, 1000–2000 ft. alt., collected in June, 1938, by P. J. Darlington.

Other localities.—Macoris, March 30, 1913, P. G. Russell; S. Francisco Mts., April 9, 1905, August Busck; Duarte, Domingo City, July 21, 1917, H. Morrison, all Dominican Republic. Poste Terre Rouge, Oct. 5, 1934, P. J. Darlington; Cape Haitien, W. M. Mann; Port au Prince, April, 1925, G. N. Wolcott; La Vanneau, June 20, and Bizoton, Nov. 25, on *Stigmatophyllum lingulatum*, both by W. A. Hoffman, all Haiti.

Remarks.—This is the fourth of the group and closely related to the Puerto Rico and St. Croix species with only a little difference in the aedeagus. The frontal convexity on the head seems a little narrower and less convex.

Homoschema orientense n. sp.

Fig. 9

From 2.4–2.9 mm. in length, 1.4–1.7 mm. in width, convex, distinctly punctate, reddish yellow with violaceous elytra. Head with a broad interantennal elevation extending down the short lower front.

Type.—Male, and 8 paratypes, U. S. N. M. Cat. No. 59202; 1 paratype in Museum of Comparative Zoology, Type No. 28245.

Type locality.—Guantanamo, Cuba, collected in 1918 by W. M. Mann.

Remarks.—The only way of distinguishing this from the following species is by comparing the aedeagi. In this species the aedeagus is narrowed towards the apex, instead of being

broader near the apex than behind it. The distinct punctation of the elytra distinguishes this from *H. latum*.

***Homoschema manni* n. sp.**

Fig. 8

From 2.5–3 mm. in length, 1.5–1.7 mm. in width, convex, with distinctly punctate elytra, reddish yellow with violaceous elytra. Head with a moderately broad interantennal area extending down the front and slightly elevated.

Type.—Male, and 2 paratypes, U. S. N. M. Cat. No. 59203, 1 paratype in Museum of Comparative Zoology, Type No. 28244.

Type locality.—Felton (Oriente Province on Antilla Bay), Cuba, collected by W. M. Mann.

Other localities.—Cayamas, Cuba, E. A. Schwarz, Bah. Honda, Cuba, in June by H. F. Wickham.

Remarks.—Like the preceding species this is distinctly punctate. The shape of the aedeagus separates it from its close relative, *H. orientense*.

***Homoschema darlingtoni* n. sp.**

Fig. 7

From 2.4–2.8 mm. in length, 1.3–1.5 mm. in width, moderately convex, without distinct punctures, reddish yellow with violaceous elytra. Head with a rather broad interantennal area elevated between antennal sockets and extending down the short lower front.

Type.—Male, and 1 paratype, Museum of Comparative Zoology, Type No. 28246; 1 paratype in U. S. N. M. Cat. No. 59204.

Type locality.—Coast below Pico Turquino, collected June 26–30, 1936, by P. J. Darlington.

Remarks.—This species although closely related to *H. orientense* and *H. manni*, differs in not having visibly punctate elytra. It has a shorter frontal elevation on the head. The aedeagus is not so broad as in *manni* and broader than in *orientense* with a strongly recurved orificial plate.

Homoschema androsense n. sp.

Fig. 6

From 2.5–3 mm. in length, 1.5–1.8 mm. in width, convex, distinctly punctate, reddish yellow with violaceous elytra. Head with a short, broad, elevated interantennal area that extends down the lower front.

Type.—Male, and 1 paratype, Museum of Comparative Zoology Type No. 28247.

Type locality.—Andros Island, Bahamas, collected Aug. 1–10, 1904, by “Barber” (? Barbour).

Remarks.—The distinctly punctate and convex elytra and the broadly rounded apex on the aedeagus place this species very near *H. manni*. The area between the antennal sockets of the head is short and broad as in *H. darlingtoni*.

THE SALAGUBONG GONG, A FILIPINO INSECT TOY

By CHARLES T. BRUES

Harvard University

While staying in the hills above Dumaguete on the island of Negros in the Philippines we had the opportunity to see in operation a very interesting and ingenious mechanical toy made and operated by the native children.

The motive power is furnished by a good-sized melolonthid beetle somewhat larger, but quite similar to our North American species of *Phyllophaga*, and still more like the common European dor beetle, *Melolontha vulgaris*. The specimens used by the children belong to two species. Most of them were *Leucopholis pulverulentus* Burm. and one belongs to another somewhat closely related species, *Lepidiota punctum* Blanch. Doubtless any other similar, lubberly lamellicorn would serve equally well. Beetles of this type are abundant in the region, and in general, together with other large phyllophagous lamellicorns are known by the Visayan name, Salagubong. The "gong," as operated by the beetle is one of the five-gallon kerosene or gasoline tins which consistently carry the flavor of civilization everywhere into the furthest reaches of the tropics. We have seen these tins used for a multiplicity of purposes, and may now add still another which seems never to have been called to the attention of entomologists.

Aside from the beetle and the can, two plant materials are used in the construction of the gong: four thin sticks of bamboo, each about two feet in length, and three strands of tenacious fibre taken from the leaf-sheaths of the abaca plant, *Musa textilis*, which is grown extensively in the region for the commercial production of Manila hemp.

As shown in the accompanying illustration, two of the bamboo sticks are implanted in the ground and connected near their tops by a strand of fibre securely tied at each end, forming a miniature pair of football goal posts. The third stick is similarly fixed in the ground to form the apex of a triangle. One end of the fourth bamboo stick is now fastened to the transverse abaca fibre by a tight abaca loop, and suspended near

its other end to the third stick by a fibre which allows it to move freely back and forth next to the vertical stick. The tin is placed near this vertical stick where it will be tapped by the horizontal stick as the latter swings on its longitudinal axis. Finally, the beetle is tied toward one side of the horizontal fibre which is short enough to keep the beetle off the ground. The base of the hind femora next to the coxae form a secure point to tie the beetle at the end of its abaca tether.

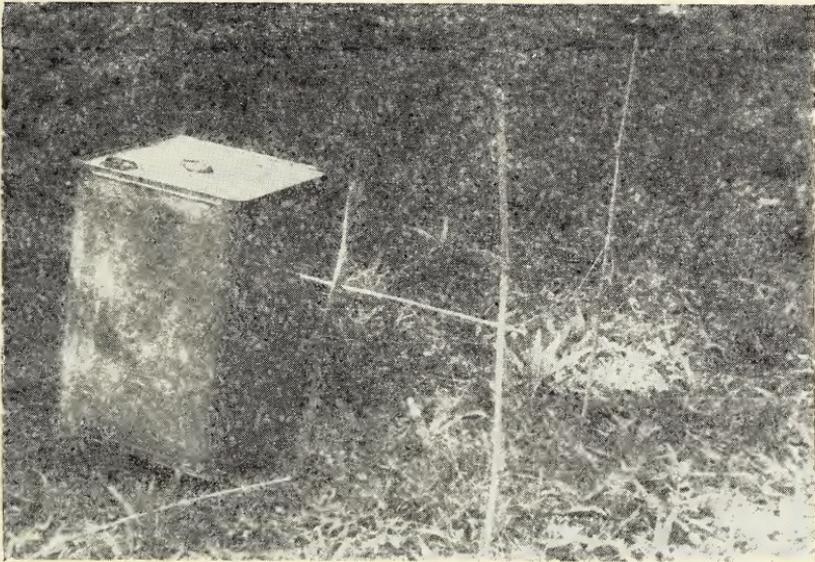


Fig. 1. The salagubong gong. The oil can which acts as a resonator is shown at the left. The first pair of bamboo sticks mentioned in the text are at the right, connected by the thread from which the beetle is suspended.

After a little teasing and manipulation, the beetle gets into action and attempts to fly away. As the abaca fibre grows taut, the path of motion assumes a circular orbit and the transverse fibre sways violently back and forth as the beetle circles unwillingly on its flying trapeze. The tin may now be shifted till it receives a staccato tap from the end of the stick at each revolution of the beetle. These taps strike the gong at the rate of two or three per second, dependent upon the muscular tonus of the

salagubong. Such taps are surprisingly loud and sufficiently strong to attract attention within a radius of 100 feet or more.

Each performance lasts half a minute or longer, till the beetle gives up the attempt to escape. After a short period of inactivity, further prodding readily induces an encore performance of similar duration.

THE EUROPEAN MANTIS (*Mantis religiosa* L.) IN NEW ENGLAND.—In view of the recent reports from Ontario (James, H. G., 1948, 79th Annu. Rept. Ent. Soc. Ont., 41-44) it seems pertinent to list the following New England records of this introduced insect: one ♀, Burlington, Vt., July 27, 1949; one ♀, Chester, Vt., Sept. 7, 1948 (Dr. C. T. Parsons); several specimens on summit of Mt. Mansfield, Vt., Aug., 1949 (Dr. E. A. Chapin); several at Cummington, Mass., Oct., 1949; one egg mass also at Cummington, Nov., 1949 (Dr. A. B. Gurney); one ♀, Melrose, Mass., Sept., 1949 (Dr. B. R. Lutz); one ♀, Watertown, Mass., Aug., 1949 (Mr. H. L. Starrett); one specimen, possibly from Conn., in Agr. Exp. Sta. Collection, no data. A number of specimens were also brought in from the Boston area during the 1949 season.

Dr. K. D. Roeder of Tufts College released specimens in Medford and Concord, Mass., in 1945, which seem to have been responsible for specimens taken in the same localities the following year. It remains for future winters to determine just how permanent this apparently wide establishment may be.—WILLIAM L. NUTTING, Biological Laboratories, Harvard University.

ON THE STATUS OF *LEPTOTHORAX* MAYR AND SOME OF ITS SUBGENERA

BY MARION R. SMITH

Bureau of Entomology and Plant Quarantine, Agricultural
Research Administration, United States Department
of Agriculture

The genus *Leptothorax* was established by Mayr in 1855 (Verh. Zool.-Bot. Gesell. Wien 5: 431) for a number of Palearctic ants, such as *clypeatus* (Mayr), *acervorum* (F.), *muscorum* (Nyl.), *tuberum* (F.), and *unifasciatus* (Latr.), without genotype designation. This was not done until 1903, when Bingham (Fauna of British India (Hymenoptera), vol. 2, p. 214) selected *acervorum* as the genotype. Ruzsky, in 1904 (Zapiski Imp. Russk. Geogr. Obshch. 41 (1): 288), described a new genus, *Mychothorax*, and chose the same form, *acervorum*, as a genotype, thus making *Mychothorax* an isogenotypic synonym of *Leptothorax*. W. M. Wheeler, in 1911 (Ann. N. Y. Acad. Sci. 21: 166), overlooking Bingham's previous designation of *acervorum* as genotype of *Leptothorax*, named *acervorum* a second time as type of this genus. Then in 1922, Emery (in Wytsman's, Genera Insectorum, fascicule 174 c: 248), apparently unaware of the previous designation, selected *clypeatus* as genotype for *Leptothorax*, presumably because it was the first species listed by Mayr in his original article; and this concept has been universally adopted. However, since Bingham's is the first valid genotype designation for *Leptothorax*, the genus must be based on *acervorum*.

It thus becomes necessary to propose a new subgenus for Emery's concept of *Leptothorax*, subg. *Leptothorax*. This group, which is both Holarctic and Neotropical in distribution, and contains a large number of North American ants, I propose to name *Myrafant*, for my wife, whose maiden name was Myra Fant.

Leptothorax, subg. **Myrafant**, new subgenus

Type: *Leptothorax curvispinosus* Mayr. By present designation.

This subgenus includes such common North American forms as *fortinodis* Mayr, *rugatulus* Emery, *longispinosus* Roger, *texanus* W. M. Wheeler, *tricarinatus* Emery and many others. For a list of forms see Emery, 1922 (in Wytsman's, *Genera Insectorum*, fascicule 174 c: 251-259).

The worker has 11- or 12-segmented antennae; thoracic humeri usually rounded, occasionally subangular; mesoepinotal impression on the dorsal surface of the thorax usually absent, if present, scarcely perceptible.

In the preparation of a catalogue of Nearctic ants, it was noted that *Goniothorax* Emery, 1896, is preoccupied by *Goniothorax* Milne-Edwards, 1879. As *Nesomyrmex* W. M. Wheeler is the next available name, it supplants *Goniothorax* Emery. The synonymy is as follows:

Leptothorax subg. *Nesomyrmex* W. M. Wheeler

Leptothorax, subgenus *Goniothorax* Emery, 1896, *Bol. Soc. Ent. Ital.* 28:26, 58. Preoccupied. Type: *Leptothorax vicinus* Mayr. Designated by W. M. Wheeler, 1911.

Nesomyrmex W. M. Wheeler, 1910, *Bul. Amer. Mus. Nat. Hist.* 28:259. Type: *Nesomyrmex clavipilis* W. M. Wheeler. Monobasic.

Caulomyrma Forel, 1914, *Bul. Soc. Vaud. des Sci. Nat.* 50: 233. Type: *Leptothorax echinatinodis* Forel. Original designation.

Most of the ants of this subgenus occur in the Ethiopian, Oriental and Neotropical Regions. Our only known North American species is *wilda* M. R. Smith, from extreme southern Texas.

BOOK REVIEW

THE ANTS OF NORTH AMERICA, by William S. Creighton. Bulletin of the Museum of Comparative Zoology at Harvard College, vol. 104, pp. 1-585, 57 plates (April, 1950).

For the first time in this century, there is available in one volume a comprehensive treatment of all the genera and species of North American (Nearctic) ants. Interest of entomologists in this work will be aroused chiefly by the complete keys and plates, which allow more accurate determination of our ants than has ever before been possible. The major significance of this volume does not rest with this quality, however.

Professor Creighton's long-awaited work easily ranks with the two most fundamental and influential previous works in formicid taxonomy, Mayr's "Formicina Austriaca" and Emery's contributions to the "Genera Insectorum." Mayr was the first to recognize and apply generic differences among ants on a logical and systematic basis. Emery digested the vast amount of world literature and produced a comprehensive classification, generic key and catalog for the family. Creighton, in a single stroke that cannot be ignored, has applied the modern concepts of population systematics to the entire North American fauna.

In its purpose and effect, Dr. Creighton's work is a detailed generic and specific *revision* of the Nearctic ants. It is bold, sweeping and relentless. The author lucidly exposes the confusion that has attended the growth of the taxonomy of our fauna. Familiar but worthless names of some of our commonest forms fall into synonymy by the score. The taxonomic categories are restricted to the species and subspecies (geographical race) below the subgenus, and the concept of variety is rejected as useless and meaningless. The evidence presented for this system is so overwhelming and detailed, in the opinion of this reviewer, that *any* myrmecologist clinging to the pentanomial or hexanomial systems will find logical refutation impossible. Although systematics based on population concepts has presumably not been completely unknown to myrmecologists, the literature of the past ten years abundantly proves that the major principles set forth by Ernst Mayr and others have rarely been applied correctly in specific cases among the ants. Most

myrmecographers seem to have understood rather vaguely that varieties should not be described, but that subspecies were allowable; the essentially geographical nature of the subspecies is not evident at all in the majority of forms placed in that category up to the present.

In the matter of individual case treatments in Creighton's work, it is necessarily true that many of the subspecies are little more than intelligent guesses based on abundant, but still insufficient material. During the many months the book remained in the hands of the editor, proofreaders and printers, some of the names carried in it have been synonymized, and several new forms have been described in the mounting North American literature. One could scarcely expect a work of this scope to be in any sense a final treatment of the group. Few entomologists, even including some myrmecologists, realize the extreme confusion that has reigned in the taxonomy of our ant fauna; the most experienced entomologists have been unable to name with any confidence many of our commonest species. For this reason, it must be made as emphatic as possible that "The Ants of North America" is *not* an infallible guide based upon a triumphant century of myrmecographic endeavor; rather, it is the exposure of the fundamental taxonomy that may make such a century possible.—WILLIAM L. BROWN, JR., Biological Laboratories, Harvard University.

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A regular meeting of the Club is held on the second Tuesday of each month (July, August and September, excepted) at 8:00 p.m. in Room B-455, Biological Laboratories, Divinity Ave., Cambridge. Entomologists visiting Boston are cordially invited to attend.

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THE ANTS OF NORTH AMERICA, by Professor Wm. S. Creighton. Published in April, 1950, as volume 104 of the Bulletin of the Museum of Comparative Zoology, with 585 pages and 57 plates. Price \$10.00 (postpaid). Send orders to Museum of Comparative Zoology, Harvard College, Cambridge, Mass.

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PSYCHE

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JUNE, 1950

No. 2

THE INFLUENCE OF TEMPERATURE UPON
THE RESPIRATION AND HEART ACTIVITY OF
THERMOBIA AND *GRYLLOBLATTA*.¹

BY

GEORGE A. EDWARDS (Tufts College)

and

WM. L. NUTTING (Harvard University)

A recent survey of the literature concerning the metabolism-temperature response of insects suggested that this large and diverse class makes no metabolic adaptations to fluctuations in environmental temperature. Therefore, it seemed appropriate to investigate several specialized insects to determine if metabolic adaptations are made to particular temperature ranges. The initial experiments included representatives of two primitive orders occupying extremes on the temperature scale. It is hoped that these may serve as limits for future work of similar nature on the insects as a group.

The firebrat, *Thermobia domestica* Packard (Thysanura), was selected as the representative of a hot environment. The firebrat has a well deserved name in that it is found in hot, damp places such as boiler rooms. It has a temperature preferendum of 32° to 44° C, and an optimum of 37.5° C and 60% relative humidity, at which level it completes the life cycle in about three months. It molts and continues to increase in weight throughout the whole life span (Adams, 1933; Sweetman, 1938; Woodland, personal communication).

¹The work described in this paper was done, in part, under contract between the Medical Division, Chemical Corps, U. S. Army and Tufts College. Under the terms of this contract the Chemical Corps neither restricts nor is responsible for the opinions or conclusions of the authors.

Grylloblatta campodeiformis Walker (Orthoptera) was chosen to represent a cold environment. The grylloblattids generally have been collected in late fall and winter, being found in mountainous areas on hillsides with coarse rock slides, in deep crevices, under stones, or in decaying moss-covered logs and stumps at the margins of glacial bogs. On mild winter days a few have been found crawling on the open snow slopes (Gurney, 1948—extensive bibliography). The nymphal stages are long, in *campodeiformis* occupying five years, with the eggs laid in the sixth year (Ford, 1926). Its food consists chiefly of softbodied insects.

MATERIAL AND METHODS

A culture of *Thermobia* that had been maintained at 37.5° C was obtained from Mr. John Woodland, of Harvard University. They were kept in plastic utility dishes in an incubator at 37.5° C and 25% R.H., fed on wheat flour and dried beef, and watered from a vial and wick.

The grylloblattids were obtained from Dr. J. H. Pepper, of Montana State College. They were kept in plastic dishes at 3° to 5° C in a mixture of moss and leaves and fed on pieces of freshly killed flies and roaches.

The oxygen consumption was determined in volumetric micro-respirometers (Scholander, 1942), using "Ascarite" to absorb CO₂ produced, oxygen from "Oxybombs" to fill the reservoirs, and shell vials of appropriate size for animal chambers. Constant temperature at each level was secured by immersing the respirometers in stirred, plastic, water baths, which were immersed in turn in a large, stirred, thermoregulated water bath. The animals were exposed to each temperature for about 1½ hours. At the end of each run the animals were weighed and their sex determined.

For determining the heart rate, each insect was coaxed into a short length of glass tubing, the ends of which were then lightly plugged with cotton. This confinement prevented violent struggling and afforded a clear view of a few cardiac chambers. Of the several available grylloblattids, only two adult females proved suitable for accurate observation of heart activity through intersegmental membranes of the anterior abdominal region. Five adult females and four adult males of *Thermobia* were selected. Each of these specimens was nearly free of scales, while dark material in the crop made

the heart visible through the mesothorax and first abdominal segment.

The tube containing the insect was placed on a plasticine platform in a porcelain crucible which could be closed with a loose-fitting, transparent cover. The temperature of the air in the chamber was taken from a thermometer piercing the cover, (with the bulb close to the specimen). Lower temperatures were obtained by supporting the chamber in a salt and ice water bath. High temperatures were furnished by fitting the chamber into the top of a paraffin oven. For many of the heart rate counts laboratory light was sufficient; for others, a diffuse, water-filtered beam from a microscope lamp was directed into the chamber.

Except at the damaging extremes, *Grylloblatta* was exposed for an average of 17 minutes to each temperature level. *Thermobia* was exposed for an average of one hour and ten minutes at each level. At least two readings were made for each temperature, but three or many more were made in most cases. No specimens were used for further recordings, after being exposed to temperatures that might be considered damaging. In all cases the rates for previously known temperature preferenda were obtained before subjecting a few individuals to lethal limits. During each run it was frequently noticed that struggles or movements of the alimentary tract produced marked irregularities or even brief cessations of heart activity.

RESULTS

A. Oxygen consumption:

Grylloblatta.—The oxygen consumption of *Grylloblatta* at various temperature levels throughout the range -2.5° to 20.5°C is given in Figure 1. The animals remained active for a number of hours at -5.0°C though the oxygen consumption at that temperature was not measurable by the techniques available. The metabolism-temperature curve for *Grylloblatta* is a straight line (Fig. 1), with an average Q_{10} of 2.7. With increase in temperature there was a regular increase in oxygen consumption up to 20.5°C . At that temperature the animals became paralyzed quickly so that a full hour exposure was not realized. Subjection of the data to an Arrhenius plot gives a temperature characteristic of 14,600 calories over the range -2.5° to 20.5°C (Fig. 3).

At -5.0°C the animals were active but movement was noticeably

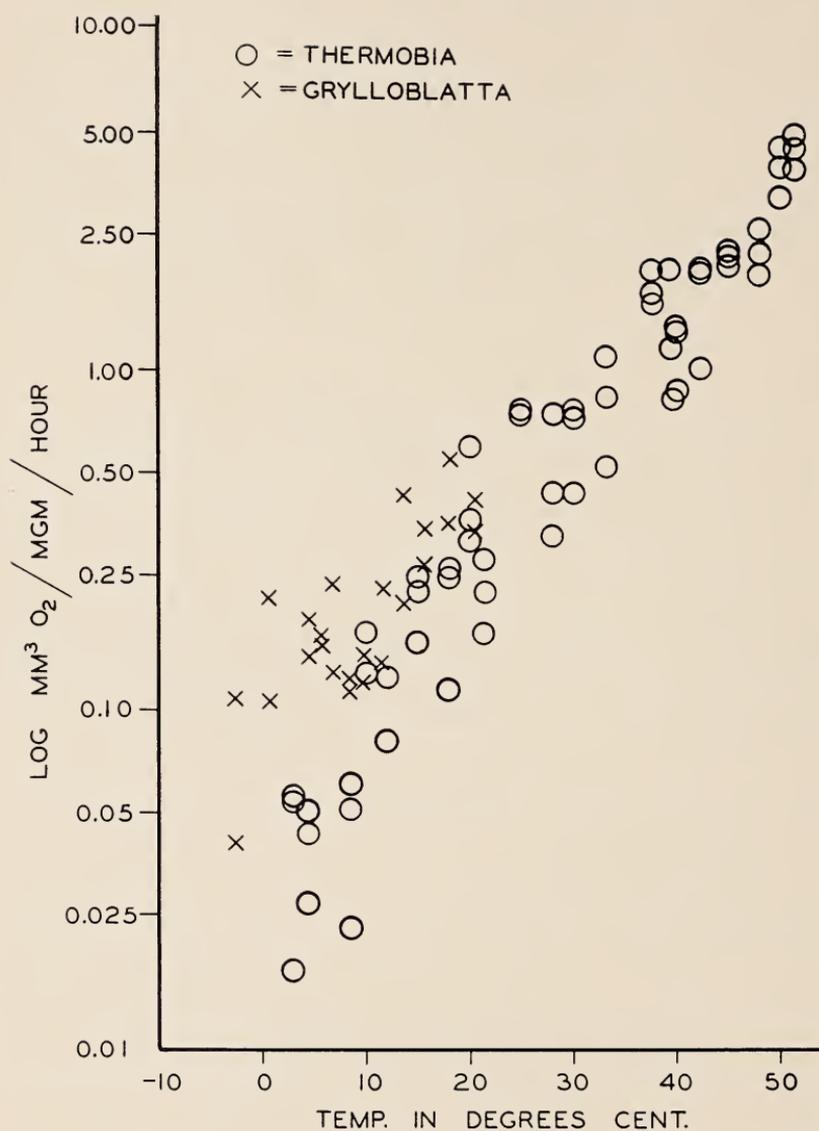


Fig. 1.—Oxygen consumption of *Thermobia* (circles) and *Grylloblatta* (crosses) over a range of temperatures.

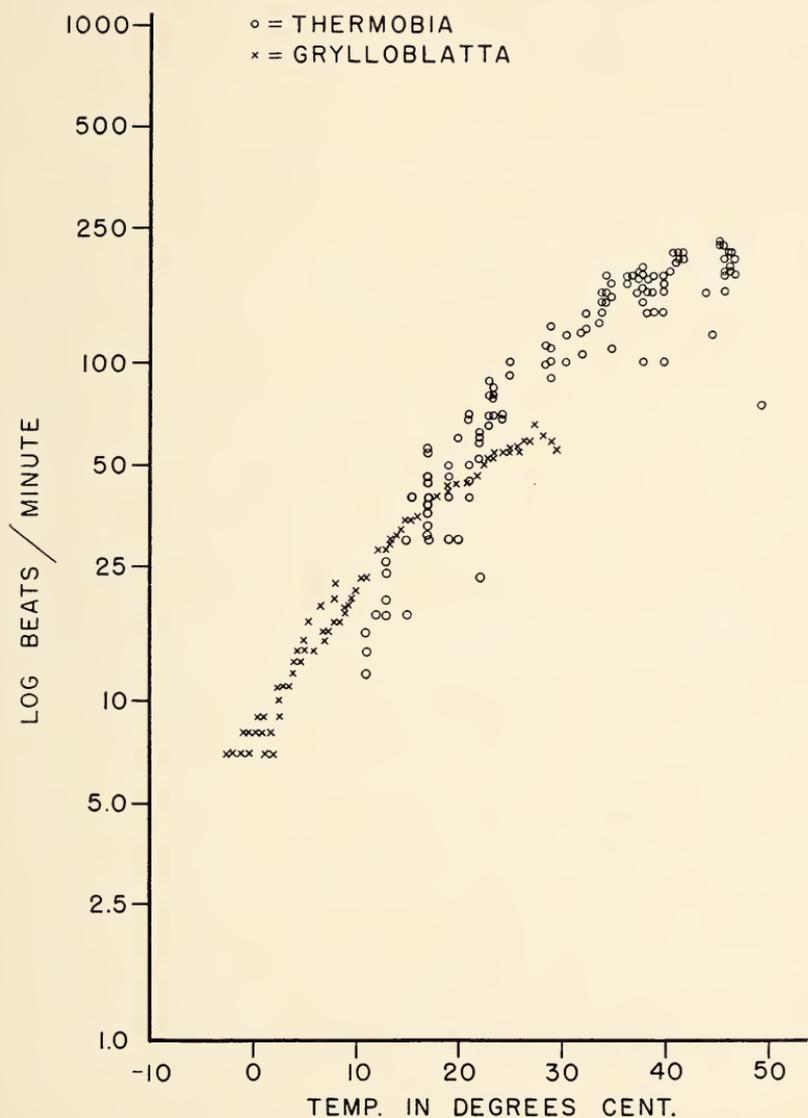


Fig. 2—Heart rate of *Thermobia* (circles) and *Grylloblatta* (crosses) over a range of temperatures.

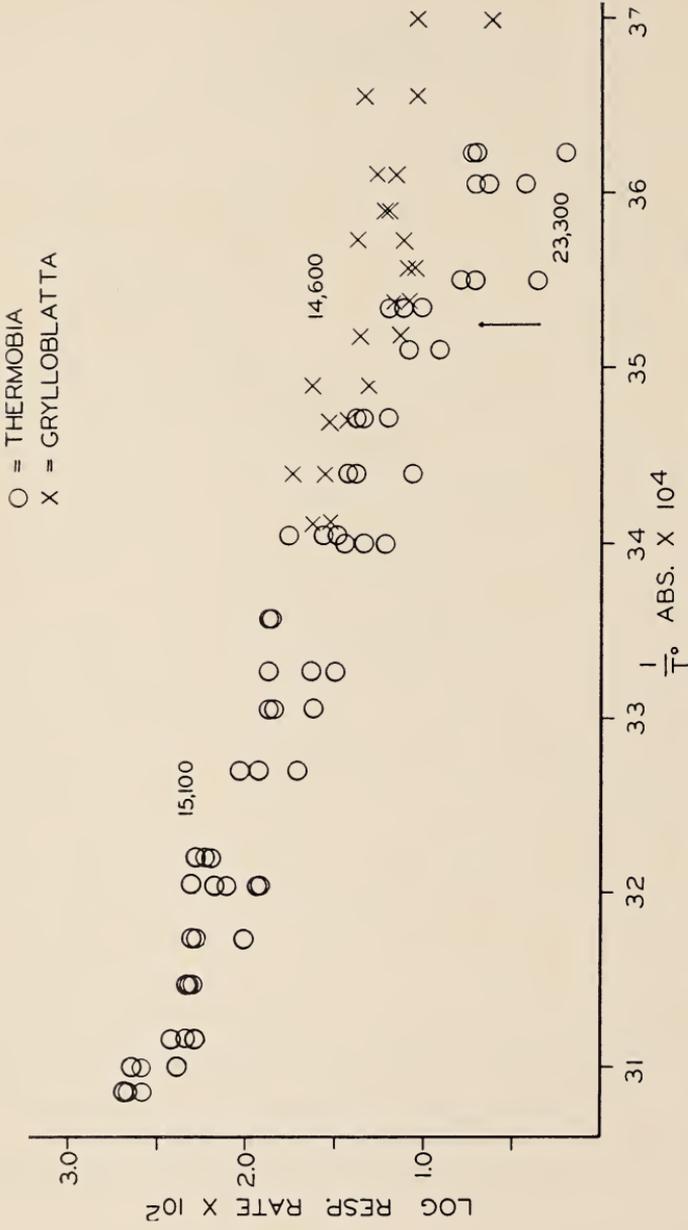


Fig. 3.—Arrhenius plot of the oxygen consumption of *Thermobia* (circles) and *Grylloblatta* (crosses).

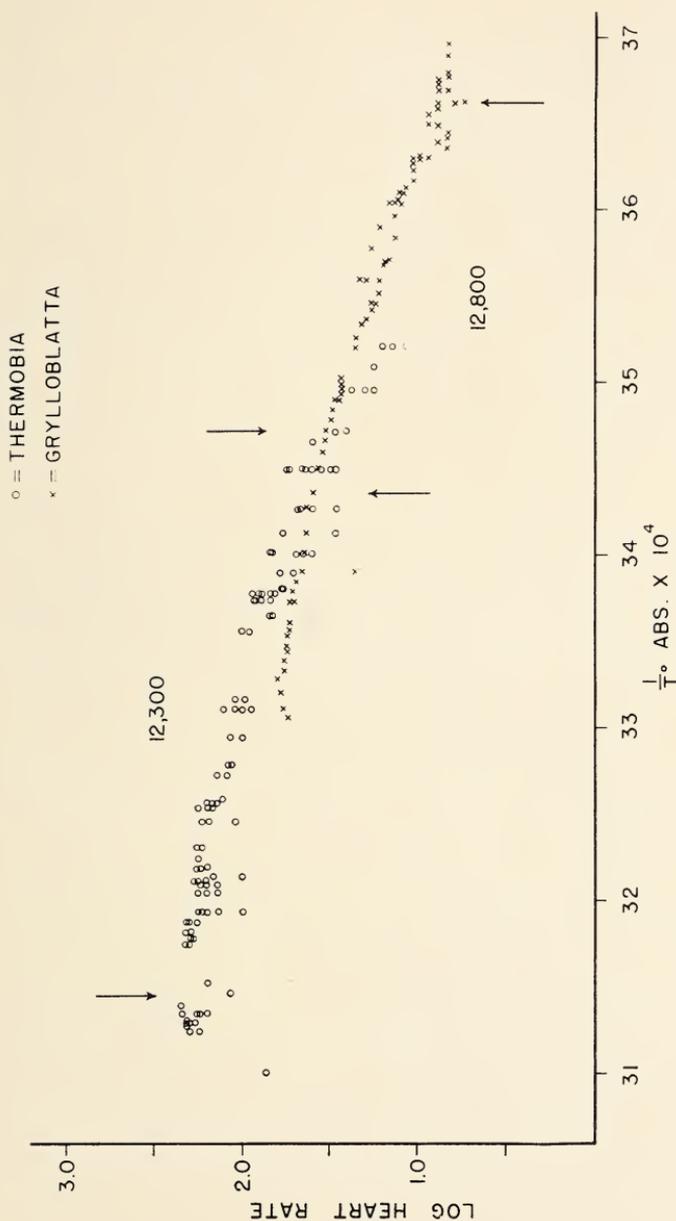


Fig. 4.—Arrhenius plot of the heart rate of *Thermobia* (circles) and *Grylloblatta* (crosses). Activation energy calculated from equation:

$$\mu = 4.58 \left(\frac{\log k_2 - \log k_1}{1/T_1 - 1/T_2} \right)$$

slower than normal. In the respirometers the animals remained quiet in the range -2.5° to 11.3°C . Above this temperature they showed increased activity, struggling violently in the vessels. At 18.0°C they struggled for the first half hour and then became abnormally quiet, but still responsive to tapping. At 20.5°C the two specimens appeared to be in poor condition, moved feebly, and finally fell to the bottom of the vials and curled up after 20 minutes exposure. At this point the respirometers were shifted to a 6°C water bath and the oxygen consumption followed for an hour, during which time it fell continuously. The following day the animals were still paralyzed, showing a low oxygen consumption, feeble heart beat, and increasingly weak responses to prodding. The female existed two and the male four days in this condition before dying.

Thermobia.—The oxygen consumption of *Thermobia* was determined at various temperatures in the range 1.0° to 51.3°C . The results are given in Figure 1.

The slope of the log QO_2 —temperature curve of *Thermobia* from 12° to 50°C is practically identical with that of *Grylloblatta*, the average Q_{10} being 2.8. The temperature characteristic for this range was 15,100 calories (see Fig. 3). Below 12°C the slope increased to 3.8 and the temperature characteristic became 23,300. At 1.0° and 51.3°C the animals were irreversibly injured. Below 12°C activity was not observable, though the insects would make slow, appendicular movements when prodded. On return to room temperature, after exposure to the range 3° to 12°C , they became normally active within 3 to 20 minutes. Between 12° and 50°C activity appeared normal.

B. Heart activity:

Grylloblatta.—Over the range -2.5° to 29.5°C , heart rate in beats per minute was recorded and plotted as shown in Figure 2. The heart rate — temperature curve approximates a straight line, although there is a tendency toward levelling off and decline above 20°C , which may be due to heat damage. The average Q_{10} , figured from -2.0° to 28.0°C is 2.1. Excluding possibilities of damage and resulting deviation at temperature extremes, a mass Arrhenius plot (Figure 4) gives a slope of 2.8 over a conservative intermediate range of 0° to 18°C , with a resulting temperature characteristic of 12,800 calories.

At about 2°C the beat became rather feeble, at 0° it was hardly discernible, and after a few minutes at -3°C no form of heart ac-

tivity was observable. Up to 20°C the heartbeat was strong and regular, but after 15 minutes at 22°C diastole appeared incomplete. After 15 minutes at 27°C the heart was almost completely relaxed but continued to beat with an increasing amount of fibrillation. This type of activity was maintained for nearly 20 minutes while the temperature was raised to 29.5°C, at which point all activity ceased.

Thermobia.—The record of heart rate from 11° to 49.5°C is presented in Figure 2. The average Q_{10} calculated from 12° to 42° is 2.6. A mass Arrhenius plot (Figure 4), over an intermediate range of 15° to 45°C, gives a slope of 2.7 and a temperature characteristic of 12,300 calories.

As the temperature was lowered the heartbeat became more and more feeble, although often quite "deliberate", (i.e. with definite pauses between systole and diastole) until, with most specimens, no heart movements were visible after 30 to 60 minutes at 11°C. At the opposite end of the scale, normal heart activity was observed up to about 42°C, after which the beat became extremely rapid with incomplete diastole and intermittent fibrillation. Cessation of activity occurred between 45° and 49.5°C. General movements of the limbs and body of both *Thermobia* and *Grylloblatta* approximated those observed during the respiration experiments.

DISCUSSION

The results show essential agreement with observations on the activity of *Grylloblatta* reported by Mills and Pepper (1937). With short exposures, they found that cold prostration set in at -6.2°, activity was observable from -5.6° to about 20°, and paralysis occurred at 24.9°, with 27.8°C being fatal. Also substantiated is their statement that *Grylloblatta* shows no dormancy at low temperatures but probably tries to avoid unpleasant conditions by sunning or seeking shelter.

The results suggest also an answer to the question of what happens to the firebrat when the fire goes out, but do not explain why the animal has a temperature preferendum so high. Data on the firebrat fit the metabolism - temperature curve of other insects for which information is available, suggesting that the wide temperature tolerance of this insect is not due to any special metabolic adaptation.

All insects thus far investigated have the same general metabolism-temperature curve, in all seasons and from all climes. The only

possible exception is the hive bee, which increases its respiratory rate and activity on either side of a preferred temperature range of 20° to 25°C (Woodworth, 1936). It was expected that *Thermobia* and *Grylloblatta* might prove to be exceptions to the rule. However, the slopes of the two oxygen consumption curves are practically identical (2.7 and 2.8); in the intermediate temperatures their respiratory rates overlap; and their Q_{10} 's are in the same range as those of all insects previously reported. They extend the general metabolism – temperature curve, and *Thermobia* most amazingly so. They are similar to other insects in that they are evidently strictly poikilothermal and utilize only supplementary insulation to offset unfavorable temperatures.

The temperature characteristics obtained over the intermediate temperature ranges agree essentially with previous work on arthropods concerning heart activity and other rhythmic neuro-muscular processes. Comparison of the two sets of data here presented, plus the fact that the heart rate temperature characteristics are not typical of catalyzed oxidative reactions, seem to support the view that respiration is not the fundamental process determining heart rate (see Fries, 1926, for further discussion and bibliography). The temperature characteristics obtained from the oxygen consumption curves are typical values for cellular respiration.

What is now needed most urgently is a thorough study of the biology of *Grylloblatta*, which would provide a firmer ground for the interpretation of data such as here presented. How does the insect manage to stay within the narrow range of -5° to 18°C in nature? Does it escape the inevitably severe sub-zero temperatures of its habitat by crawling into deep, rocky, fissures, or in and around roots and in humus where the temperature may remain close to freezing? Is it possible, however unlikely, that the paralysis preceding death at the extremes of its range may be a hibernation state? What relationship exists between the length of the nymphal stages and the low temperature range? What intra- and interspecific variations in temperature responses occur and how do these relate to distribution? A clue to the answer to the last question has perhaps been suggested by Campbell (1948). He reported that a form of *Grylloblatta* found at Kamloops, under conditions less severe than those of the Canadian Rockies and Montana, did not succumb to warmth as easily as typical *campodeiformis* usually does. This may represent lack of uniformity in temperature preferenda, but it

strongly suggests physiological adaptation and perhaps even taxonomic subspeciation.

SUMMARY

The oxygen consumption, heart rate, and activity at various temperatures over the range -5.0° to 51.3°C have been determined for the firebrat, *Thermobia domestica* Packard and for *Grylloblatta campodeiformis* Walker.

Grylloblatta is normally active from -2.5° to 11.3°C . At lower temperatures activity is decreased and at higher temperatures activity is increased until at 18.0° the animals become stuporous and at 20.5°C become irreversibly damaged by heat. Over the range of temperatures from -2.5° to 20.5°C the log Q_{10} - temperature curve is a straight line, having the slope of 2.7 per 10 degrees. In this range the temperature characteristic for oxygen consumption is 14,600 calories. In the range -2.5° to 29.5°C the curve relating heart rate to temperature resembles the respiratory curve giving an average Q_{10} of 2.1. In the intermediate range of 0° to 18°C an Arrhenius plot of heart rate gives a slope of 2.8 and temperature characteristic of 12,800 calories.

Thermobia is active throughout the range 12° to 50°C . Below 12° it becomes inactive, and is irreversibly injured by cold at 1°C . At 50° activity decreases and heat injury becomes apparent at 51.3°C . The log Q_{O_2} - temperature curve has a slope of 3.8 per 10° from 3° to 12°C , and a slope of 2.8 between 12° and 50°C . Temperature characteristics for respiration in these ranges are 23,300 and 15,100 calories respectively. The heart rate - temperature curve is practically identical with the respiration curve, giving an average Q_{10} of 2.6. The temperature characteristic for heart beat in the intermediate range of 15° to 45°C is 12,300 calories.

These two insects extend the general insect metabolism - temperature curve, and appear to be strictly poikilothermal in that they make no metabolic adaptation to offset unfavorable temperatures.

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THE C. ANDRESEN HUBBARD COLLECTION OF FLEAS OF THE PACIFIC NORTHWEST.—Students of fleas will be interested to learn that the Museum of Comparative Zoology of Harvard University recently received from Dr. C. Andresen Hubbard a collection of carefully prepared and labeled slides representing about 75 species and sub-species of western fleas. The slides are neatly put up in a case, together with a numbered index of the forms presented and a copy of Dr. Hubbard's paper on "The Fleas of California" (1943). Appropriate gaps are left in the case for additional kinds which Dr. Hubbard intends adding from time to time to this set. It now contains paratypes of *Megabothris clantoni*, *Epitedia jordani*, and *Corypsylla jordani*. The Harvard set is Dr. Hubbard's "Depository No. 20," as he is sending similar sets to 19 other institutions here and abroad, in addition to the "Master Collection" to be deposited at the U. S. National Museum. Dr. Hubbard is to be greatly commended for his unusual generosity and foresight in distributing his material so widely so that it may be available to many present and future students of this most fascinating and medically important order of Insects.—J. BEQUAERT, Museum of Comparative Zoology, Cambridge, Massachusetts.

NOTES AND DESCRIPTIONS OF WESTERN CHRYSOPIDAE (NEUROPTERA)¹

By NATHAN BANKS
Holliston, Mass.

For some years Chrysopidae have been accumulating in the collection at the Museum of Comparative Zoology, and in recent years I have received, with other Neuropteroids, many specimens from Grace H. and John L. Sperry, especially from California and Arizona, from Prof. A. L. Melander also material from the same states, and from P. H. Arnaud specimens from California. During the summer of 1948 two students, F. Werner and W. Nutting, made an automobile trip to the southwest and to Mexico, and captured many hundreds more.

Most of the new species are from the western part of the United States and this paper is devoted to their description.

Many of the new forms are in the *Eremochrysa* section, so I have tabulated them, and made new descriptions of some of the old species.

Genus *Meleoma*

The males of the species of *Meleoma* can be recognized by the interantennal process. In the western States are four species, to these I add three more, two of them from California; another species occurs in Arizona, but the specimen has no antennae, so I leave it undescribed.

***Meleoma comata* sp. nov.**

A species similar to *M. emuncta* with a different interantennal piece, the wings less coarsely haired.

Green; a medium white stripe from vertex back over the abdomen; in the female there is a faint trace of a reddish stripe before the side-margin; legs greenish, tarsi soiled whitish; antennae mostly pale, first joint green. Venation green, a few crossveins dark, mostly toward wing-base; several costals toward base, and some

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beyond dark at one end; gradates green. Cheeks with a narrow black line, interrupted near middle; palpi with a narrow black line above on one or two joints; in the male these lines more prominent, and the basal joint of antennae pale, with a reddish mark in front toward the tip, the basal joint extends laterally over the eye; the upper edge, seen from in front very concave; the second joint is much longer than broad, constricted below the middle, the lower part bearing minute erect hairs. The third joint is elongate, swollen mostly toward the inner base, the outer edge there concave, the inner edge has the row of white curved hairs which extends, somewhat obliquely upward. The interantennal process is much broader than long, concave in front (seen from above) each side at tip extending somewhat laterally and tipped by some short bristles. On the front, just before the anterior slope, is a group of erect hairs, pointing toward the process.

The wings are more slender than in *M. emuncta*, the tip almost in a point. The hairs on the costal fringe are very much shorter than in *M. emuncta*, and those elsewhere on the venation are much fewer. In the fore wing about twenty-four costals before stigma, the cells, except toward stigma, are plainly higher than broad; the costal area (at widest) hardly equal the radial area; the divisory cell two and a half times as long as broad, ending beyond cross-vein above; below there are seven cubital cross-veins. The hind marginal area is one and one-half times as broad as the cubital, but not quite twice as broad as costal area. Seven to nine inner gradates and eight to ten outer ones, in parallel rows; each gradate separated about its length from the next. In hind wings eight gradates in each row, about parallel. Beyond the end of medius (fore wing) there are five or six forks before wing tip. Length of fore wing, 14.5 mm.; width, 5 mm.

Male and female from Upper Santa Ana River, San Bernardino Co., California, 15 July, 6 Aug., 1948. (G. H. and J. L. Sperry). Also an old female from San Bernardino Mts., South Fork, 20 June, 6000 ft. (Grinnell).

Type: M. C. Z. no. 28348.

***Meleoma cavifrons* sp. nov.**

A small, slender-winged species, with few cross-veins, basal joint of antennae erect, and, seen from in front, each side convex, the

male with almost entire front forming a large heartshaped concavity.

Body and wings pale yellowish, female rather more green, a broad black stripe on cheek, scarcely interrupted; palpi lined with black; pronotum broadly reddish brown on each side; third antennal joint scarcely longer than second or fourth, not modified; second joint constricted below middle; vertex with the median raised area margined on sides and front by a dark line. Basal joints of antennae hardly one-half their diameter apart, erect, and sides convex, in both sexes alike. The interantennal process is slender between antennae, but widened and forked in front, each arm with bristles at tip; below there is a great, heart-shaped concavity occupying almost entire dorsal surface of face, each upper corner reaching to the eyes; its surface and margin bears erect, short hairs, and below tip of interantennal process are two tufts of long, erect hairs; pronotum narrowed in front, behind as broad as long.

Wings about three and one-half times as long as broad, tip nearly in a point; venation open, but eighteen to twenty costals, and only nine or ten radial cross-veins, mostly dark. Medius to tip of the second cubital cell is dark, also the basal part of the radial sector; branches of radial sector dark on basal part; also dark are the gradates, cubital cross-veins, and branches of anal vein near wing base; marginal veins pale. In hind wings not so many veins dark. The costal fringe is moderately long, but much shorter than in *M. emuncta*; hairs on cross-veins but few. Divisory cell ends at the cross-vein above.

The costal cells are higher than long, except near the stigma; radial cells about as long as high; the gradates in parallel rows, inner of three or four, outer of five, each widely separate from the next. Beyond the end of the medius but two and one-half forks before wing-tip. Length of fore wings, 11.8 mm.; width, 3.7 mm.

Male type from Pinecrest, Tuolumne Co., California, 10 July, 1948. P. H. Arnaud, Jr., collector.

A female taken at the same locality, but on 19 July, is apparently the same species. The head and a median stripe on the pronotum are whitish, elsewhere and wings green. Nine radial cross-veins as in male, and other venation similar; the costal fringe longer than the male, but six cubitals beyond the divisory cell; basal antennal joint as in male; of same size.

Type: M. C. Z. no. 28350.

Meleoma delicata sp. nov.

A small species, the third antennal joint not modified, the basal antennal joint, slender, enlarged at tip in usual manner, but with a flat area or scar at tip; nearly all of the cross-veins are dark.

Pale greenish, abdomen green, wings hyaline, cross-veins and branches of anal are dark. Basal antennal joints hardly diameter apart, cylindric, from in front outer side concave, somewhat shorter than usual, with a swelling near tip in front. Interantennal process broad, nearly truncate at tip, below it is a broad cavity, each side reaching to eyes, but not long, and reaching scarcely one-third way to tip of head; the margin is bordered with hairs, and a central group of hairs a little in front of it; from the side an erect process is seen, with an upcurved tip, pointing toward the front of the interantennal process. In certain views the upper outer corner of the basal antennal joint shows a short spur. Pronotum short, brown, with a pale median line.

Wings sparsely veined, but hardly as much so as *cavifrons*. Costal area quite broad, but the radial area broader, and about equal to marginal; cubital area almost as broad as costal; tip of wings almost in a point.

Practically all cross-veins, and the gradates dark, or at least partly so, also the anal branches. Divisory cell about two and one-half times as long as broad, ending beyond the cross-vein above. Twenty costals before stigma, the cells higher than broad, except those toward stigma; eleven radial cross-veins, three cells near middle higher than broad; gradates parallel, seven in each row, mostly about their length apart; six cubitals beyond the divisory; hind margins of fore wing with four forks beyond end of medius and before tip of wing. Costal fringe fairly long, hairs on cross-veins few and rather short.

In hind wings the costal cross-veins and the radials mostly dark, nearly all the other venation greenish; six inner gradates, seven outer rows parallel. Length of fore wing, 12 mm.; width, 4 mm.

A male from Ft. Wingate, New Mexico, 14 August 1908, John Woodgate.

Type: M. C. Z. no. 28349.

Another male from two miles southwest of Patagonia, Santa Cruz Co., Arizona, 30 July 1948 (Werner and Nutting).

***Chrysopa pinalena* sp. nov.**

Head rather short and broad, pale; directly below the antennal sockets is a transverse dark brown band from eye to eye, it bends upward in the middle, below it on the clypeal edge is another and similar band, almost as broad, reaching from eye to eye, and also bent up in the middle, a little more than the upper band; below this in the middle is a short, slightly down-curved brown band. At each end of both complete bands the dark is enlarged. In the specimen figured the antennae are strongly thrown back, in one with the antennae porrect, the upper band is almost hidden. Palpi black, with pale tips to the joints (except last); antennae (including second joint) pale, unmarked. Vertex rufous, and somewhat swollen in middle, leaving only a very narrow groove between it and the eyes. Pronotum narrowed in front, longer than broad, at least a little; pale in middle, dark on sides, broadly so behind; also the meso- and metanotum pale in middle, the lateral lobes dull black. Legs pale, unmarked.

Abdomen pale below, and mostly on the sides; above with several segments toward base with a large dark mark, sometimes the marks hardly distinct.

Fore wings with anals black, the subcostal vein toward, but not at base and the upper side of third cubital cell dark, other veins slightly darkened, but often only at bases of hairs; gradates no darker than others.

Stigmal area darkened for a long space, and with five to seven subcostal cross-veins; twenty-four or twenty-five costals, twelve radials, four or five inner, and six to eight outer gradates, subparallel, the inner as near radial sector as to outer, seven branches of radial sector reach outer margin. Divisory cell slender, ending much beyond the cross-vein above, seven cubitals beyond the cell. Hind wing very similar, with seven branches of radial sector to margin, and one or two fewer gradates. Length of fore wing, 13.5 mm.; width, 4 mm.

Two specimens from the Pinals, Globe, Arizona, 18 July 1948. (Nutting and Werner).

Type: M. C. Z. no. 28345.

***Chrysopa yuma* sp. nov.**

Body green as also venation, legs and antennae. Face scarcely marked; there is a very faint reddish tinge under the base of each

antenna; there is no cheek mark, nor any spots on the clypeus; palpi wholly pale green. Antennae entirely pale greenish, no marks on basal nor second joint; in one specimen the vertex is faintly yellowish in front; the subtriangular elevated area is rather smaller than usual, the groove between it and the eye being quite broad.

Pronotum nearly twice as broad as long, sides parallel, but in front narrowed at the head. Legs short, pale, unmarked. Abdomen of female about as long as usual, in male not reaching half way to tip of wings, its tip rounded. The hairs on abdomen (and pronotum) are wholly white.

The wings of male are almost acute at tip, but more rounded in female. The venation is the usual *Chrysopa* type; the sub-costal cross-veins at stigma weak and few. Sixteen costals before stigma, eight radials; costal area only a little more than one-half the width of the radial area; marginal area much broader than cubital; divisory vein ends beyond the cross-vein above, but five cubital cross-veins beyond; three or four outer gradates, and one inner, about the same in hind wing. The third cubital cell has two branches to the hind margin, and the next cell beyond but one branch (as normal *Chrysopa*).

The costal fringe is quite long, but not dense, the hairs on the veins are long, but not numerous. Length of fore wing, 8.5 mm.; width, 2.8 mm.

Male and female from Ft. Yuma, California, 6 June, 13 June, Andahl collector, from G. H. and J. L. Sperry.

This insect has no near relation to the *plorabunda* section of *Chrysopa*, which are almost wholly green. It has no sinuous costal cross-veins found in that section. The venation is more open than the usual *Chrysopa*. In the male the apical part of wing is more narrow and there are but three branches of the radial sector that reach the outer margin of wing.

Type: M. C. Z. no. 28346.

Chrysopa clarivena sp. nov.

Pale; no marks on face nor cheek; basal antennal joint unmarked, second joint black, beyond faintly darkened; basal joint rather short and broad at base, little separated from each other, palpi pale, last joint darkened. Vertex with a red mark each side by eye, middle area elevated.

Pronotum pale, with sides parallel, but in front narrowed; no distinct marks; meso- and metanotum dull, pale brownish; legs wholly pale, hind femora unmarked. Abdomen pale, dull gray to brown above with the apical three segments pale yellowish, below with only the apical segment pale.

Wings hyaline, with hyaline or whitish (perhaps greenish alive) venation, the base of the second cubital cell and the cross-vein below it in certain views dark; no sinuous costal cross-vein; the costal area, which, at broadest, is much more than one-half of radial area, has three long cells near base (fourth, fifth, and sixth) which are almost or fully as long as high and beyond are several cells longer than usual. The divisory cell very slender, narrowed at base, and ending beyond the cross-vein above, six cubitals beyond the divisory cell; two inner gradates and five outer, the inner much nearer to outer than to the radial sector. Three branches of radial sector reach to margin, tip of fore wing rounded, that of hind wing plainly acute; costal fringe fairly dense and of moderate length, hairs on veins rather few and quite long. Length of fore wing, 10.2 mm.; width, 3.7 mm.

One specimen from Ehrenberg, Yuma Co., Arizona, 11 July 1948, mesquite area (Nutting and Werner).

Type: M. C. Z. no. 28347.

This species is peculiar in the long costal cells, but not unique; this character is found in *Chrysopa apache* Bks., and in *Chrysopa yuma*, the small green species described in this paper. For them I make a new subgenus with *Chrysopa apache* the type. It is based on the character of having especially long cells at the widest part of the costal area, at least one of them being as long as high; the antennae beyond the second joint, tend to be darkened, and the inner gradates much reduced, sometimes none; the number of branches of radial sector to reach hind margin is reduced so that the wings tend to have the shape of *Eremochrysa*. The three species now known to belong to this subgenus *Yumachrysa*, are *apache* with venation almost wholly dark, longitudinal as well as cross-veins, and the hind femora have a black band. The others, *yuma* and *clarivena* (described in this paper) have almost wholly pale venation; *yuma* with the radial area but little broader than the costal, and *clarivena* with the radial area much broader than the costal, elsewhere also broader.

Genus *Eremochrysa*

This genus is represented in the western part of our country by many species. All have the cross-veins more or less darkened, and often the longitudinal veins dotted. As a rule the wings are less widened apically than in *Chrysopa*, and the tips more rounded. In *Chrysopa* the branches of the radial sector which reach the outer wing-marking are forked beyond the outer gradates, in *Eremochrysa* rarely more than one is forked beyond the outer gradates.

The males have an extension at the lower end of the abdomen, not present in *Chrysopa*; in one group this process is upcurved, and with simple hairs, in the other group the process is straight and provided with reclinate hairs or bristles.

Table of Species of *Eremochrysa*

1. Front and mid tibiae with a dark cross-band about one-third way from base, often also a dark spot at base of these tibiae; venation mostly dotted, vertex usually with reddish lines or spots*tibialis* sp. nov.
Front and mid tibiae without dark band.....2
2. Antennae just beyond second joint with several joints black or with a black band; face with a reddish stain under bases of antennae.....*rufina* sp. nov.
Antennae beyond second joint not at all black.....3
3. Veins and many of the cross-veins dotted with dark.....4
Veins not dotted, cross-veins mostly entirely dark.....5
4. Face often with yellowish or reddish marks (sometimes united) vertex with reddish lines or spots; fore wings rather broad so that four or five of the branches of radial sector reach the outer margin.....*punctinervis* McLach.
Face usually without marks, vertex mostly rufous, at least in front, and few if any lines or spots; the apical part of wing more narrow so that only two or three branches of radial sector reach outer margin.....*pumilis* sp. nov.
5. Four or five branches of radial sector reach margin; usually black or dark marks on face and vertex, and three stripes on the basal joints of antennae, and three on pronotum.
fraterna Bks.
But two or three branches of radial sector reach outer margin.
Not so heavily marked, few marks on face or pronotum.....6

6. Vertex at least in front rufous, no marks or few; cross-veins of fore wings rather fine, face with few or no marks.

rufifrons sp. nov.

Vertex mostly pale, with reddish or darker lines; face below antennae more or less plainly rufous, cross-veins of fore wing noticeably heavy.....*altilis* sp. nov.

Eremochrysa punctinervis McLach.

Female.—Head with line below each eye extending towards mouth; a row of three black spots (often connected) across clypeus; below antennal sockets usually a transverse band (yellowish to rufous); a black spot between the bases of the antennae, and extended behind on vertex as two slender divergent lines. Palpi partly dark. Basal antennal joint usually with one nearly complete dark line and one or two dark spots; second antennal joint with a dark ring.

Pronotum with two broad brown or reddish brown spots on each side, usually more or less connected, and sometimes with median extensions; usually a dark median line; meso- and metanotum usually with dark or black spots laterally.

Wings with both longitudinal and cross-veins dotted with black (dark), sometimes some of the cross-veins are wholly dark, especially the costals; the markings are more prominent on the fore wings, and sometimes venation of hind wings is almost wholly pale. The hairs on pronotum are short and black, on the abdomen often longer but mostly, at least, black.

The males are usually less completely marked; at the tip of the abdomen of the male there is a lower process, projecting more or less conical, and provided with short hairs among which are some reclinate stiff bristles, some almost spine-like.

The type is from Texas, but the species is widely distributed in the western states, most common in the southern ones; eastward it extends to Florida.

Eremochrysa fraterna Bks.

A long black streak on each cheek; three, usually elongate, dark spots form a line across clypeus; below antennal sockets sometimes a transverse dark line, or often broken in middle; between the antennae two dark (black) lines extend up and on the vertex and

diverge; often a dark line along inner edge of eyes. Palpi mostly black, including last joint. Basal antennal joint with two stripes nearly black, and very prominent, usually also a third shorter stripe; second joint with a black ring or more fully black; rest of antennae pale for some distance, but toward tip often a stretch of nearly black joints.

The pale legs nearly always have a dark spot on under side of the femur near tip, most prominent on hind legs; sometimes the tibiae show a cross-band of brown near base. Hairs on pronotum mostly black, and also most of those on the abdomen.

Fore wings with many of the cross-veins, and the gradates wholly black, especially costals and radials; longitudinal veins often also may be almost wholly dark, but in many cases they are dark at connections and elsewhere more or less dotted. Radial area plainly a little broader than costal area, marginal area plainly broader than cubital area, six cubitals beyond the divisory cell, latter not much narrowed at base, ending beyond the cross-vein above. About eighteen to twenty costal cross-veins; three or four subcostal cross-veins at stigma, and each dark and bordered with yellowish brown; gradates two to four inner; and about as many outer ones, well separated. Sometimes the cross-veins are not entirely black, especially in teneral specimens.

At the tip of the abdomen of the male the lower projecting piece is larger and less tapering than in *punctinervis*.

This species occurs over most of the western states, and often in mountainous areas, but not as common as *punctinervis*.

Eremochrysa rufina sp. nov.

Face with a reddish fan-shaped mark under antennae, broad below, ending on each side in three branches, other small reddish spots on lower face, palpi marked with dark; vertex with a narrow angulate line above antennae, another across the front margin of the elevated area, also somewhat irregular marks each side on the elevated area, and a reddish spot each side close to eye. Antennae not marked on basal joint, second joint faintly rufous, about three joints beyond are black, and four or five with a basal black ring.

Pronotum narrowed in front, each side broadly dark reddish; rest of thorax and abdomen above dark reddish-brown, the abdomen near tip with some white spots; pleura and venter pale; hairs white, as also on pronotum; legs pale, unmarked. Wings with dull brown

cross-veins and gradates, longitudinal veins pale, without dark dots; in hind wings the dark less distinct; stigma somewhat infuscate, but the cross-veins not bordered. Tip of hind wing pointed, that of the fore wing more broadly rounded; venation very similar to the other species; the costal area rather narrow near base; three inner and four outer gradates. Hairs on veins about as in allied species. The divisory cell is shaped much as in *Nodita*, with a broad, oblique base.

The process at tip of abdomen is shorter than in the other species, and projects only a little; it is densely long-haired and I see no reclinate bristles, but there are raised conical processes tipped with a stiff hair (best seen on lower edge). The elliptical pale lobe on side of last segment is larger than in the other forms. Length of fore wing, 10 mm.; width, 3 mm.

One male from Grand Canyon, Arizona, 24 July.

Type: M. C. Z. no. 28351.

***Eremochrysa tibialis* sp. nov.**

Head, thorax, legs whitish; face with a reddish mark each side, divided inwardly; the upper, narrow part borders the antennal socket, the lower and broader reaching nearly to middle of face; clypeus with a dark median spot near lower edge, and a larger black spot at upper corner of clypeus, and extending a bit onto clypeus; cheek with a broad, dark brown (or rich brown) stripe, reaching to upper edge of clypeus; palpi dark, except tips of the joints. The basal antennal joint has a short black line or spot toward the inner tip; a black line on outer side and one above, and the second antennal joint dark (rich brown). The vertex has a dark spot each side on the raised area, with a short line extending forward, and a long dark spot close to the posterior part of eye; the collar (below the front of pronotum), has two dark brown marks on outer side.

The pronotum has a dark margin (formed of dark lines), broken near middle; there is a dark dot near the middle of front margin, another at middle before the cross-groove, and two behind the groove. The lateral lobes of meso- and metanotum have dark spots, and one on each lateral corner of the mid-lobe of mesonotum. Legs pale, all the tibiae have a dark dot near base, and a dark cross-line about one-third way down; the hind femur has a small dark spot near end.

The abdomen above is dull yellowish, with narrow dark hind

borders on the segments, broader on the fourth and fifth segments. Pleura and venter dull, with a broad pale border to the fourth and fifth segments; the last two segments wholly pale. Apical process of male straight and rather stout, but tapering, with reclinate bristles, and some long, simple hairs. The tip of upper part has long, slender hairs; elsewhere the numerous hairs are extremely minute and very short, shorter than in *E. fraterna*.

The venation is mostly pale, with numerous dots, a few of the costals wholly dark; gradates partly dark, three inner, four outer. The divisory cell, rather slender, ends on the cross-vein above. Fifteen costals; eight radials; gradates parallel, inner about as near to radial sector as to outer series. In this male there is but one cross-vein from the third cubital cell to margin, two from the fourth cubital cell. Length of fore wing, male 8.5 mm.; female 9.5 to 10 mm.

A male from Florence Jet., Arizona, 18 April 1935 (F. H. Parker) and many specimens from Watson, Utah, 22 July (F. M. Carpenter), also Vidal, California, 9 April (Sperry).

Type: M. C. Z. no. 28358.

Eremochrysa atilis sp. nov.

Head pale, face below antennae to the clypeus almost entirely reddish brown; a pale spot between antennal bases, and a smaller one on middle of clypeal margin; three dark spots on clypeus, one each side, and a median one, higher up. Below each eye is the usual dark brown stripe on the cheek; palpi reddish-brown, tips of joints, and basal joint pale; basal joint of antennae has a dark stripe on outer side, and a much shorter one on inner side; second joint not darkened. Rest of antennae whitish, but toward tip some joints are partly dark.

Pronotum longer than broad, sides parallel, rather broadly dark, mesonotum and metanotum with dark spots; legs pale, hind femora with a rather broad red-brown band a little before the tip.

Abdomen grey, somewhat marked with darker above; tip pale; the lower piece of male is rather broad and tapering but little until near the tip; it bears many reclinate bristles, and below near base is a group of erect hairs, the upper tip of abdomen is thickly clothed with long white hair, much shorter white hairs elsewhere.

Wings shaped as in *E. fraterna*, a broadly rounded tip, no acute point; costal area quite narrow; thirteen costals, before stigma,

marginal area scarcely more narrow than the cubital, six radial cross-veins, four outer gradates, these close to wing-tip; no inner gradates. Cross-veins wholly dark brown, longitudinals pale, unmarked except at joinings. Three stigmal cross-veins dark, but scarcely bordered; hind wings also with the cross-veins dark, and the longitudinal pale, except at joinings.

A female is similar, but the mark below antennae does not occupy the whole area; pronotum as broad as long. Length fore wings, male 6.5 mm.; female 8 mm.

One male and several females from Stockton Pass, Pinaleno Mts., Graham Co., Arizona, 5440 ft. (Nutting and Werner).

Type: M. C. Z. no. 28357.

***Eremochrysa rufifrons* sp. nov.**

Face whitish or pale yellowish, usually the three clypeal dark spots and a slender cheek-mark; basal antennal joint with an outer black stripe, and one on the inner side, none above, second joint of antennae more or less darkened; palpi mostly black, with more or less distinct pale bands; vertex more or less rufous in front, shining. Legs pale, hind femur with a dark mark near tip.

Pronotum usually a little longer than broad and tapering slightly in front; pale, dull yellowish, no marks on side nor band across, but in front are two small dark spots, sometimes faint. Meso- and metanotum and pleurae also pale yellowish, without marks. Abdomen also pale, unmarked. Hairs on pronotum dark, those on abdomen mostly pale, but in females there are some black bristles on the dorsum of some segments near tip of abdomen; in the male the hair on abdomen is white and very short.

Fore wings with cross-veins wholly dark, some toward base are often more broadly dark; the longitudinal veins are pale, except at endings of the cross-veins, no dots. Stigma but little darkened, and the three cross-veins not strongly marked. The wings are not broadened before tip as much as in *E. fraterna*, there being but two or three branches of radial sector to reach the outer border.

Twelve or thirteen costals, six or seven radials, two or three inner gradates and three or four outer ones. The divisory cell is slender and ends well beyond the cross-vein above, six cubital cross-veins beyond. In the hind wing the median and cubitus are united for a long distance near base; no inner gradates. Length of fore wing, 8 mm.

From Globe, Arizona, 9 August 1933 (Parker 34), also Globe, Arizona, 19 July, at light (Werner and Nutting).

Type: M. C. Z. no. 28356.

In structure and color of veins, this species is close to *E. fraterna*, but readily separated by the absence of markings on pronotum and rest of thorax, and on the vertex, and absence of a stripe on the upper side of basal antennal joint.

***Eremochrysa pumilis* sp. nov.**

Face pale whitish or yellowish; usual black cheek-mark, clypeus with a dark spot each side, a larger median spot, no marks on face. Basal antennal joint with a black line on outer side, and one on inner side; second joint dark above. Vertex pale, with two more or less distinct dark spots on middle area, and a dark spot each side close to eye.

Pronotum with distinct dark border each side; in front at middle a short dark line, and behind usually some traces of its continuance; a black point each side near the middle on the transverse groove. Meso- and metanotum show dark marks on the lateral portions above, and also on sides. Legs pale, a small dark mark near tip of hind femur; palpi banded with dark.

Abdomen pale; hairs mostly pale, black and longer on the segments near tip, in male almost all very short and white. The wings are moderately slender; the costals (about fifteen), the radials (eight or nine), and gradates are dotted, all are fine, not bordered, a few cross-veins toward base wholly dark. Usually four in each row of gradates; but two or three branches of radial sector reach the outer margin. The stigmal area is colored, and the subcostal cross-veins darkened.

The lower process of the tip of abdomen of the male is rather large for the small insects, and rather blunt at tip with fine apical hairs, and before with recurved bristles. Length of fore wing, male 8 mm.

Type and two others from Garland, Colorado, July (Yarrow), other from Eureka, Utah, 17 July (Spalding); Chisos Mts., Texas, 9 to 12 July (Nutting and Werner).

Type: M. C. Z. no. 28355.

Lolochrysa subgen. n.

A species (male) I described in 1903 as *Eremochrysa hageni* from Texas was, I noted, different from the other forms. I now see that the male has the lower process at the tip of abdomen long, slender, upcurved, and at tip has only short fine hairs, none of the short, reclinate bristles of the normal *Eremochrysa*. The hairs on pronotum are longer and white and that on the abdomen is also long and chiefly white. The raised area on the vertex occupies almost the whole vertex. There is none of the dotting of the veins, these being dark only at connections; the tip of the wings is very broadly rounded. In the female there is no median spot on the clypeus.

For *E. hageni* and related forms I propose a new subgenus—*Lolochrysa*, with *E. hageni* as type.

Table of Species of *Lolochrysa*

1. Antennae without marks on first and second joints; no face marks, except a black dot between antennae, and faintly on sides of clypeus; palpi pale, unmarked.....*californica* Bks.
Antennae have the basal joints with lines on side or broad upper surface brown or darker, palpi mostly black (except *pima*)2
2. Upper surface of basal joint almost wholly brown.....4
Upper surface of basal joint largely pale, but a black line....3
3. Pronotum mostly white, a deep black spot (quite large) in middle of front margin, another at each hind corner; palpi mostly black.....*spilota* sp. nov.
Pronotum brown, with a black line across, connecting three small black spots; palpi mostly pale.....*pima* sp. nov.
4. Costal cross-vein almost wholly pale, dark only at sub-costal end; costa also very pale, unmarked; fourth and fifth segments above pale, with dark preapical band.....*hageni* Bks.
Costal cross-veins wholly dark, and costa also somewhat darkened5
5. Upper edge of the abdominal process bordered with black, many cross-veins bordered; but three branches of radial sector reach the outer border of wing; hair on abdomen white and rather short, pronotum narrowed in front..*yosemite* sp. nov.
No dark border to process; cross-veins not bordered, fine;

four branches of radial sector reach outer border; hair on abdomen white, and plainly longer; pronotum not narrowed in front.....*canadensis* Bks.

Eremochrysa (Lolochrysa) hageni Bks.

The type is a female from Austin, Texas; another female from the same locality agrees with it, as below.

Face white, a black spot on each outer side of clypeus; cheeks with a very broad black stripe, tip joining the clypeal black spot; palpi plainly black; a black spot between antennae, extending a little below on face, and above antennae spreads widely on the front of the elevated part of the vertex, and fades gradually behind; basal antennal joint has a broad brown mark covering the upper side of the joint; second joint with a dark ring at tip; beyond, the antennae are pale.

Pronotum with three dark spots on each side-margin, one in middle of front margin, and another opposite the second spot of the side, the two in middle may be united by a dark line. Lateral lobes of meso- and metanotum darker. Legs very slender and very pale. Hair on pronotum mostly white.

The abdomen is mostly pale, many clear white spots, the second and third segment dark above, and also the sixth and seventh. Venter wholly pale, with white hair.

Wings with broad, rounded tips as in allied species; venation as other species of this subgenus.

The costal area not nearly as broad as the radial, and the marginal very much broader than cubital area; two inner and four outer gradates; at the stigma the subcostal area is more than twice as broad as the costal area, and with three cross-veins not margined; fifteen costals before stigma, eight radials. The longitudinal veins are pale, dark only where touched by a cross-vein; the cross-veins are mostly dark, but the costals are almost entirely pale, only a few dark at the subcostal end; the costal vein is also pale. Length of fore wing 9 to 9.5 mm.

The types are from Texas; I have another from Austin, Tex.; two from Eureka, Utah, 26 July (Tom Spalding); one from St. Augustine, New Mexico (Cockerell 2102); and one from Globe, Arizona, 14 April (Parker). The head and antennae are much like eastern specimens of *E. canadensis*, but the markings of pronotum,

and abdomen, and the entirely dark costal cross-veins readily separate them.

Eremochrysa (Lolochrysa) spilota sp. nov.

Pale yellowish to greenish white, almost white on thorax; a short black streak below each eye, a black spot on each lateral corner of clypeus (no middle spot), face below antennae unmarked; basal antennal joint with three black stripes; one on outer side, one on upper side, and one (often short) on inner edge; sometimes a pair of rufous streaks on raised area of vertex, and a prominent black spot each side near eye. Palpi mostly black. Pronotum white, with a large diamond-shaped spot on middle near front margin, toward anterior corner a small black spot, in the transverse groove near middle are two black dots, a fairly large black spot on hind margin each side; seen from side a black spot in front and another near middle of the edge. Mesonotum with a prominent black spot near base of wing, the cavity each side behind is black. Metanotum with a small black spot on each lateral lobe.

Legs very pale whitish, the tibia in front with a black dot near base, and lower, but before middle, is a narrow black line across. Abdomen a dull yellowish grey, no dark marks. Hair on pronotum and abdomen white, and rather longer than usual.

Wings clear; the veins marked with dark, outer end of costals dark, two subcostals in stigma broadly dark. The cross-veins and gradates rarely wholly dark, most cubitals and marginals only dotted; longitudinal veins unmarked except a dot at junction of a cross-vein. The fore wings are proportionally broader on outer part than in *punctinervis*. The divisory cell slender, ends at or near the cross-vein above; six cubitals beyond. Seventeen costals before stigma, eight or nine radials; three inner and four outer gradates. Costal area near base broader than in other species, almost or quite as broad as radial area; marginal area much broader than the cubital; tip of fore wings very broadly rounded. Length of fore wing, 9.5 mm. to 9.8 mm.

The four specimens are from Ft. Yuma, California, 6 to 13 June 1948 (Andahl coll.) from G. H. and J. L. Sperry; another from Brawley, 8 April, California (A. L. Melander), all are females.

Type: M. C. Z. no. 28352.

Eremochrysa (Lolochrysa) pima sp. nov.

Face pale; a black streak on cheek from eye toward mouth;

clypeus with a black dot on each side, a deep black mark between antennae, below somewhat swollen, above spreading each side and connected to the broad, parallel marks on the raised area of the vertex; palpi mostly pale, basal antennal joint with a black spot on inner side above, and below an oblique mark more on upper side, no mark on outer side; second joint with a black ring, beyond, the antennae are more or less brown.

Pronotum grey, or with a little brown, with a narrow transverse black mark slightly behind middle, and with a short, blunt extension before tip in front and also one behind; the hairs short and at least mostly white, the lateral margins are narrowly black, and some black on front margin; the pronotum is almost twice as broad as long. Mesonotum grayish brown, a large black spot on the front of each lateral lobe, and extending onto the sides of the middle area. Legs pale, some black on coxae.

Abdomen beneath pale, with much white hair, above much mottled, a long black area before the tip, next to last segment above (in male) pale, with a narrow median black line.

Wings hyaline; cross-veins and gradates mostly black or very dark, cubitals sometimes pale in middle, some veins toward base may be slightly bordered with dark. The costals are usually pale on outer part. Divisory cell slender, ends beyond cross-vein above, six cubitals beyond, two to four inner gradates, three or four outer gradates. Twenty costals before stigma, eight or nine radials. Costal area at broadest much narrower than the radial area, latter about equal to cubital, the marginal area only toward base broader than cubital area. Fore wing not so broadly rounded at tip as *spilota*. Length of fore wing, 9.5 mm.

One from S. Fork Camp, White Mts., Arizona, 22 June 1947, G. H. and J. L. Sperry. The other from Santa Fe, New Mexico, Cockerell 4305.

Type: M. C. Z. no. 28354.

Eremochrysa (Lolochrysa) californica Bks.

Head yellowish; vertex somewhat reddish each side; no face marks, but the usual dark streak on cheek, and a dot between bases of antennae; a faint dark mark on extreme side of the clypeus; palpi pale, unmarked; basal antennal joint small, short, and rounded, unmarked, nor on second joint, the joints beyond are pale for about one-third way out, then becoming darker. The vertex with a short black spot each side, close to the eye.

Pronotum short and broad, roundedly narrowed in front; three small dark marks on front part, not plainly marked on sides. Rest of thorax not very plainly marked, pale above. Legs pale, unmarked, tarsi a little darker.

Abdomen pale brownish above, last two segments pale, the two before them plainly brown above.

Wings long and slender; fore wings with cross-veins, costals, and gradates brown, the veins dark only at joining; divisory vein dark and ending at or just beyond the cross-vein above. Costal area slender; some cells toward base are twice as long as broad; twelve or thirteen costals, six radials, and six cubitals, beyond the divisory cell. Between end of medius and end of radial sector but two branches reach outer margin. One or two inner and one to four outer gradates, rather far apart. In hind wing the veins are paler, but none dotted. Length of fore wing, 8 to 9 mm.

Described from Santa Clara Co., California; I have seen but one other specimen, it is from Globe, Arizona, 14 April 1935 (Parker).

Eremochrysa (Lolochrysa) yosemite sp. nov.

Face white; a broad black cheek-mark reaching to the side of clypeus; a black dot between bases of antennae; basal antennal joint dark brown on whole of upper side; second joint black. Elevated area of vertex a broad dark stripe on each side, connected in front, and a dark spot each side in the lateral groove, close to eye. Pronotum plainly narrowed in front, a little longer than broad behind; two dark spots near front margin, with a streak reaching back, a spot in middle of each side margin, a spot near each side connecting through the middle spot; another larger dark spot covering each hind corner. Thorax pale but with large dark spots on the lateral lobes; and on the sides, of the anterior lobe, and on its hind border.

Abdomen above black; a broad white mark on first segment above, a smaller one on second; fourth and fifth white above, with dark spots at each end, and traces of a median line; sixth and seventh black; eighth mostly black but with a pale spot over most of apical part; ninth pale. The hairs mostly white and rather short. Legs pale, the hind femur with a dark mark above near middle of length.

Wings with all cross-veins wholly dark, those on disc of fore wings plainly bordered, and a dark spot covering the origin of the radial sector. But three branches of radial sector reaching hind border;

also in the hind wing, and two much curved toward base to do it. Divisory cell ends just beyond the cross-vein above; about fifteen costals, and seven radials; two inner gradates and four outer ones, the latter fairly close to outer margin; the three stigmal cross-veins hardly bordered. Length of fore wing, 9 mm.

A male from Yosemite, California, 12 June 1931, Essig. In wing appearance it is much like *Eremochrysa altilis*.

Type: M. C. Z. no. 28353.

Eremochrysa (Lolochrysa) canadensis Bks.

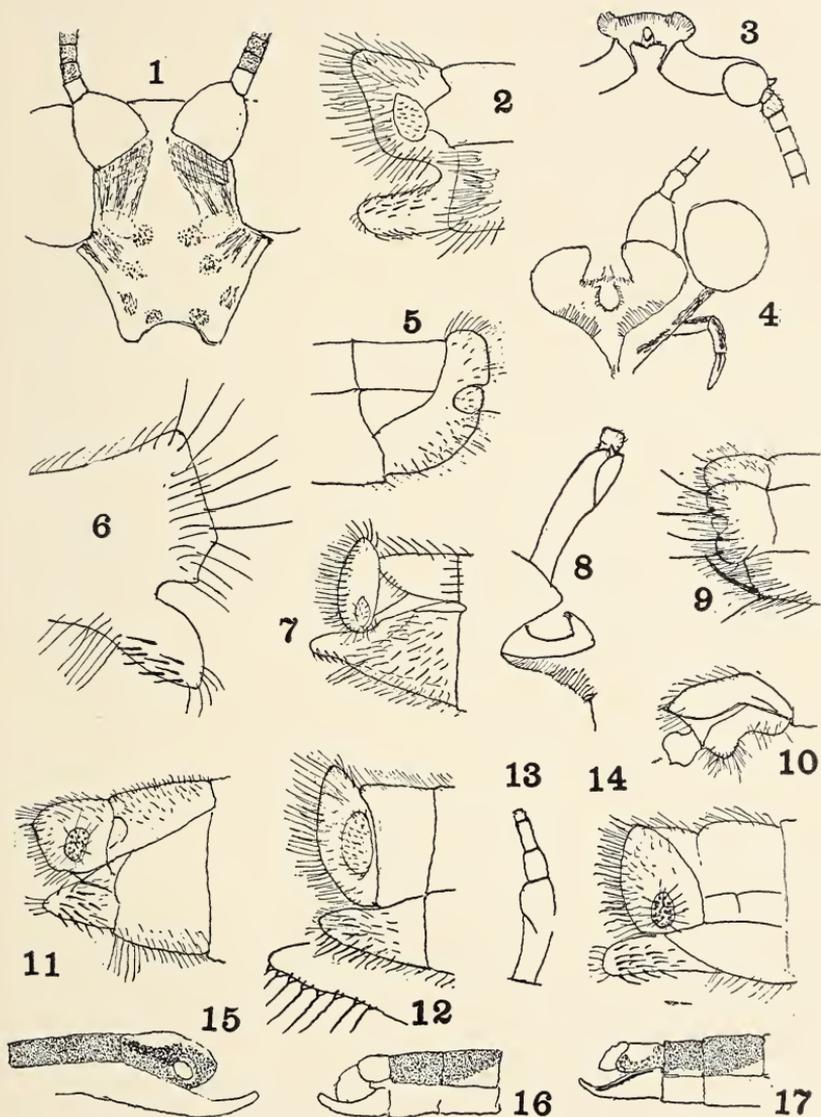
Face white to slightly yellowish, no marks; clypeus with a small dark mark on each side margin; the usual black cheek mark, broader than usual; palpi mostly black; a black spot between bases of antennae, connected to the double black mark on the front of the raised part of the vertex, sometimes with two streaks tapering behind. Basal joint of antennae with a large brown spot covering the upper side (as in *E. hageni*), no other mark; the second joint is black both in front and behind.

Pronotum is much broader than long, sides parallel, generally pale brownish, two black spots in front part, and a more or less definite row of spots across near the groove, rear corners usually black. Lateral lobes of meso- and metanotum with brown spots, legs very pale, unmarked.

Abdomen gray to yellowish below; above the first two or three segments black, then three segments mostly white, with a median black line, sometimes broadened behind, next segment black above, then the last two more or less pale, and with much long, pale hair.

EXPLANATION OF PLATE 3

Fig. 1. *Eremochrysa rufina*, face. Fig. 2. *Eremochrysa fraterna*, tip of male abdomen. Fig. 3. *Meleoma delicata*, basal part of antennae, and interantennal process. Fig. 4. *Meleoma cavifrons*, face and interantennal process. Fig. 5. *Eremochrysa punctinervis*, tip of female abdomen. Fig. 6. *Eremochrysa altilis*, tip of male abdomen. Fig. 7. *Eremochrysa punctinervis*, tip of male abdomen. Fig. 8. *Meleoma delicata*, side of antennae, and lower piece of process. Fig. 9. *Chrysopa yuma*, tip of male abdomen. Fig. 10. *Meleoma delicata*, tip of male abdomen. Fig. 11. *Eremochrysa rufifrons*, tip of male abdomen. Fig. 12. *Eremochrysa rufina*, tip of male abdomen, and lower edge more enlarged. Fig. 13. *Meleoma cavifrons*, basal part of antenna. Fig. 14. *Eremochrysa pumilis*, tip of male abdomen. Fig. 15. *Lolochrysa canadensis*, abdomen of male from side. Fig. 16. *Lolochrysa hageni*, abdomen of male from side. Fig. 17. *Lolochrysa yosemite*, abdomen of male from side.



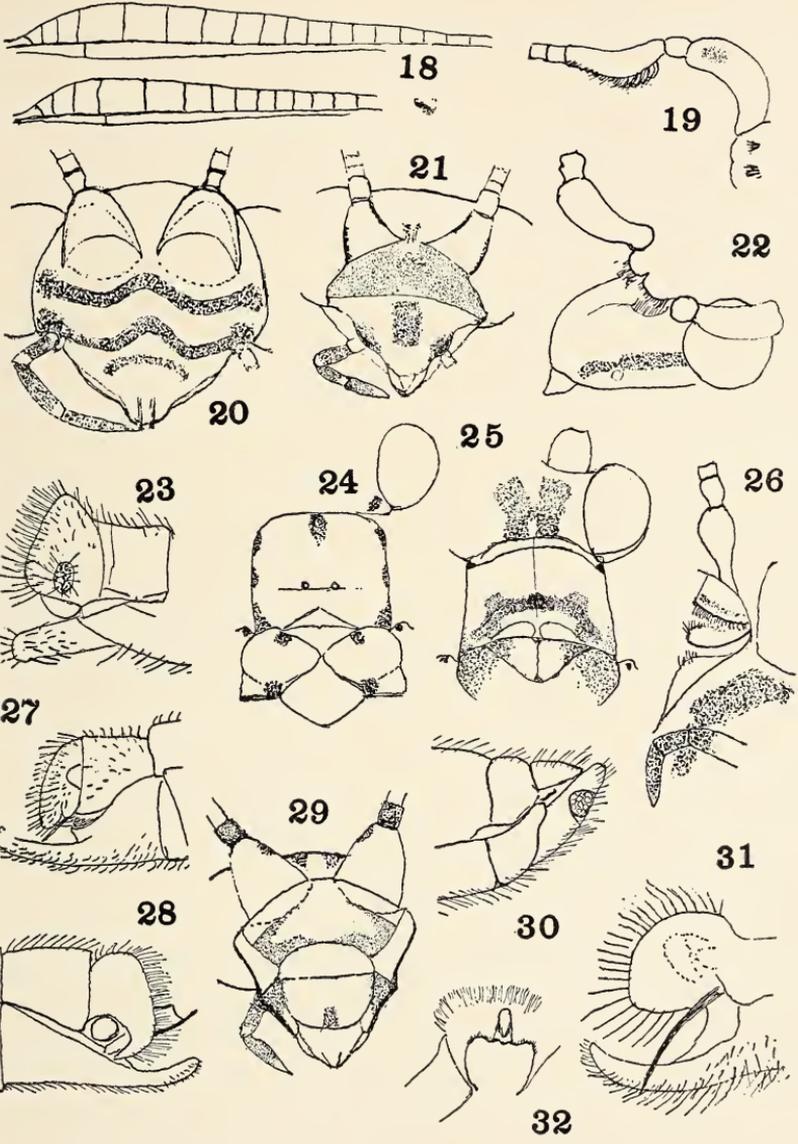
The lower edge of all the dorsal segments has a jet black stripe, which continues in a curve on the last segment; over all the segments are scattered snow-white hairs. The apical process of the male is very long and quite slender, extending more than usual beyond the tip of abdomen.

The wings are not very broad; usually but three branches of the radial sector reach the outer margin. Costal area near base is moderately broad; the costals, cross-veins, and gradates wholly brown, a cloud covers the base of radial sector; longitudinal veins pale, except at joinings, thirteen costals, seven or eight radials, and six cubitals beyond the divisory cell; the divisory vein ends a little beyond the cross-vein above; there are three to five inner gradates, about four outer ones. The inner series is nearly parallel to the radial sector, the first being about as near to the sector as the last; the three or four outer gradates are very short, and not far from the outer margin. The hind marginal area is broad so that the first few marginal cells are much more than twice as high as broad. Length of fore wing, 10 mm.

The type is from Go Home Bay, Lake Huron, Canada, 12 July; others are from Provincetown, Mass., July 1877 (Sanborn), Princeton, Mass., 16 Aug. (Johnson), Durham, N.H. (Fiske) and Mt. Desert, Me. (Proctor).

EXPLANATION OF PLATE 4

Fig. 18. Costal area of fore wing of *Chrysopa clarivena* (top) and *Chrysopa azteca* (below). Fig. 19. *Meleoma comata*, basal part of antenna. Fig. 20. *Chrysopa pinalena*, face. Fig. 21. *Eremochrysa attilis*, face. Fig. 22. *Meleoma comata*, face from side, obliquely. Fig. 23. *Eremochrysa pumilis*, tip of male abdomen. Fig. 24. *Lolochrysa spilota*, pronotum and mesonotum. Fig. 25. *Lolochrysa pima*, vertex, pronotum, and mesonotum. Fig. 26. *Meleoma cavifrons*, face from side. Fig. 27. *Lolochrysa canadensis*, tip of male abdomen. Fig. 28. *Lolochrysa pima*, tip of male abdomen. Fig. 29. *Eremochrysa tibialis*, face. Fig. 30. *Lolochrysa spilota*, tip of female abdomen. Fig. 31. *Lolochrysa californica*, tip of male abdomen (type). Fig. 32. *Meleoma delicata*, interantennal process.



BANKS—LIMNEPHILIDAE

TWO NEW PAUSSID BEETLES FROM THE PANAMA CANAL ZONE AND THE PHILIPPINES¹

BY P. J. DARLINGTON, JR.

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The following two new species of paussid beetles are described here for reference in other connections.

Homopterus (s. s.) subcordatus n. sp.

Fig. 1

Form average in genus; castaneous, moderately shining; most of head, pronotum, and elytra rather closely punctate with punctures of moderate size, but not obviously pubescent (some of the punctures have very short hairs which scarcely rise above the level of the body surface). *Head* across eyes (not including post-ocular tubercles) about $\frac{5}{6}$ as wide as prothorax; post-ocular tubercles prominent; occiput only vaguely swollen; front concave, with a pair of deeper impressions within the concavity; antennae as figured, the flattened segments irregularly granulate above, more closely so on the anterior sides of the transverse segments and around the apical segment, the granules bearing short, inconspicuous hairs; mouth-parts normal for genus. *Prothorax* as figured, wide, with sides sinuate before base; disk convex, slightly swollen on each side, rather deeply longitudinally impressed at middle; disk also vaguely impressed or flattened across base and apex; lateral margins unusually broad, running into moderate baso-lateral impressions. *Elytra* rather elongate (in genus), about $\frac{1}{4}$ wider than prothorax, subparallel, with outer sides very weakly arcuate. *Femora* and *tibiae* only moderately wide in genus. *Pygidium* closely punctate; *preceding dorsal abdominal segment* more finely and less closely so. *Male* copulatory organs as figured. *Length* to apex of elytra, about 8 mm.; *width*, about 3 mm. or slightly more (both specimens too warped for accurate measurement of width).

Holotype ♂ in the Museum of Comparative Zoölogy (No. 28,369) from BARRO COLORADO ISLAND, PANAMA CANAL ZONE, 5-6-37, col-

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lected and very kindly presented by Prof. S. W. Frost. One ♂ paratype in the United States National Museum (No. 59,425) from the same locality, June 1940, collected by James Zetek (original No. Z-4669).

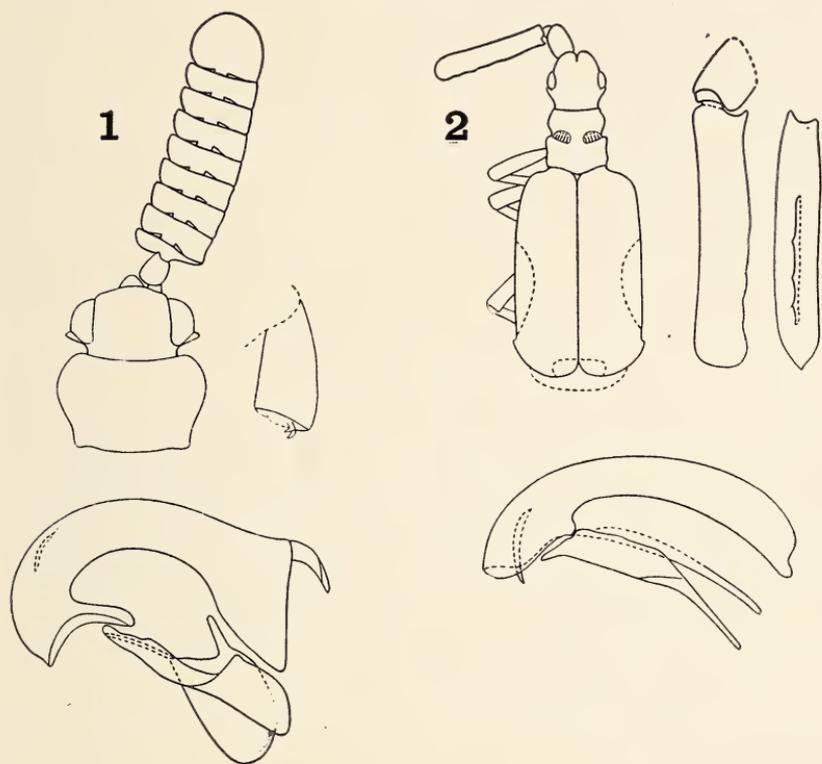


Fig. 1. *Homopterus subcordatus* n. sp. (Holotype ♂): prothorax, head, and right antenna; left hind tibia with retractile tarsus indicated; and male copulatory organs from left.

Fig. 2. *Paussus oclusus* n. sp. (Holotype ♂): whole insect; left antenna from above and (flagellum only) from behind; and male copulatory organs from left.

The subcordate prothorax, prominent post-ocular tubercles, unusually wide lateral prothoracic margins, triangular rather than rounded tibiae, absence of distinct pubescence on upper surface of body, and antennal form are characters which, combined, distinguish

this new species from all previously known *Homopterus*. The antennae are intermediate in form within the genus, with the posterior edges of the flagellar segments not so straight as in *kriegi* Reichensp., *bolivianus* Kolbe, or *brasiliensis* Westw., but not so deeply emarginate as in *steinbachi* Kolbe etc, (cf. Reichensperger 1938, Figs. 1-8). As compared with *H. hondurensis* Darl., which is of about the same size and general appearance and which also occurs on Barro Colorado Island (five specimens from various sources in M. C. Z. and U. S. N. M.), the present new species has a more cordate prothorax, slightly different antennae, and more prominent post-ocular tubercles, and the new species lacks the light but distinct pubescence of *hondurensis*.

I suspect, incidentally, that my *Homopterus hondurensis* (1937) and *H. kriegi* Reichensperger (1938) are the same, but a comparison of specimens will be necessary to establish the synonymy.

Paussus oculus n. sp.

Fig. 2

Form as figured, convex; color light brown, redder anteriorly, with the following parts black or piceous: anterior and supra-ocular callosities of head, lateral and apical marks of elytra, lower surfaces of head and prothorax and (in part) mesothorax, and main portions of appendages; surface of body above (including elytra) and below dull, microscopically wrinkled; pubescence above of rather sparse, short, slightly curved, slightly thickened, yellowish hairs (this type of pubescence lacking in depressions of back of head and of pronotum, and rubbed off inner portions of disk of elytra); pubescence below of more inconspicuous, minute, pale hairs. *Head*: front with 2 longitudinal, parallel ridges anteriorly, curving in and nearly meeting above bases of antennae, and with 4 tubercles, 1 median, 1 occipital, and 1 above and behind each eye, each supra-ocular tubercle with a semicircular impression concave inwardly; antennae as figured, flagellum sub-cylindrical, with fine raised margin along anterior edge, and with the vestige of a longitudinal sulcus posteriorly under a slight ridge which shows traces of segmentation although the bottom of the sulcus does not; surface of both basal and flagellar parts of antennae closely, coarsely punctate, each puncture with a short, slightly thickened, pale hair; labial and especially maxillary palpi broad, moderately flattened, more finely sculptured and pubescent than antennae. *Prothorax* deeply, trans-

versely divided, with large trichomes in the cleft on each side, and pronotum also with a less sharply defined longitudinal depression, widest basally but deepest toward the middle. *Elytra* and *pygidium* without dense trichome-fringes or special marginal hairs; pygidial margin indistinct. *Legs* not flattened. *Male* copulatory organs as figured. *Length* (to apex of *elytra*), just over 7 mm.

Holotype ♂ in the United States National Museum (No. 59,426) from BILIRAN ISLAND [north of Leyte], PHILIPPINE ISLANDS, C. F. Baker Collection; unique.

This new *Paussus* goes in a group to which belong also *P. cat-oxanthus* Gestro, *tagalicus* Gestro, and *kolbei* Reichensperger. The group in the strictest sense may be confined to the Philippines, but it is probably related to *Paussus waterhousei* Westwood and some other Oriental-Malayan forms. The new species is probably closest to *tagalicus* (Gestro 1918), which it resembles in coloration and most other details, but the new species is distinguished from *tagalicus* by much more strongly tuberculate head and much narrower posterior sulcus of the antennal flagellum.

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A NEW SPECIES OF LIMNEPHILIDAE FROM MAINE
(TRICHOPTERA)

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Hydatophylax victor sp. nov.

In general appearance similar to *Allegophylax subfasciatus*. Body, legs, antennae, palpi mostly pale yellowish; fore wings with a large brown or yellowish brown area, mostly over the posterior part of wing, sometimes covering the basal two-thirds of the front part also. The apical third of the discal cell and of the cell behind it remains clear whitish hyaline; this is usually connected to a similar spot in the apical part of the thyridial cell. These clear areas are constant, although the amount of dark above, before, and behind them varies.

There is a curved brown mark, somewhat before outer half of apical area, over the second and third apical cells. Sometimes the area beyond it is also darkened a little; the tips of the outer veins are also dark.

The surface of the fore wing is closely roughened as in *Allegophylax*. The venation of fore wing is similar to that of *Allegophylax*, except that the discal cell reaches almost as far back as the thyridial cell. In the hind wing the discal cell is also very slender and reaches much further basally than in *Allegophylax*. In the anal cells of the fore wing, the separation from *Allegophylax* is very distinct; the third anal cell being extremely long and slender.

The head is scarcely as broad as in *Allegophylax*, but the vertex and ocelli about the same. The pronotum is extremely short, as in *Allegophylax*, each side with tubercles and stout bristles.

The legs are also similar to *Allegophylax*, the front and middle tibiae spined to base, and on outer side a few spines near base. The hind legs are long; the tibiae spined a little before middle; the last joint of hind tarsus has one or two spines below.

The male genitalia has a pair of slender processes from the lower base, with more slender tips, these (seen from side) reach above the top of the last dorsal segment; from the side one sees a short median projection.

Length of fore wing: 14 to 16 mm.

Types numbered 28499 in the Museum of Comparative Zoology. Several specimens taken at light at Round Mt., Maine, by the Maine Forest Service, 15, 16, 17 July.

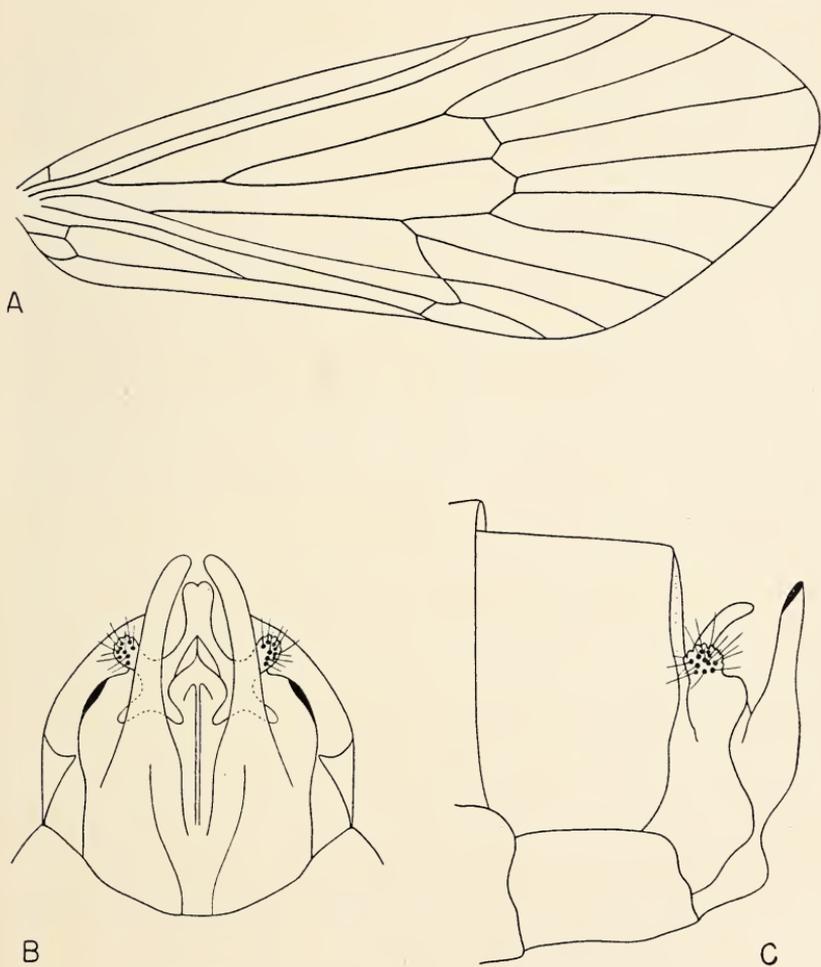


Figure 1. *Hydatophylax victor*, sp. nov. A, fore wing; B, posterior view, and C, lateral view, of end of abdomen of male.

LARGE RAPTORIAL BIRDS AS ENEMIES OF CICADAS

BY CHARLES T. BRUES

Harvard University

Cicadas form an important source of food for many carnivorous birds. There are abundant published records which attest the fondness of a great variety of birds for these large Homoptera which constitute a notable part of the insect fauna over many extensive areas throughout the world.

By reason of its periodical appearance in immense swarms, the North American *Magicicada septendecim* is naturally eaten in large numbers by a great variety of insectivorous birds on the rare occasions that it appears. Extensive records collated by Marlatt, Myers and McAttee¹ show that this cicada, as well as many others, frequently forms a part of the avian diet.

It is usually the smaller and less powerful species of birds which prey on cicadas, but often some of the larger raptorial Falconidae do not disdain to capture and eat them with apparent relish. An early account of kites feeding on cicadas in the American tropics is contained in Belt's "Naturalist in Nicaragua" published in 1874 (p. 230), where he found on dissection that their crops were filled with these insects. Later, in India, Distant, and also Bingham noted similar birds preying on cicadas and Myers (*loc. cit.*) quotes Australian records of similar occurrences.

During our recent stay in the Philippines we had the opportunity to observe the frequent capture of a very large cicada (*Cryptotympana acuta* Sign.) that was common during the summer months (May and June) in the wooded foot-hills above Dumaguete on Negros Island. I am indebted to my friend, Dr. Z. P. Metcalf for the specific determination. The cicadas could be seen frequently resting in numbers among the smaller branches of trees, and at frequent intervals one or several soaring kites would appear, circle among the high trees and pick off the immobile insects.² At this season the shrill din of the singing insects was very pronounced and

¹Marlatt, C. L. The Periodical Cicada. Bull. U. S. Dept. Agric., n. s. No. 14 (1878). Myers, J. G. Insect Singers. G. Rutledge & Sons, London (1929). McAttee, W. L. Effectiveness in Nature of the So-called Adaptations of animals Chiefly as Illustrated by the Food Habits of Nearctic Birds. Smithsonian Misc. Coll., vol 85, No. 7 (1932).

²The identification of the birds is not positive, but they were, without much question, the common honey buzzard (*Pernis ptilorhynchus*).

the capture of one or two specimens was accomplished so adroitly that there was no interruption in the rhythm of the chorus. Occasionally a cicada would let out a piercing shriek as the bird's beak closed upon it, and instantly the whole assemblage lapsed into silence for a time while the kites drifted away. When picked up in the fingers the cicadas behave similarly with a sudden vocal outburst of unbelievable vigor, or if one is captured by a large mantis its prolonged swan-song assumes deafening proportions. Neither the mantises nor larger birds give any indication that they notice such outbursts, although they must have some protective value against smaller birds. In my own experience, the cicadas of more temperate regions do not respond so loudly to rough handling, particularly the periodical cicada which is very docile in this respect.

Although the actual capture of the cicadas by kites must depend upon sight, the preliminary approach of the birds to the trees is probably influenced by the shrill and incessant singing of the insects since the birds lose interest during temporary lulls in the chorus.

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SEPTEMBER, 1950

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NAJADICOLA INGENS (KOENIKE),
A WATER-MITE PARASITIC IN FRESH-WATER CLAMS
ARTHUR G. HUMES AND HUGO A. JAMNBACK
Department of Biology, Boston University

The distribution of *Najadicola ingens* (Koenike 1895) Piersig 1897, a hydrachnid parasite of fresh-water clams in North America, is known only from a few scattered records. Relatively few specimens have been reported up to the present. Koenike (1895) described the species from specimens found in *Anodonta fragilis* Lamarck and *Unio complanata* (Solander)¹ and sent to him by Dr. Tyrrell of Ottawa. The collection locality was given only as Canada. Wolcott (1899) collected this mite from *Anodonta fragilis* at "26" Lake, near Charlevoix, Michigan, and Intermediate Lake, Ellsworth, Michigan, from *Unio gibbosus* Barnes, *U. ligamentinus* Lamarck, and *Anodonta footiana* Lea at Grand Rapids, Michigan, and from *U. luteolus* Lamarck at Long Lake, Kalamazoo, Michigan. He examined 3500 clams representing 60 species from Michigan, Wisconsin, Nebraska, New York, Illinois, Iowa, and Pennsylvania, but found not more than 16 specimens, all from the Michigan localities just mentioned. Wolcott (1918) stated that the species is generally distributed, but did not give additional distribution records. Marshall (1929) reported 16 adults and a few nymphs in two specimens of *Anodonta* in a small lake on Bruce peninsula, near Georgian Bay, Ontario. Kelly (1899) examined 1614 clams representing 44 species from Illinois, Iowa, and Pennsylvania, but reported no *N. ingens*, although he found several species of *Atax* (now *Unionicola*). In view of the abundance indicated below of *N. ingens* in New Eng-

¹The name *Unio* is now properly applied to certain European clams, the North American species formerly included having been placed in other genera.

land, the apparent scarcity in other parts of the United States and Canada would seem to be only because of the inattention of investigators to this species and lack of collections.

During the five months from June 14 to November 19, 1949, 3077 fresh-water clams from 74 localities in New England, Quebec, and New Brunswick, representing 14 species, were examined for *N. ingens*. The mite was found in 43 or 58% of the localities. Altogether 906 specimens of *N. ingens* were collected, comprising 494 males and 412 females. Specimens of the clam hosts, together with about 50 mites of both sexes and from each of the three hosts reported below, have been deposited in the Museum of Comparative Zoology, Harvard University. The assistance of Mr. William J. Clench of the Museum of Comparative Zoology in identifying the clams is gratefully acknowledged.

Mites were collected from clams in the following localities which are indicated on the accompanying map (Fig. 1):

Massachusetts: (1) Sampson Pond, South Carver; (2) Monponsett Pond, Halifax; (3) Unionville Pond, Holden; (4) Carbuncle Pond, Oxford; (5) Lake Chaubunagungamaug, Webster; (6) Wickaboag Pond, West Brookfield; (7) Sandy Pond, Ayer; (8) Ward Pond, Ashby; (9) Nabnasset Pond, Tyngsboro; (10) Mashpee Pond, Mashpee; (11) Buckmaster Pond, Westwood; (12) Lake Winneconnet, Taunton; (13) Quarter Mile Pond, Medford; (14) Forge Pond, Westford; (15) Bare Hill Pond, Harvard; (16) Warner's Pond, Concord; (17) Heart Pond, South Chelmsford; (18) Lake Cochichewick, North Andover; (19) Winter Pond, Winchester; (20) Lake Attitash, Amesbury; (21) Fort Pond, Lancaster; (22) Hoosiewhisick Pond, Milton; (23) Hemenway Pond, Milton.

Rhode Island: (24) Worden's Pond, South Kingston.

Vermont: (25) Island Pond, Brighton; (26) Bomoseen Lake, Castleton; (27) Lake Champlain at Sandbar State Forest Park, Milton.

New Hampshire: (28) Crystal Lake, Eaton Center; (29) Province Lake, Effingham; (30) Wash Pond, Hampstead; (31) Island Pond, Hampstead; (32) Great Pond, Kingston; (33) Angle Pond, East Hampstead; (34) Country Pond, Newton.

Maine: (35) Long Pond, at Long Pond; (36) Madawaska Lake, Stockholm; (37) stream at Ouelette; (38) Eagle Lake; (39)

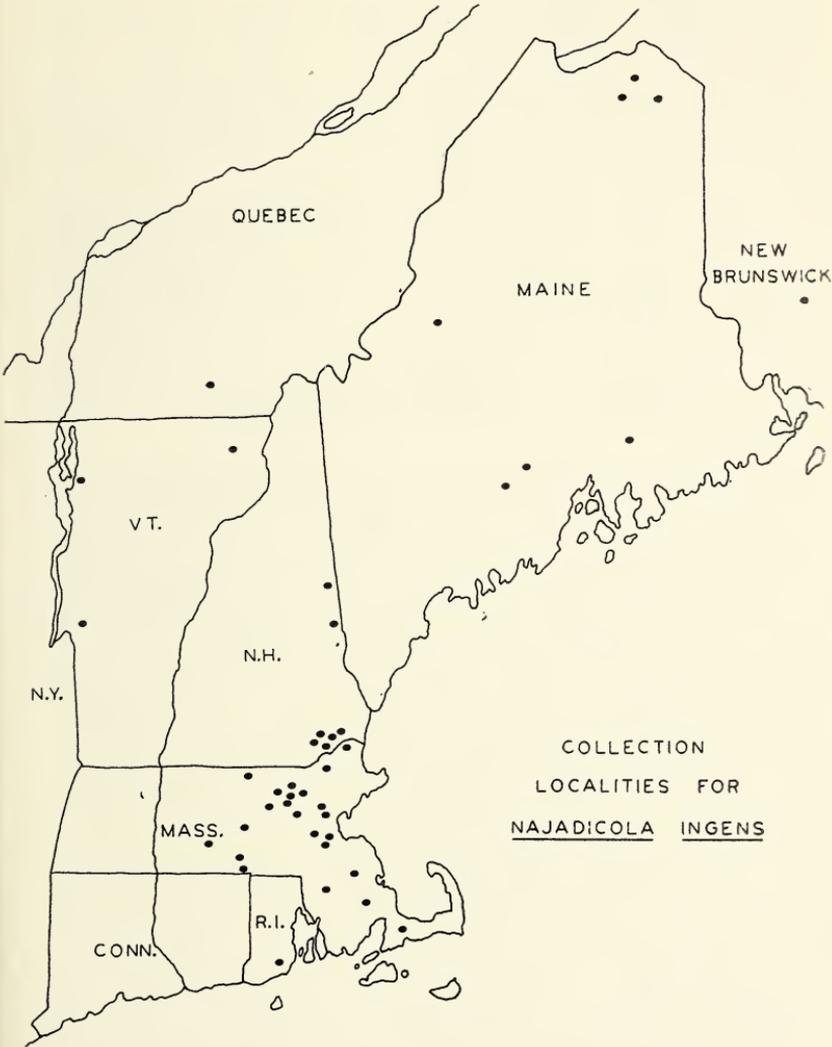


Fig. 1. Localities in New England, Quebec, and New Brunswick where *Najadicola ingens* was collected.

Park's Pond, Clifton; (40)Unity Pond, Unity; (41)China Lake, China.

Quebec: (42)Massawippi Lake, at Ayer's Cliff.

New Brunswick: (43)Cranberry Lake, Harvey Station.

Of the 14 species of clam hosts 3 were parasitized by *N. ingens* and 11 were negative. The 3 positive species were *Elliptio complanatus* (Solander) (2054 specimens of which 231 or 11.2% were positive), *Anodonta cataracta* Say (625 specimens of which 242 or 38.7% were positive), and *Lampsilis radiata* (Gmelin) (152 specimens of which 18 or 11.8% were positive). The negative species included 17 *Ligumia nasuta* (Say), 3 *Lampsilis cariosa* (Say), 3 *Lampsilis ventricosa* (Barnes), 19 *Lampsilis ochracea* (Say), 79 *Anodonta implicata* Say, 59 *Anodonta marginata* Say, 38 *Alasmidonta undulata* (Say), 1 *Alasmidonta heterodon* (Lea), 25 *Strophitus rugosus* Swainson, 1 *Leptodea fragilis* Rafinesque, and 1 *Prop-
tera alata* Say.

The highest degree of parasitism in any single locality was 87.3% for *Anodonta cataracta* at Wash Pond, N.H., and 57% for *Elliptio complanatus* at Crystal Lake, N.H.

Judging from the relative number of individual clams parasitized, the preferred host seems to be *Anodonta cataracta*, with 1 out of every 3 clams containing mites. *Elliptio complanatus* appears to be next in preference, with 1 out of every 9 parasitized. *Lampsilis radiata* seems least preferred of the three hosts. The high figure of 11.8% is misleading, since it is based upon parasitized clams from only two localities. One, Massawippi Lake, Quebec, produced 18 clams of which 16 were parasitized; the other, Lake Champlain at Sandbar State Forest Park, Vt., comprised 23 *L. radiata* of which only 2 contained mites. The remaining 134 *L. radiata* were negative.

The samples of clams from the various localities were not of equal size. At several localities only a few clams were collected. Table I shows the number of clams of each of the 3 host species examined in the 43 localities. The numbers in parentheses indicate the number of individuals which were parasitized by *N. ingens*. The average number of clams examined of all 14 species in the 43 positive localities was 51 (1-253) and in the 31 negative localities 28 (3-134). Only 2 of the negative localities comprised more than 100 clams. Excluding these the average number of clams examined in 29 negative localities becomes 21 (3-80). These data indicate the possibil-

locality number	<i>Anodonta cataracta</i>	<i>Elliptio complanatus</i>	<i>Lampsilis radiata</i>	locality number	<i>Anodonta cataracta</i>	<i>Elliptio complanatus</i>	<i>Lampsilis radiata</i>
1		16(1)	3	23	75(27)	7	1
2	4	16(1)		24		64(6)	1
3	2(2)	4		25	6(6)	16	
4	1(1)			26	10(2)	4	4
5	8	113(12)		27		18(2)	23(1)
6	29(9)			28	9	63(36)	
7		54(7)		29		25(12)	
8		15(2)		30	142(124)		
9	25(1)	208(43)	20	31	23(21)	22(2)	
10	2	16(1)	3	32	4(1)	12(3)	
11	8(5)	32		33	2(1)	6	
12		77(8)	19	34	2	5(2)	
13	4(4)			35	13	12(1)	
14	2	80(3)	1	36	12(3)	11	
15	2(2)	18		37	3(1)	9	
16		185(7)	1	38	11(1)	11	
17	26(2)	5	2	39	22	10(1)	
18	2(2)			40	17	17(1)	12
19	1(1)			41		34(2)	1
20	19	57(19)	8	42	11	22	18(16)
21	11(8)	193(49)		43	4(4)	12	2
22		46(6)	1				

Table I. The total number of clams examined and number with *N. ingens* for each of the three host species in the 43 positive localities.

ity that mites in certain localities may have been overlooked because of the small sampling.

Commonly 1 male and 1 female mite were found in each parasitized *A. cataracta* and *E. complanatus*. Single males and single females were frequently found in these clams, but very rarely two of the same sex. This was not the case in *L. radiata*, where at least two of each sex were present, one clam having 4 males and 8 females. The average number of mites per clam was 1.7 in *E. complanatus* and 1.8 in *A. cataracta*.

The smaller and presumably younger individuals of *E. complanatus* and *A. cataracta* were more frequently parasitized, as shown in Figs. 2 and 3. The arithmetical mean length for unparasitized *E. complanatus* was 6.9 cm. and for parasitized individuals 5.6 cm. The arithmetical mean length for unparasitized *A. cataracta* was 7.1 cm. and for parasitized individuals 6.2 cm. The largest parasitized clam was an *A. cataracta* 11.2 cm. in length. The smallest was an *E. complanatus* 2.7 cm. in length.

The position of *N. ingens* in the host clams varied with the host species. Almost invariably when there was a male and a female present they occurred in the same suprabranchial chamber, usually in the anterior half of the gill area. Immature mites or single males were generally located distally between the gill lamellae. The mites occurred in any of the four suprabranchial chambers, but there was noticed a distinct difference in location in *E. complanatus* and *A. cataracta*. In *A. cataracta* the mites occurred with about equal frequency in the right and left outer suprabranchial chambers. In only 4 individuals were mites found in the inner gill chambers. In *E. complanatus* the mites occurred nearly equally in the right and left inner suprabranchial chambers. In only 6 individuals were mites found in the outer gill chambers. Since mites were found in the outer chambers of *E. complanatus* and in the inner chambers of *A. cataracta*, they are probably not mechanically prevented from entering those chambers. The position of the mites seems to have little relation to the use of the gill as a marsupium, since in *A. cataracta* mites were found in both gravid and non-gravid gills. According to Baker (1928) the specialized long-term breeding clams like *Anodonta* have the gills modified to provide better water circulation than in the short-term breeders like *Elliptio*. This may have some bearing on the difference in location of the mites in the two clam genera. It is of interest to note that both these genera use the

two outer gills as marsupia. In the 17 positive *Lampsilis radiata* the mites occurred nearly equally in the four suprabranchial chambers. One clam had mites in all four of its suprabranchial chambers.

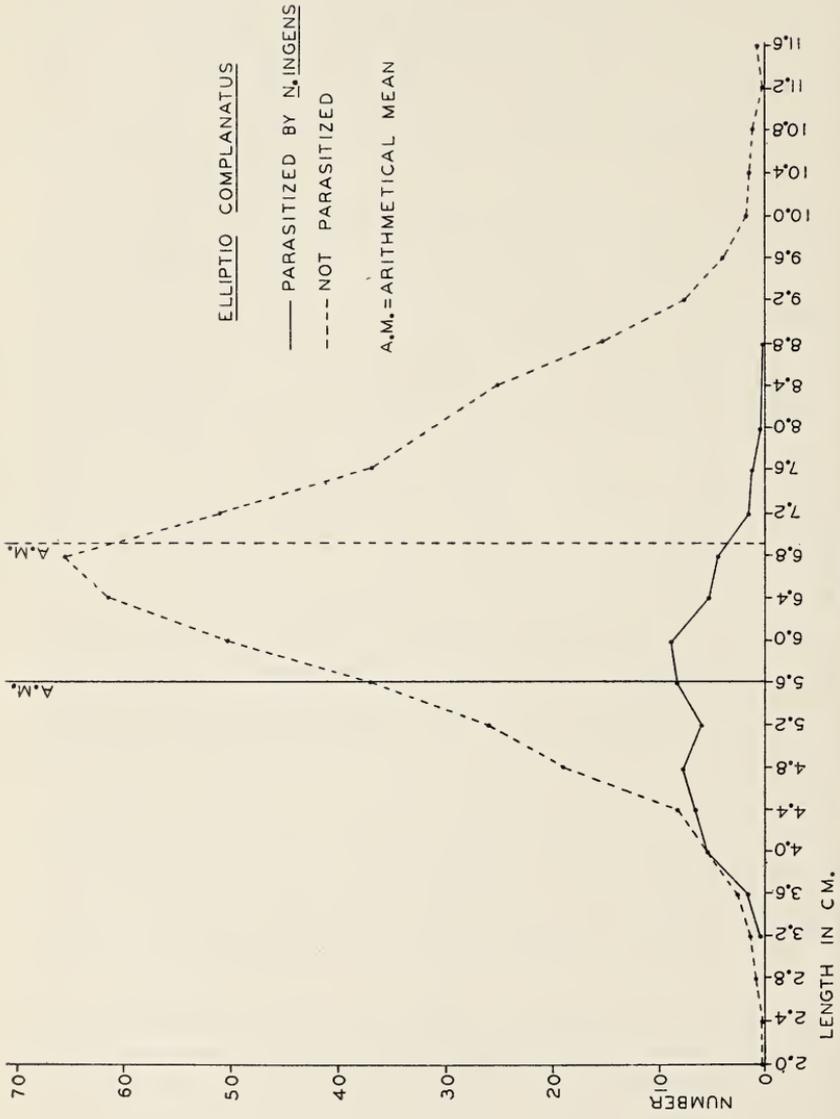
Ninety-one per cent of the parasitized clams had papillae of various sizes on the walls of the suprabranchial chambers. As many as 40 papillae were counted in one suprabranchial chamber containing a pair of mites. The largest papillae measured were 3 mm. in diameter and 5 mm. in length. Fig. 4 shows a specimen of *Anodonta cataracta* from which the left valve and mantle have been removed. The left outer suprabranchial chamber has been opened to show the papillae, a male and a female *N. ingens*, and several small, dark egg masses. In only 10 clams were papillae found without mites. Presumably these clams had previously been parasitized by *N. ingens*. The papillae were often arranged in an incomplete ring around the mites and their egg masses, perhaps acting as a barrier to prevent the eggs from being carried out of the gill chambers, either via the excurrent siphon in *Anodonta* or into the mantle cavity by way of the incomplete connection of the innermost gill lamella and visceral mass in *Elliptio*. The papillae occur mostly within the suprabranchial chambers, but in a few cases in *E. complanatus* extended down on the side of the visceral mass.

The presence of the mites apparently interferes with the use of the gills as marsupia. In many gravid, parasitized *A. cataracta* the marsupia containing mites were asymmetrically developed. The anterior half of the parasitized gill contained few or no glochidia, while the unparasitized gill of the opposite side was normally developed.

The factors involved in regulating the geographical distribution of *N. ingens* are difficult to determine. The mites occurred in small ponds, large lakes, and in slowly flowing streams. All clams examined were taken from a depth of not more than 4 feet. The types of bottom included soft clay, silt, fine white sand, gravel, or small stones.

Both *N. ingens* and species of *Unionicola* were occasionally found in the same clam host. Adults of the two genera are easily differentiated, *Najadicola* being larger, cream-colored, and remaining within the suprabranchial chambers, while *Unionicola* is smaller, dark-colored, and crawling about over the surface of the gills and mantle.

The eggs of *N. ingens* are laid in masses in the suprabranchial



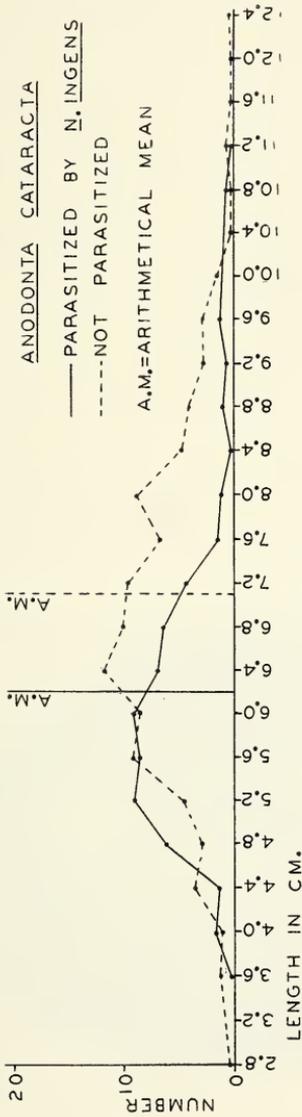


Figure 3

Fig. 2. Size of *Elliptio complanatus* indicated by length of shell valve in relation to presence of *Najadicola ingens*.

Fig. 3. Size of *Anodonta cataracta* indicated by length of shell valve in relation to presence of *Najadicola ingens*.

chambers of the clams, not inserted into the mantle or gills as in *Unionicola*. The greatest number of egg masses found in a single clam was 23 in one *A. cataracta*. Each egg mass contained approximately 250-300 eggs, and was enclosed in gelatinous material, lying unattached in the suprabranchial chamber. The color of the eggs varied from light cream when freshly laid, through orange, to nearly black when about to hatch. Masses of light cream-colored eggs were hatched in 17 days in distilled water at summer room temperature.

Sexual dimorphism is very pronounced in *N. ingens*, gravid females reaching a diameter of 5 x 6 mm., 3 or 4 times that of males. The color varies from honey yellow to light reddish brown. Microscopically the sexes may be recognized by the position of the pair of triangular genital plates. Those of the male are contiguous medially, while in the female the two plates are separated. The average number of acetabula per plate in 10 males was 72 (39-142) and in 10 females 94 (59-122). The two acetabula located near the outer apex of the plate are larger than the others.

Adult *N. ingens* can survive for several weeks at least outside the clam host. In distilled water at summer room temperature a male survived 36 days and a female 49 days. The female laid eggs during this period.

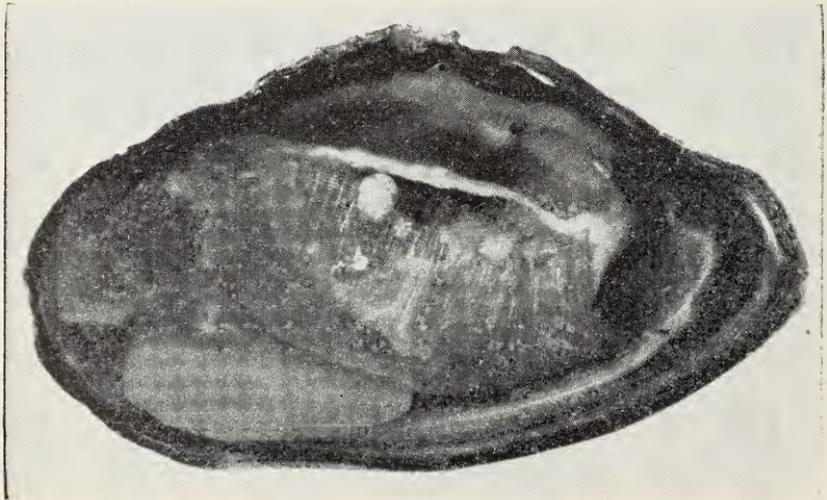


Fig. 4. *Anodonta cataracta* with left valve and mantle removed and left outer suprabranchial chamber opened to show papillae, a male and a female *N. ingens*, and several small, dark egg masses. (x1.5)

SUMMARY

Najadicola ingens is reported from 43 localities in Massachusetts, Rhode Island, Vermont, New Hampshire, Maine, Quebec, and New Brunswick, after an examination of 3077 fresh-water clams from 74 localities in New England and adjacent areas of Canada. The mite parasitizes principally two host clams, *Anodonta cataracta* and *Elliptio complanatus*, and occasionally *Lampsilis radiata*.

The smaller and presumably younger *A. cataracta* and *E. complanatus* are parasitized more often than larger individuals. In *A. cataracta* the mites occur mostly in the outer suprabranchial chambers, but in *E. complanatus* in the inner suprabranchial chambers. The walls of the suprabranchial chambers containing mites almost invariably bear numerous papillae. The presence of mites in gravid gills apparently interferes with the normal use of the gill as a marsupium.

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NOTES ON THE HABITS AND HABITAT OF *GEOTRUPES*
CHALYBAEUS LECONTE IN FLORIDA¹

BY FRANK N. YOUNG

Geotrupes chalybaeus described by LeConte² from fragments found at Tampa, Florida has long been a rarity in collections. This rarity seems to be due to the restricted habitat of the species and to its occurrence in the winter and early spring months. In many areas of "Scrub" vegetation on St. Lucie and other deep sands it is relatively common, and can be trapped in numbers by burying pint jars up to the neck in the ground and placing an inch or so of molasses and water, honey and water, or decaying mushrooms in the bottom.³ Careful examination of other unusual habitats and use of different methods of collecting will probably reveal that many "rarities" are really quite common when their exact habitat is known.

In February, 1949, I stumbled upon a "colony" of *Geotrupes chalybaeus* in a small area of scrub in Putnam County south of Interlachen, Florida. The abundance of this supposedly rare beetle in this situation aroused my interest and subsequent collecting and observation indicated that the species extends over most of the dry sand areas of northern peninsular Florida. Its burrowing habits seem to restrict it to deep sands, and it can probably be expected wherever such occur within its range—possibly as far north as Maryland. There is some indication that local populations differ, but further study will be necessary to determine the significance of this variation.

The area in which the beetles were first observed south of Interlachen is largely covered by a stand of mature sand pines (*Pinus clausa*)⁴ on St. Lucie sand on top of an elevation completely surrounded by the ground-water podzols of the Leon-St. Johns series

¹Contribution No. 431 from the Department of Zoology, Indiana University and from the Department of Biology, University of Florida.

²Coleoptera of Florida, *Proc. Amer. Philos. Soc.*, 17, 1878: 402.

³See also Hubbell, T. H. A monographic revision of the genus *Ceuthophilus*, *Univ. of Fla. Publ., Biol. Sci. Ser.*, 2(1), 1936, for further notes on methods of using "molasses traps."

⁴Plant names are after Davis, J. H. Natural features of southern Florida, *Fla. Geol. Surv., Bull.* 25, 1943.

of "Flatwoods" soils. The area actually represents an island, probably developed as an offshore bar in the Pamlico or earlier sea, of the late Pleistocene epoch. It appears as an isolated, low hill about a mile in diameter (Putnam County, T-11-S, R-25-E, Sec. 17) on the topographic map of Florida (Contour Topographic Map, scale 1:500,000) prepared by the U. S. Engineer Department. The high central part of the "island" is almost pure sand pine scrub surrounded by a zone of *Quercus laevis*-*Pinus palustris* associates which grades through an ecotonal belt of *Quercus cinerea*-*Pinus palustris*/*Pinus elliotti* into the *Pinus palustris*-*Aristida* associates on Leon sand—in local terms "Scrub" surrounded by "High Pine-Turkey Oak" grading through "High Pine-Blue Jack Oak" into "Long Leaf Pine Flatwoods".

Large specimens of the sand pine (*Pinus clausa*) cover the central portion of the "island" so closely that there is almost no ground vegetation except for a few small and scattered scrub oaks (*Quercus chapmani*, *Q. myrtifolia*, and *Q. virginiana geminata*), straggling patches of sedges and wire grass, and a few stunted *Xolisma*, *Garberia*, and other shrubs. A very few specimens of *Ceratiola ericoides*, the Scrub Rosemary, were found after some searching. The surface of the sand beneath the trees is covered with a thin mat of pine needles which together with an occasional fallen pine trunk, scattered plants of reindeer moss (*Cladonia* spp.), and occasional polypore and other mushrooms give the surface a characteristic aspect. The porous nature of the soil makes this a very dry situation. It was noticed on several occasions that the surface sand would be quite dry a short time after a heavy rain.

In late February, I found yellowish mounds of sand scattered over the pine needle mat in every direction. It was soon discovered that these mounds marked the burrows of *Geotrupes chalybaeus* since an occasional specimen could be dug out of the burrow beneath a mound by quickly thrusting a trowel or shovel into the ground so as to intercept the burrow. In a relatively small area, about 50 by 100 feet, along the western edge of the pines almost a thousand mounds were counted. This was the maximum density encountered, although some were found almost everywhere the sand pines occurred. Not all were fresh, many showing the slumping effect produced by rains, and some were so old that only the difference in color indicated their former position.

A series of "molasses traps" was extended from the edge of the

scrub area across the thickest concentration of the mounds and about 150 feet farther into the pines. About 50 jars and cans were used placed about 5 to 10 feet apart. Several days later, as many as 15 *G. chalybaeus* were found in a single jar, the number generally being highest near the greatest concentration of mounds. No specimens were taken in the five traps which extended outside the sand pine area, probably because of the density of the wiregrass which interfered with the movements of the beetles.

BURROWING HABITS

Geotrupes chalybaeus is a remarkable burrower. The burrows beneath the mounds or "throwups" descend practically straight down, and apparently offer no particular difficulties to excavation, but the loose sand falls into burrows so readily it is very difficult to reach the bottom. In early March, several burrows were excavated to a depth below 60" below which they were lost or the sand caved in upon them. One burrow was excavated to a depth of 61" at which point it turned abruptly at right angle and ran 3" more before coming to an end at which a small female beetle was found among some pine needles and male pine cones. None of the burrows excavated gave any clue as to the possible larval or adult food. Old burrows which might have contained larval chambers could not be traced because they had filled with sand to within a short distance of the surface.

The mounds or "throwups" are quite characteristic and easily identified once they have been seen. Groups of typical mounds found in many places seldom failed to produce at least a token specimen or be associated with fragments caught in spider webs beneath logs or rocks. In size the *G. chalybaeus* "throwup" is intermediate between that of smaller *Geotrupes*, *Bolboceras*, etc. and the smallest pocket gopher mounds. A typical "throwup" is about 6" long by 5" wide by 1½ to 2" high. The burrow (about ⅞" in diameter) opens under one end of this small mound and is usually loosely closed with a plug of damp sand. In the fresh burrows a small clump of roundish roll of damp sand broken into small segments indicates the end of the mound at which the burrows opens. Occasionally this roll of damp sand was seen being pushed out of the burrow, and once a beetle was taken by thrusting a trowel into the soil beneath the end of the roll. It seems very probable that the beetle excavates its burrow by bringing up small pellets of damp sand from the bot-

tom and pressing them against the bottom of a plug which is gradually forced out upon the surface. Such a method would allow the burrow to be closed most of the time, which might be of value in preventing excess evaporation in so xeric an environment. Burrows in which the mouth was open were in many cases filled with sand a little ways beneath the surface. This sand seemed to have been washed in rather than being a plug formed by the beetles.

ABOVEGROUND ACTIVITIES

Night observations revealed a few males and females on the surface among the mounds. No feeding, mating, or other activities were observed, however, since all specimens found were lying on the pine needle mat and did not move while under observation which in some cases lasted as long as half an hour. The smaller size of the females in relation to the males and the grouping together of the mounds suggests that some sub-social activity might be expected. Presence of light in the area and other activity may have disturbed the beetles because the trapping results indicated that there was considerable wandering about at night.

FOOD

The only information on food is indirect. Adult beetles were attracted to molasses and water, honey and water, decaying mushrooms, and molasses-honey-mushrooms and water. Some specimens were trapped in empty jars or jars containing only water. Jars containing cow manure, horse dung, or human excreta seemed to repel the beetles since none were taken in such traps although others in the same area fell into empty jars. Molasses and honey caught more beetles than decaying mushrooms, but the latter did not trap the beetles as did the sticky solutions so that many more may have visited the mushrooms and then left. The amount of possible food in such a situation as the "Scrub" is rather limited, but mushrooms and various lichens are frequently very abundant.

DISTRIBUTION IN FLORIDA

"Throwups" accompanied by fragments or specimens of *G. chalybaeus* were found in a number of places in northern peninsular Florida. All were located in areas of St. Lucie, Lakeland, Chiefland, or Orlando sands. None were found in St. Lucie or Dade sands in

southern Florida during June, 1949, but search in the period from January to May might reveal them. The largest "colony" found beside the one near Interlachen was near Belleview in Marion County. Several hundred "throwups" were found there in deep Lakeland sand supporting the *Quercus laevis*-*Pinus palustris* associates. Typical "throwups" were also found in the "Big Scrub" south of the Oklawaha River, but no beetles were taken.

Florida counties from which records were established are: Gilchrist (2 localities), Levy (2 localities), Alachua (2 localities, also records by T. H. Hubbell), Putnam [3 localities, also Welaka (A. F. Van Pelt and J. C. Moore), and north of Palatka (H. K. Wallace)], Volusia (1 locality), Marion (2 localities), and Hernando (1 locality.) All of these localities were in areas of *Pinus clausa*-*Ceratiola ericoides* associates or *Quercus laevis*-*Pinus palustris* associates. In nearly all cases they were associated with mounds of pocket gophers (*Geomys* spp.) and the gopher tortoise (*Gopherus polyphemus*).

All specimens are in the collection of the University of Michigan Museum of Zoology, Ann Arbor, Michigan.

Chalepus bicolor OLIV. (COLEOPTERA).—This species has not been listed north of Connecticut but I took one here on June 19, 1942, by sweeping. About a dozen were taken here on August 2 and 10, 1947, on *Panicum scribnerianum* Nash. The determination of this grass was obtained through the kindness of Dr. I. M. Johnston of the Arnold Arboretum. Another specimen of the beetle was obtained by sweeping in the Quabbin Reservation in Ware, Mass., June 26, 1947. My other specimens are from South Carolina, Indiana, Florida and Connecticut.—C. A. Frost, Framingham, Mass.

POLYHOMOA AZUMA, A SYNONYM OF KYIDRIS BROWN
(HYMENOPTERA: FORMICIDAE)

BY WILLIAM S. CREIGHTON

Dept. of Biology, College of the City of New York

During April of 1950 the writer received from Professor Masao Azuma of Nishinomiya, Hyogo Prefecture, Japan, a short paper dealing with Japanese ants. The paper is a separate from Volume 1, No. 4 of a publication entitled *Hyogo Biology*. Its pages are numbered 34-37 and it bears the date 30 Aug. 1949. As I shall subsequently show, this date is the acceptance date of the article, not its date of publication.

As the paper is almost entirely in Japanese I could make little of it other than to note that it carries the original description of a new genus *Polyhomoa*. Some weeks later Dr. Wm. Brown, who had meanwhile had the paper translated into English, informed me that *Polyhomoa* is the same as his *Kyidris* and that, if the date on the reprint represents its time of publication, Azuma's name would take precedence. The original description of *Kyidris* Brown was published in the Japanese journal *Mushi* in the issue which appeared on September 20, 1949 (Vol. 20, pars 1, p. 3.) Dr. Brown made various efforts to learn the significance of the date on Azuma's article. The only positive response came from Dr. Yasumatsu, to whom Dr. Brown had applied for information. According to Dr. Yasumatsu the date of publication of *Hyogo Biology*, Volume 1, No. 4 was January 10, 1950. This strongly suggested that the date carried on Azuma's article was an acceptance date. The verification of this surmise required access to the entire number of *Hyogo Biology* containing Azuma's article. With the distribution of the journal restricted to Japan, this possibility seemed remote. However Miss Hazel Gay, the Librarian of the American Museum of Natural History became interested in the problem and was able to secure a full file of *Hyogo Biology* (Volume 1, Nos. 1-4) for the Museum library. As nearly as can be ascertained, this is the only set of this journal in the United States and Miss Gay is to be congratulated on the success of her efforts.

The articles which compose the Number 4 issue of *Hyogo Biology* are separately dated during the year 1949. The dates run from

March to September, at which time the number was apparently closed and sent to the printer. The printing of the issue consumed three months. In consequence, the cover bears the date of publication, January 10, 1950.

This being the case, the genus *Kyidris* Brown takes precedence over the synonymic genus *Polyhomoa* Azuma. As to whether Azuma's species *itoi* is a synonym of Brown's *mutica* is not certain but it seems probable that this is the case.

MASSACHUSETTS RECORDS OF *Cyphoderus assimilis* BORNER (COLLEMBOLA).—During the last three years, specimens of this species have been recovered in the field from ant nests in four localities in Massachusetts. The species has been taken from Annisquam in May, June, and July, from Boston in September, from Swampscott in September, and from Cambridge in October. In the New World this species is ordinarily found in tropical and subtropical areas, and when taken in more northerly regions it is usually in such artificially sheltered areas as greenhouses. Its occurrence in Massachusetts may be only a local invasion, but that this has been successful to some extent is shown by the recovery of specimens in one area (Annisquam) in three successive years. Although the species has not been found outside of ant nests, it shows little selectivity as to the ant, having been found in nests of *Aphaenogaster*, *Acanthomyops*, *Chthonolasius*, *Lasius*, and *Tetramorium*.—K. A. CHRISTIANSEN, Biological Laboratories, Harvard University.

SOME NEW NEARCTIC COLLEMBOLA

BY D. L. WRAY

Raleigh, N. C.

The insect order Collembola seems to have as extensive geographical distribution as any other animal group. Many species are very widely distributed geographically, but some are limited to particular ecological situations. A few years ago I described *Tetracanthella ethelae* taken here at Raleigh, N. C., at an altitude of only 325 feet. The habitat of this genus was the Arctic regions of North America and the higher mountainous regions of Europe and Asia. This past year *T. ethelae* was taken near the top of Mt. Mitchell, at an altitude of about 6500 feet and up on the side of Grandfather Mt. at an altitude of about 5000 feet. Hence here is a species with a wide range as to both altitude and geographical distribution. Recently in some material sent to me for study by Dr. G. F. Knowlton from Utah I found a *Tullbergia* having three anal horns, a form very close to the European *T. affinis* Börner. Bonet (1944) has described a form (*Mesaphorura incisa*) with three anal horns from Mexico. Of particular interest is the occurrence of another European form (*Xenyllodes armatus* Axels.) in North America fauna. A note on this species is given below.

The forms described in this paper are *Tullbergia knowltoni* (*Onychiurinae*), *Onychiurus wilchi* (*Onychiurinae*), and *Folsomia highlandia* (*Isotominae*).

FAMILY ENTOMOBRYIDAE.

Genus *Folsomia* Willem.

***Folsomia highlandia*, n. sp.**

(Figs. 10-17)

Length up to 1.8 mm. Dirty gray in color, speckled with purplish-black pigment over head and body segments dorsally and ventrally. The pigment is noticeably heavy on the frontal area of the head (Fig. 16). The pigment on the body segments is heavier on the

median portion, each margin lightly pigmented, or with it entirely lacking, giving the body a banded appearance. Antennae slightly pigmented basally, lighter distally. Basal segments of legs pigmented, lighter distally. Manubrium lightly pigmented basally.

Eyes (Fig. 13) 4 on each side of head, equal, three anterior ones close together on a dark eye patch, the posterior one is situated back of others about 4 eye-diameters on a dark eye-patch. Post-antennal organ (Fig. 13) unusually elongate, bent, and 6 or 7 times as long as the diameter of adjacent eye, notched in middle. Antennae as long as head on well developed antennal base. Antennal segments as: 7:15: 10:30. Sense organ of third antennal segment (Fig. 11) consisting of two small, slightly bent sense rods. Fourth antennal segment with several olfactory setae. Last three abdominal segments ankylosed, sometimes with a trace of a suture showing between fourth and fifth segments.

Unguis (Fig. 10) curved, unarmed. Unguiculus (Fig. 10) unarmed, broadly lanceolate, and extended setaceously; about two-thirds the length of unguis. Tenent hairs absent. Furcula reaching to the middle of the second abdominal segment. Manubrium (Fig. 12) with several fine, short setae dorsally and with many short, stout setae ventrally. Manubrium to dens to mucro as: 25:35:5. Dentes (Fig. 15) with a long basal seta and at least 3 shorter, curving setae dorsally; with many short, rather stout setae ventrally; dorsally crenulate, the crenulations ending about two mucro-lengths from mucro. Mucro (Fig. 15) large, bidentate, the apical tooth much smaller than ante-apical. Rami of tenaculum quadridentate, with one stout, curving seta on corpus (Fig. 14).

Clothing at posterior end of abdomen composed of very many long setae intermingled with shorter, curving ones. Clothing on body segments (Fig. 17), from a lateral view, generally consists of two long, curved setae, and numerous shorter, reclinate ones. Body in general unusually heavily clothed with setae.

This species is very close to an eight-eyed species (*Folsomia octoculata* Handschin) described from Java and the South-west provinces of India, as to number and arrangement of eyes, but differs in other body structures.

Highlands, N. C., September 22, 1949, D. L. Wray. Eighteen specimens were taken from leaf mould from a mixed pine, hemlock, and hardwood forest at about 4000 feet altitude. This region stays

rather moist due to the very heavy yearly rainfall making it ideal for collembolan fauna. Cotypes in author's collection.

FAMILY PODURIDAE.

Genus *Tullbergia* Lubbock.

***Tullbergia* (*Mesaphorura*) *knowltoni*, n. sp.**

(Figs. 1-9)

Length up to 0.7 mm. White. Slender (Fig. 1), body five times as long as broad. Antennae short, two-thirds as long as head, the third and fourth segments not distinctly separated. Relative lengths of antennal segments as: 3:4:6:5. Antennal base well developed. Fourth antennal segment with a terminal sense knob and with 6 to 8 large, curving olfactory setae (Fig. 4). Organ of third antennal segment (Fig. 5) with three guard setae, two large sub-reniform sense clubs, curving toward each other, and two large papillae shielding the sense clubs; ventro-laterally to these is an auxiliary sense club. Postantennal organ in an elongated groove, with about 24-28 irregular tubercles (Fig. 3), somewhat shaped like the *Onychiurus fimetarius* group postantennal organ. Pseudocelli, rosette-like, situated on each side as follows: 1 between postantennal organ and base of antenna, 1 on posterior part of head, 1 on mesothorax and metathorax, and with 1 on abdominal segments I-V, wanting on abdominal segment VI.

Unguis (Fig. 8) unarmed. Unguiculus absent. Anal horns (Fig. 7) 3; two long, strongly curved ones about twice the length of the hind unguis are situated on the postero-dorsal end of body on large nearly contiguous papillae; the third horn is short, bluntly rounded at apex, in length about half the unguis, and is situated mid-ventral to the pair above.

Body with short backward curving setae in three rows on mesothorax to abdominal segment V. Longer setae intermingled in one row on each segment and are more abundant on head and 5th and 6th abdominal segments. The 6th abdominal segment with two rows of long curving setae. Integument granulate, becoming coarser dorsally on the posterior margin of thorax II to abdominal segment V.

Logan, Utah, October 31, 1949, G. F. Knowlton and S. C. Ma. Taken in honeysuckle leaves by means of a modified Berlese funnel. Cotypes at present in author's collection.

This species is very close to *Tullbergia affinis* Börner in the arrangement and size of the 3 anal horns, but differs in that pseudocelli were not observed on thorax I, the unguiculus was not distinguished, the size is smaller, and there seems to be differences in the organ of the 3rd antennal segment and postantennal organ.

Genus *Onychiurus* Gervais.

***Onychiurus wilchi*, n. sp.**

(Figs. 18-25)

Length up to 1.5 mm. White. Postantennal organ (Fig. 20) of the *finetarius* type, each with 18-20 branched tubercles placed at right angles to the long axis. Antennae shorter than the head, with the antennal segments in the following proportions: 7:13:15:17. Organ of the third antennal segment (Fig. 19) with 5 papillae, 5 guard setae, 2 sense rods, and 2 sense clubs. Fourth antennal segment with 10-12 curving olfactory hairs. Pseudocelli (Fig. 18) on each side as follows: 2 on inner side of antennal base and one between antennal base and postantennal organ; 2 obliquely situated on back of head; meso- and meta-thorax 2; 2nd and 3rd abdominal 2; 4th and 5th abdominal 3. One pseudocellus on each precoxal.

Unguis (Fig. 21) stout, curving, unarmed. Unguiculus unarmed, slender, gradually tapering to apex which is extended in the form of a fine filament to length of unguis. Anal spines 2 (Fig. 23), stout, and almost straight, bases widely separated; two-thirds as long as hind unguis. Long curving setae at posterior end of abdomen. Clothing of scattered long straight setae, sparse short setae, and a few minute strongly curved setae (Fig. 24). Cuticular tubercles (Fig. 23) coarse.

Highland, Illinois June 7, 1946, B. T. Wilch. This species is named for Mr. B. T. Wilch who collected fifteen specimens from garden soil, and which were transmitted to me for study by Dr. H. H. Ross, of the Illinois Natural History Survey, with whom most of the cotypes will be deposited.

Genus *Xenyllodes* Axelson, 1903.

Eyes 5 on each side of head. Postantennal organ consisting of a single, trilobed tubercle. Antennae with broad basal segments,

almost touching, distally segments become conical. Mouthparts reduced. Unguis unarmed. Unguiculus present. Furcula shorter than antennae; manubrium slightly longer than dens, which is slightly longer than mucro. Anal horns 2. Integument finely granulated. Body short, thick, length up to 1 mm.

Xenyllodes armatus Axelson 1903.

(Figs. 26-30)

This form from Raleigh, N. C., collected from leaf mould has been referred to this species as it agrees very well in most essential characters with the description given by Axelson (1912), and also with that by Dr. Jan Stach (1949). However, it does vary in some characters, such as the length of the anal horns, postantennal organ, and furcula measurements, from the illustrations given by Axelson. This is probably the first time this genus has been recorded as occurring in North America. The form from here has been examined by Dr. H. B. Mills, Illinois Natural History Survey, and credit is given him as first recognizing this form as occurring in North America as he states that he found it in Montana, previously to the ones I sent from this locality. As far as we are aware this genus has not been in North American literature as yet. Dr. Jan Stach (1949) states that till now this species is only known from Europe. Thus, this is an interesting extension of the range of this genus and as with other genera, when more intensive collecting is done, one may expect or not be surprised to find an ever widening geographical distribution.

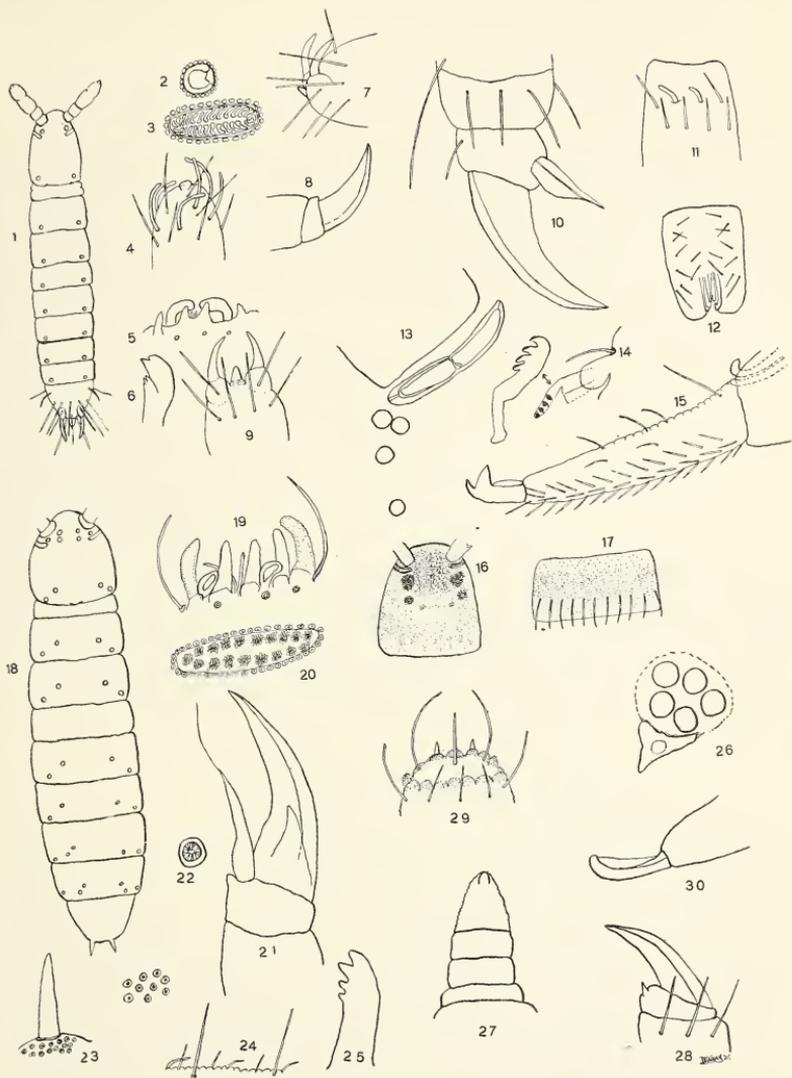
Description of North Carolina form. Eyes 5 (Fig. 26) on each side of head, equal in size on a dark eyepatch. Postantennal organ consisting of a single, trilobed tubercle with a round "central organ"; situated in a depression close to front of the eye complex (Fig. 26). Antennae with broad basal segments, almost touching, distally segments become conical (Fig. 27); shorter than head, relative lengths of segments as: 3:5:5:8. Fourth antennal segment with a rounded lobe at tip, and with 5 or 6 olfactory hairs. Mouthparts reduced. Unguis (Fig. 28) unarmed. Unguiculus present but weakly developed, small, spinnate. Furcula well developed, shorter than antennae; manubrium slightly longer than dens, which is slightly longer than mucro (Fig. 30). Anal horns 2, very small but well developed (Fig. 29). Integument finely granulate. Clothing of

short, curving setae; posterior end of abdomen with longer curving setae (Fig. 29). Length 0.4 mm. White with bluish tinge mainly on head.

I wish to express my many thanks and appreciation to Dr. G. F. Knowlton and Mr. S. C. Ma for material from Utah, to Dr. H. B. Mills for his notes on *Xenyllodes*, to Dr. H. H. Ross for material from Illinois, and to Dr. Hermann Gisin, Genève, Switzerland, for making available specimens of *Tullbergia affinis* Börner from Europe.

EXPLANATION OF PLATE 5

Tullbergia knowltoni, n. sp. (Figs. 1-9) 1. Dorsal view of the whole animal. 2. Ocellus. 3. Postantennal organ. 4. Tip of fourth antennal segment. 5. Organ of third antennal segment. 6. Mandible. 7. Posterior end of abdomen showing anal horns. 8. Unguis. 9. Ventral view of posterior end of abdomen. *Folsomia highlandia*, n. sp. (Figs. 10-17) 10. Hind foot. 11. Organ of third antennal segment. 12. Dorsal surface of manubrium. 13. Eyes and postantennal organ. 14. Tenaculum. 15. Dens-mucro 15. Dorsal surface of head. 17. Pigmentation of body segment, dorsal surface scheme. *Onychiurus wilchi*, n. sp. (Figs. 18-25) 18. Dorsal view of whole animal. 19. Organ of third antennal segment. 20. Postantennal organ. 21. Hind foot. 22. Ocellus. 23. Anal horn. 24. Clothing arrangement of setae. 25. Mandible. *Xenyllodes armatus* Axelson. (Figs. 26-30) 26. Eyes and postantennal organ. 27. Antenna showing round knob at tip. 28. Hind foot. 29. Posterior end of body, dorsal view, showing anal horns. 30. Dens-mucro.



ANT LARVAE OF THE SUBFAMILY CERAPACHYINAE

BY GEORGE C. WHEELER

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The Cerapachyinae are a neglected group of ants even among myrmecologists. This may be attributed to a combination of factors; the subfamily is a small one, about one hundred species; all species are rare and sporadic; their colonies are small; nearly all are tropical; they have no spectacular habits or bizarre structures; they are of no economic importance.

Nevertheless, they are a very interesting group phylogenetically, since they show both doryline and ponerine affinities. In fact, they have been included in both subfamilies. Forel in 1893 first recognized the group of genera as a tribe and placed it in the Ponerinae. In 1895 Emery transferred it to the Dorylinae. After protests from Forel and Wheeler he returned it in 1913 to the Ponerinae as the Section Prodorylinae. Wheeler considered the group to be intermediate between the Dorylinae and the Ponerinae and in 1920 elevated it to the rank of subfamily. It is especially significant here that he used larval as well as adult characters to justify this change.

In view of the neglect just mentioned, it is surprising that so many cerapachyine larvae are known: six species representing four of the eight genera.

Subfamily CERAPACHYINAE Forel

Elongate and very slender; subcylindrical; arcuate, i.e., the whole body rather evenly curved ventrally. Segmentation distinct. Spiracles small. Vestigial legs present or absent. Head small; at the anterior end. Mouth parts large and prominent. Head hairs few, 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 serrate. Maxillae lobose; mostly rather long and round-pointed; palp small, a cluster of three to six sensilla or a low elevation bear-

ing sensilla or a short obtuse projection bearing sensilla; galea a slender conical projection bearing a single apical sensillum. Labium large and prominent; palp a cluster of three to five sensilla, sometimes slightly elevated. Opening of sericteries mostly well developed. Trophorhinium poorly developed or absent.

Emery (1911) describes the larvae (under Section Prodorylinae of the Subfamily Ponerinae) as "uniformément poilues, sans tubercules piligères" (p. 4) and "à peu près cylindrique (comme la larve d'*Eciton*) revêtue de poils courts et sans tubercules piligères" (p. 5).

Wheeler, 1903, pp. 208-209: "What light do these few observations, together with those recorded in my previous paper, shed on the affinities of the Cerapachyi to the Ponerinae on the one hand and the Dorylinae on the other? . . . The following characters [of *Cerapachys augustae*] are common to both Dorylinae and Ponerinae:— 1. The method of carrying the larvae is common to forms like *Eciton* and *Leptogenys*. 2. The larva is intermediate between that of *Eciton* and *Stigmatomma*. It is covered with shorter, less flexuous, and less abundant hairs than the latter and in these particulars resembles the larvae of *Eciton*."

Wheeler, 1920: "During the past year a study of ant-larvae, representing more than a hundred genera and many subgenera of all five subfamilies, has convinced me that Emery was right in 1899, when he regarded the Pseudomyrminae as constituting an independent subfamily. I am also of the opinion that the Cerapachyini should be removed from the Ponerinae and raised to the rank of an independent subfamily, between the Dorylinae and the Ponerinae" (p. 46). "A study of the larvae of the Cerapachyini shows that they are extremely like the larvae of the Dorylinae. This was noticed by Emery in his observations on the larva of *Acanthostichus serratulus* (1899). The mandibles are small, narrow, pointed and rather feebly chitinized, and I have failed to find a trophorhinium in either group. Apparently the young are fed only on soft food" (p. 50). On page 48 he states that the larvae of the Cerapachyinae are exceptional in not having a beautifully developed trophorhinium.

Wheeler, 1922, p. 52: "The larvae are extremely like those of the Dorylinae; they are elongate and almost cylindrical, uniformly covered with short hairs, and without piliferous tubercles. The mandibles are small, narrow, pointed, and rather feebly chitinized, and I have failed to find a trophorhinium, or triturating organ in the mouth. Apparently the young are fed only on soft food."

Tribe Cerapachyini Forel

Genus *Eusphinctus* Emery

Diameter greatest at the sixth abdominal somite decreasing gradually toward the anterior end (except for a slight enlargement of meso- and metathorax in mature larvae) and more abruptly toward the posterior end. No leg vestiges. Hairs rather numerous, uniformly distributed, short and bifid. Cranium about as long as its greatest breadth; broad above, narrowed below. Head hairs simple (except one or two pairs which are bifid) and minute. Labrum small, not covering the bases and tips of mandibles; about twice as broad as long; slightly narrowed distally; a few sensilla on the anterior surface near the distal border; central cluster of sensilla on the posterior surface. Maxillary palp a short stout peg. Labium with a few spinules.

Eusphinctus steinheili Forel.—Figure 1. Elongate, slender, sub-cylindrical, arcuate (i.e., rather evenly curved ventrally). Diameter greatest at the sixth abdominal somite; decreasing gradually toward the anterior end (except in mature specimens in which there is a slight enlargement of the meso- and metathorax) and more abruptly toward the posterior end which is round-pointed. Anus ventral. Anterior portion of prothorax constricted rather abruptly to form a sort of wedge-shaped neck, which is naked except for a few ventral hairs. Ten differentiated somites. No leg vestiges. Spiracles small. Body uniformly and rather densely covered with short bifid hairs about 0.04 mm. long. Intersomitic membranes and anterodorsal surface of prothorax naked. Head small. Cranium about as long as its greatest breadth; broad above, narrowed below; occipital border slightly curved. Mouth parts large and prominent. Head hairs few and scattered; one or two pairs bifid, the rest simple; minute (length 0.018 - 0.028mm.). Antennae of moderate size; with two or three sensilla. Labrum a small thick flap, about twice as broad as long, slightly narrowed distally; a few sensilla on the anterior surface near the distal border; a central cluster of six sensilla on the posterior surface. Mandibles rather feebly sclerotized; long and slender; base moderately stout; distal two-thirds narrow and thin, tapering to an acute apex which is slightly curved backward and medially; distal half of medial border serrate with five or six denticles. Maxillae lobose, round-pointed, rather long; palp a short stout projection bearing five or six sensilla; galea a slender truncate cone bearing a sensillum on the apex. Labium subhemispherical;

capping the ventral end of the gula; anterior surface with a few minute spinules in regular transverse rows (concealed behind labrum); palp a cluster of three sensilla. Opening of sericteries a long transverse slit. (Material studied: several larvae from New South Wales.)

Wheeler, 1918: "Long and slender, cylindrical and not enlarged at the posterior end, with eleven distinct postcephalic segments, all uniformly clothed with short, erect, two-branched hairs. Head small, as broad as long, with vestigial antennae and long falcate mandibles, which have finely serrate internal borders. There are few hairs on the head and these are simple, with the exception of a pair near the occipital border, which are two-branched like those on the body. The color of the larva is dull white" (p. 228). Fig. 2 shows a larva in side view, a head hair, the head in anterior view and a mandible (p. 227).

Wheeler, G. C., 1938; no leg vestiges (p. 140); no vestigial gonopods (p. 142).

Genus *Cerapachys* F. Smith

Leg vestiges small paraboloidal papillae. Body hairs simple. Head (including mouth parts) subpyriform in anterior view; cranium transversely subelliptical; occipital border slightly curved. Head hairs short. Labrum small, not covering the bases and tips of the mandibles; breadth one and one-half times the length; constricted near the base; free border strongly curved; numerous sensilla on the free border and posterior surface; posterior surface spinulose near periphery. Maxillae with the apical half spinulose; palp a low elevation together with a contiguous papilla. Labium with spinules on the middle of the anterior surface.

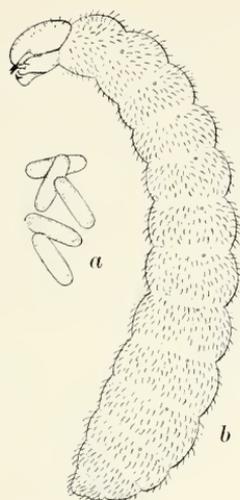
Cerapachys (Syscia) cryta Mann.—Fig. 2 a-d. Anterior portion of prothorax constricted abruptly to form a short wedge-shaped neck. Vestigial legs a pair of small paraboloidal papillae on the ventral surface near the middle of the posterior border of each thoracic somite. Spiracles small. Body hairs few, very long (0.4-0.6 mm.), simple, flexuous and extremely slender; longest and most abundant near posterior end; also a very few minute (0.013 mm.) stiff hairs. Head (with mouth parts) subpyriform in anterior view; small; mouth parts large and prominent; cranium transversely subelliptical. Head hairs few and scattered; simple, slightly curved, short (0.036 mm.). Antennae moderately large; each with three

sensilla. Clypeus distinct; a thick flap. Labrum a thick flap; small; broader than long; constricted near base; free border strongly curved and bearing several conspicuous sensilla; posterior surface with numerous sensilla near the middle and with spinules arranged in short arcuate rows near the periphery. Mandibles rather feebly sclerotized; long and slender; base moderately stout; apical two-thirds narrow, thin, curved backward and medially, and tapering to a rounded point; apical half of medial border serrate with five or six denticles. Maxillae lobose, round-pointed, rather long; apical half spinulose, the spinules grouped in short rows; palp a low elliptical elevation (bearing two sensilla) together with a contiguous papilla (which bears an apical sensillum); galea a long slender finger-like projection bearing an apical sensillum. Labium prominent, constricted at the base; free end broadly rounded; middle of anterior surface spinulose, with the spinules arranged in short transverse rows; palp a low rounded elevation (bearing three sensilla) together with a contiguous paxilla (bearing a single apical sensillum). Opening of sericteries distinct. (Material studied: three semipupae from Fiji collected by Dr. W. M. Mann.)

Cerapachys (Cerapachys) sp.—Fig. 2e. Similar to *crypta* but differing in a few details. The body hairs are shorter (0.2 - 0.3 mm. long) but more abundant. The head hairs are longer (0.054 mm. long). The mandibles have more denticles (about a dozen on each). The maxillary palp is a low elevation bearing four sensilla. The labial palp is a low elevation bearing five sensilla. (Material studied: 10 semipupae from Borneo.)

Wheeler, G. C. 1938, p. 141: no evidence of wing rudiments.

Cerapachys (Parasyscia) augustae Wheeler.—Text fig. 1. "The larvae were extremely slender, not twice as broad behind as at the anterior end, with well-marked segmental constrictions. The head is proportionately large, with strong, acute mandibles projecting beyond the clypeal and labial regions. The maxillae are furnished with a pair of prominent sensory papillae and the labium with a well-developed duct to the spinning glands. The dorsal surface of the head as well as the whole surface of the body is covered uniformly with short, slightly curved hairs. There are no traces of tubercles of any description. Attempts to observe the method employed by the ants in feeding their larvae were unsuccessful. Once, on placing a number of eggs and young larvae of *Camponotus festinatus* in the nest I saw the young *Cerapachys* larvae feeding



Text figure 1.—*Cerapachys (Parasyscia) augustae*. a, eggs; b, young larva in lateral view. (After Wheeler, 1903 and 1910. By permission of Columbia University Press.)

on the former after they had been carried under the slide by the workers. It was apparent also that the ants and their older larvae soon began to feed on the unhatched eggs and younger larvae of their own species, for the number of progeny decreased rapidly from day to day . . . These larvae were carried by the ants after the manner of *Eciton* and *Leptogenys*, i.e., by the neck, with the long slender body extending back between the legs of the worker. The ants were quite as careful of their larvae as of their eggs." (Wheeler, 1903, p. 207.) The figure of the young larva on page 206 is repeated by Wheeler (1910, Fig. 37 on p. 71) and is reproduced here (Text fig. 1) through the courtesy of Columbia University Press.

Wheeler, 1903, p. 209: "The larva probably spins a cocoon . . . The larva is intermediate between that of *Eciton* and *Stigmatomma*. It is covered with shorter, less flexuous, and less abundant hairs than the latter and in these particulars resembles the larvae of *Eciton*."

Wheeler (1910) describes the larva of *Parasyscia* as "more cylindrical" than typical ant larvae (p. 72) and as "smooth, slender larvae, with a rather dense covering of hairs" (p. 233).

Genus *Leoponera* Mayr

Diameter least at the first abdominal somite, increasing toward either end. No leg vestiges. Body hairs of three types: (1) long and flexuous with the tip hooked; (2) short and simple; (3) minute and simple. Cranium subhexagonal in anterior view; occipital border broadly angulate. Head hairs minute or short. Labrum large, covering most of the mandibles; width about three times the length; free border strongly curved; numerous sensilla on posterior surface. Mandibles short and stout; very feebly sclerotized. Maxillae very large and inflated; palp represented by a cluster of sensilla. No spinules on the mouth parts.

Leoponera luzuriagae Wheeler & Chapman.—Fig. 3. Elongate, slender, subcylindrical, arcuate (i.e., rather evenly curved ventrally); diameter least at the first abdominal somite, increasing gradually toward the ends. Anus subterminal. Eleven differentiated somites. No leg vestiges. Spiracles small. Body hairs of three types: (1) long (0.1 - 0.2 mm.) and flexuous, with the tip hooked, arranged in rows, one row of 6-12 hairs around each somite near the middle; (2) short (0.05 - 0.1 mm.), simple, slightly curved, sparsely and irregularly distributed, except on the prothorax, where they produce a bristly aspect; (3) minute (0.013 - 0.026 mm. long), simple, moderately numerous and uniformly distributed. Head small. Cranium subhexagonal in anterior view; a little broader than long; occipital border obtusely angulate at the middle. Head hairs very few; simple; variable in length (0.013 - 0.027 mm.), number and location. Antennae moderately large, each with three sensilla. Labrum a large thick flap twice as broad as long and covering most of the mandibles; with its base constricted and its free border broadly rounded; numerous sensilla on posterior surface. Mandibles very feebly sclerotized; short and stout; with the basal two-thirds greatly inflated and subtriangular in anterior view; distal third very small and curved posteriorly, its apex curved medially and blunt-pointed; distal half of medial border furnished with five to nine sharp denticles of various sizes and irregularly arranged. Maxillae very large, inflated, lobose; palp represented by a cluster of five sensilla; galea a small finger-like projection bearing an apical sensillum. Labium large and prominent; palp a cluster of five sensilla. (Material studied: several larvae from the Philippine Islands, collected by Dr. J. W. Chapman.)

A few of the larvae in the vial have branched hairs, but they also

have a very wrinkled integument. This latter causes me to suspect that they have been dried out and later relaxed. At any rate, they do not differ otherwise from the larvae described above. Hence I conclude tentatively that the branching may be an artifact due to dessication. Dimorphic larvae are extremely rare among the Formicidae. Without better evidence I would not wish to consider the larva of this species dimorphic.

Whether dimorphic or not, *Lioponera* larvae are still the queerest of the cerapachyines. Their hooked hairs and their short broad mandibles make them decidedly atypical.

The only reference to the larva of *Lioponera* in the literature refers to the absence of vestigial legs in *L. luzuriagae* (G. C. Wheeler, 1938, p. 140).



Text figure 2.—*Acanthostichus serratulus*. a, nearly mature larva; b, head enlarged, in profile; c, same in dorsal (*sic!*) view; d, mandible greatly enlarged, viewed obliquely from the side. (After Emery, 1899)

Tribe Acanthostichini Emery

Genus *Acanthostichus* Mayr

I have seen no larvae of this genus and hence must be content with Emery's description (1899, p. 4) and figures (Pl. 2, figs. 5

a - d) of *A. serratulus* (F. Smith). His description is quoted and translated below and his figures are copied as Text fig. 2.

"Sono . . . subcilindriche, coi segmenti tutti distinti: sono prive di tubercoli o altre appendici e fornite di peli numerosi, brevi e semplici; non esistono peli foreuti, ritorti o uncinati . . . Il capo, benchè più piccolo e meno convesso che nelle Ponerinae è ben staccato dal tronco, e le mandibole sono lunghe, strette, sporgenti in avanti, fuori del labbro superiore; il loro margine interno è dentelato e offre alla base una forte dilatazione. Nelle mascelle, il cono più vicino all'apice è semplice e allungato; al posto del l'altro cono, si trova una sporgenza ottusa, fornita di due piccoli tubercoli."

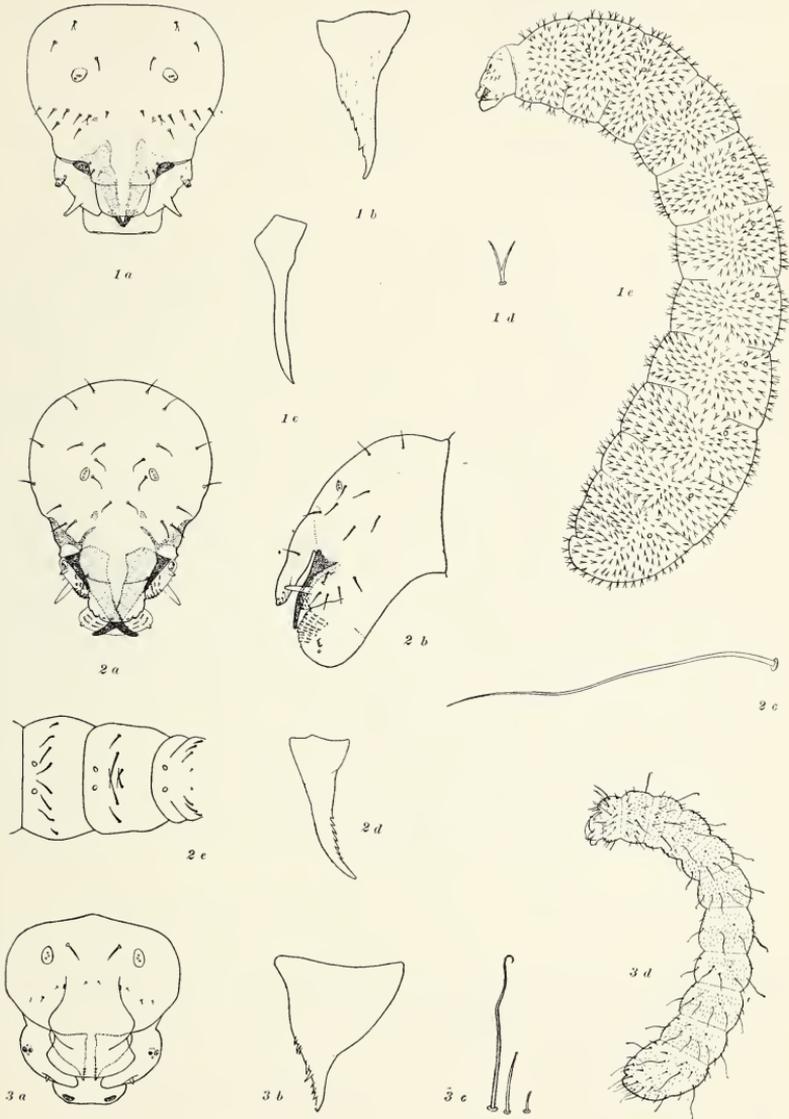
[Translation: Subcylindrical, with all segments distinct; no tubercles or other appendages; furnished with numerous short simple hairs; no forked, twisted or uncinat hairs. The head, although smaller and less convex than in the Ponerinae is quite distinct from the body and the mandibles are long and narrow and project forward beyond the labrum; their medial borders are denticulate and strongly dilated at the base. The subapical cone of the maxillae is simple and elongate; in place of the other cone there is an obtuse projection furnished with two small tubercles.]

DISCUSSION

The ant larvae of the Subfamily Cerapachyinae constitute a well defined group which may be distinguished from the larvae of other subfamilies by the elongate, very slender, subcylindrical body which is rather strongly curved ventrally; by the large and prominent mouth parts; by the paucity and shortness of the head hairs; by the rather feebly sclerotized mandibles, which are typically elongate and slender and have the medial border denticulate in part; by the inconspicuousness of the labial and maxillary palps; and by the absence (or scant development) of a trophorhinium.

EXPLANATION OF PLATE 6

Eusphinctus steinheili Forel, Fig. 1. - a, head in anterior view, x 97; b, left mandible in anterior view, x 150; c, left mandible in side view, x 150; d, body hair, x 167; e, larva in side view, x 27. *Cerapachys (Syscia) crypta* Mann, Fig. 2. - a, head in anterior view, x 74; b, head in side view, x 74; c, two body hairs, x 100; d, right mandible in anterior view, x 100. *Cerapachys* (C.) sp. Fig. 2e, ventral view of vestigial legs, x 22. *Lio-ponera luzuriagae* Wheeler and Chapman, Fig. 3. - a, head in anterior view, x 120; b, left mandible in anterior view, x 387; c, three body hairs, x 167; d, larva in side view, x 20.



WHEELER—ANT LARVAE

Cerapachyine larvae most nearly resemble the larvae of the Dorylinae. Both types have an elongate subcylindrical body with the head at the anterior end; rather feebly sclerotized mandibles, which are typically elongate and slender and have the medial border denticulate in part; inconspicuous maxillary palps; and the trophorhinium wanting or poorly developed. They differ in that doryline larvae are a little stouter and more nearly straight, have more hairs on the head and have smaller mouth parts.

Cerapachyine larvae also show a marked resemblance in body shape to the larvae of the ponerine genus *Myrmecia*. The larvae of this genus have the posterior half of the body noticeably stouter than in the Cerapachyinae, but there is a gradual attenuation from behind forward; hence there is no sharply defined "neck" which is characteristic of the higher Ponerinae. Wheeler considered the adults of *Myrmecia* to be eminently primitive and generalized and the larvae the most primitive of existing Formicidae.

It seems therefore that the following hypothesis might be justified. The larva of *Myrmecia* represents an ancestral formicid type. From this type, by differentiation into a large "body" and a slender curved "neck", the higher Ponerinae evolved. But before this differentiation occurred, a side branch was formed, the larvae of which became more attenuated posteriorly. This line led to the Cerapachyinae. A secondary offshoot from it gave rise (through straightening of the larval body) to the Dorylinae.

This study, then, supports Wheeler's conclusion (see above) that the Cerapachyinae are intermediate between the Ponerinae and the Dorylinae and also tends to confirm his diagram (1920, p. 52) of the phylogenetic relationships of the subfamilies of Formicidae.

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THE NORTHERNMOST EXTENSION OF BIRD HIPPOBOSCIDAE IN THE NEW WORLD (DIPTERA).—The Hippoboscidae are essentially a tropical and subtropical group of insects. In cold temperate regions the number of species is very small and most of them seem to occur only as accidental summer visitors. In the New World the 50th parallel forms about the northern limit for the family as a whole. Farther north the flies are probably not truly part of the autochthonous fauna. Among the many hundreds of North American flies I have seen in recent years, only half a dozen, all of one species, *Ornithomyia fringillina* Curtis, were taken in Alaska, at the following localities: Crater Mt., off "Columbia falcon"; Nelchina River, north of Mt. Witherspoon (N.W. of Valdez); Takotna, 63°N., 165°W., off Hudsonian spruce grouse, *Canachites c. canadensis* (Linnaeus); and Old Crow River, Timber Creek, Yukon. Takotna is the northernmost locality for a hippoboscid in the New World. In the eastern part of the continent these flies stay much farther south, the northernmost record there being an *Ornithomyia fringillina* taken by Eidmann off a junco on the Matamek River in the southern part of the Labrador Peninsula (50° 17' N.). Hippoboscidae of birds seem to extend farther north in Europe, where several species occur in Finland. One of them (*O. fringillina*) has been reported also from Iceland. None are known from Greenland. Several of the common passerine birds, serving as hosts of *O. fringillina* in southern Canada and the United States, extend during the summer to the Arctic Circle and beyond, so that the virtual absence of hippoboscids from the far north is most probably due to adverse climatic conditions.—J. BEQUAERT, Museum of Comparative Zoology, Harvard University.

VESPID WASPS (*EUMENES CURVATA*)
ATTRACTED TO SMOKE

BY CHARLES T. BRUES

Biological Laboratories, Harvard University

Smoke is not ordinarily attractive to insects, but certain flies of the family of Clythiidae have been noted by several entomologists to be strongly attracted by the smoke from burning weeds or even by chimney smoke. Kessel has recently published an account¹ of the American smoke flies which belong to the genus *Microsania*. The genus is represented by several species in Europe, two in North America, and others in Australia, New Zealand and equatorial Africa. From Kessel's account of his own observations made in California and his well documented summary of observations reported by others, it is evident that all the known species of *Microsania* throughout the world are irresistably attracted to smoke. Smoke from varied sources causes the flies to congregate, as the numerous observations relate to smouldering fires of vegetable debris, smouldering heath fires, forest fires, smouldering bonfires, and the dense smoke cloud from the chimney of a barbecue. Their occurrence on the tent of a camp in the woods is undoubtedly a similar response to a camp-fire.

My own observations on the vespid wasp, *Eumenes curvata* Saussure,² were made in the Southern Philippines, near Dumaguete, on Negros Island. This is a common wasp in the locality, frequently building its clay nests attached to walls covered with shingles made of the leaf sheaths of abaca or on bamboo slats on porches and in rooms open to continuous access from without. The flying wasps were frequently noticed flying in the porch and adjoining room of a cottage where we were living, in the hills above Dumaguete at an elevation of about 1500 feet.

When we were smoking on the porch it was noted on many occasions that the wasps on the way back and forth to their nests hovered in lanes of drifting cigarette smoke. This is obviously very

¹Kessel, E. M., American Smoke Flies. Wasmann Collector, vol. 7, pp. 23-30 (1947).

²This and the other identifications of Vespidae were kindly made by Dr. J. Bequaert.

attractive and quickly sensed by them, either by sight or odor from adjoining areas of clear air. Aside from certain small vespid wasps (*Ropalidia*) which nest in hollow bamboo railings, the large *Vespa tropica philippinensis* Sauss. which builds its carton nests under wide overhanging eaves, and certain itinerant scoliids in search of prey, this is the commonest wasp to be seen about houses. It is the only one which deliberately enters any zones of smoke that may be drifting about, as such fumes cause the others to dart quickly away when encountered during flight.

There can be no doubt that the *Eumenes* wasps, like the small *Microsania* flies are attracted by some material in smoke, quite possibly the creosote emanating from incompletely aerated fires.



Fig. 1. *Eumenes curvata* Sauss. on nest; specimen now in the collection of the Museum of Comparative Zoology.

THE ALESSANDRO FOCARILE COLLECTION OF CARABIDAE (COLLEOPTERA).—The main part of my collection of Carabidae (as of 1949) is now in the Museum of Comparative Zoology at Harvard College, Cambridge, Massachusetts, U.S.A. This museum now possesses the types, as listed below, of the ten species and subspecies of *Trechus* described by me in *Bollettino della Società Entomologica Italiana* Vol. LXXIX, 1949, pages 71-79. In some cases I did not select the actual "Type" (holotype and allotype) specimens from the type series at the time of description. In these cases I have asked Mr. P. J. Darlington to select and label appropriate specimens from the type series in question. His selections, listed below, I here designate as the holotypes and allotypes of the forms in question. The following types are now in the Museum of Comparative Zoology:

Trechus obtusus lucanus Focarile: original ♂ and ♀ (holo- and allo)types.

Trechus strigipennis valstronae Focarile: ♂ holotype and ♀ allotype from Lago Capezzone, selected by Mr. Darlington from the original type series.

Trechus schatzmayri Focarile: original ♂ and ♀ (holo- and allo)types.

Trechus marianii Focarile: ♂ holotype and ♀ allotype from Cima di Piazze, selected by Mr. Darlington from the original type series.

Trechus bremanus Focarile: original ♂ (holo)type; and ♀ allotype from Mte. Ponteranica selected by Mr. Darlington from the original type series.

Trechus magistretti Focarile: original ♂ (holo)type; and ♀ allotype from (Pizzo) Presolana selected by Mr. Darlington from the original type series.

Trechus barii Focarile: original ♂ and ♀ (holo- and allo)types.

Trechus barajoni Focarile: original ♂ and ♀ (holo- and allo)types.

Trechus larianus Focarile: original ♂ (holo)type; and ♀ allotype from Passo di Sasso Canale selected from the original type series by Mr. Darlington.

Trechus maritimus pesianus Focarile: original ♂ and ♀ (holo- and allo)types.—ALESSANDRO FOCARILE, Milano, Italy.

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THE GENERIC NAMES FOR TABANIDAE (DIPTERA) PROPOSED BY ADOLFO LUTZ¹

BY G. B. FAIRCHILD²
University of Minnesota

Beginning in 1905, Dr. Adolfo Lutz published a considerable number of papers on South American Tabanidae, mainly the Brazilian fauna. He had evidently intended to monograph the fauna, and did treat the *Pangoniinae*, the *Diachlorini* and the genera *Dichelacera*, *Stibasoma* and *Acanthocera* in a thorough way. His other publications on the family consisted mostly of local lists, descriptions of new species, and short papers outlining his views on the generic classification of the Neotropical species.

In his papers of a monographic or revisional nature, Dr. Lutz appears to have well understood the rules governing zoological nomenclature, and new names appearing in these publications are for the most part validly proposed. In his papers on general classification and in his local lists, however, which he seems to have considered of a preliminary nature, it appears that he did not realize that the names he was using were then appearing for the first time and would have to be taken into consideration by subsequent students. In many cases these names were so casually proposed, either without adequate definition or without valid included species, and almost always without bibliographic reference, that it has proven very difficult to come to a decision on their validity. In other cases, it has been difficult to decide on the year in which a certain name, published as new on several occasions, was validated.

¹Paper No. 2455 of the Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul 1, Minnesota.

²On leave of absence 1949-1950 from Gorgas Memorial Laboratory, Panama, Republic of Panama.

Several students have attempted to clarify these matters, notably Bequaert (1924) who selected genotypes of many of Lutz' genera and Borgmeier (1933) who, with better access to Lutz' published works, corrected the dates of first appearance of some of his names and added others overlooked by previous workers. Enderlein (1922, 1925) and Kröber (1932, 1934) have used a number of Lutz' names, and placed a good many more in synonymy, in some cases without adequate consideration.

In spite of these efforts, however, no complete listing of Lutz' generic names has appeared, nor has the status of a number of them ever been carefully examined in the light of the International Rules of Zoological Nomenclature. The present paper is an attempt to do this. I have seen, I believe, all of Lutz' publications, except one, which contain new generic names for Tabanidae, though there is always the possibility that others will turn up. Carlos Chagas (1925, 1929, 1934) published a list, with supplements, of Lutz' published works on all subjects numbering over 200, but even it contains some errors and omissions. His papers dealing, in whole or in part, with Tabanidae number 27, of which about 17 contain matter of nomenclatorial importance. I have appended a list of all his papers containing references to Tabanidae of which I have knowledge, but there may be others.

Lutz appears to have published, alone or jointly, 43 generic names. Some of these were variants in spelling or new names to replace preoccupied names, but 32 seem to refer definitely to newly defined groups of generic or subgeneric rank. All these names are here listed, together with references to their first appearance in print and remarks on their validity. I have not attempted to show synonymies except in a few undoubted cases, as generic and subgeneric concepts in Tabanidae are still in a rather fluid state.

The most difficult point to settle is the status of the names published in the 1909c list. This publication is an illustrated brochure or guide book giving a description of the physical plant and investigations being undertaken by the Instituto Oswaldo Cruz. It also contains lists of the collections, publications, and library. It bears no date other than the year, and no authorship. In the list of Tabanidae, 15 new generic names are proposed, being indicated by "nov. gen." or "n. gen." in all cases. 13 of these appear with valid specific names, and, although the International Rules are somewhat loosely worded on this point, I believe, ignoring other considerations,

they are thereby validated. In regard to the authorship, it is now well known that Lutz was the author of this list. It is doubtful if he realized that the names appearing therein were being published in the nomenclatorial sense as he never subsequently referred to this paper although he consistently used the names proposed therein. He himself gave me my copy, and the whole list, with minor changes, was republished in 1911a, where the new genera are all credited to Lutz, according to Borgmeier. I have not been able to secure a copy of this paper, but it seems to have been also in the nature of a guidebook to the exhibit of the Instituto Oswaldo Cruz at some sort of international scientific exposition.

The difficulty in accepting these names as of 1909 lies not only in a lack of definitions, (which is of less importance, as the names were published before 1930, when the rules on this point were modified), but in the dubious character of the publication itself. The pamphlet is anonymous, it is not a periodical, nor any regular form of scientific publication, and there is much probability that it was never intended or offered for sale, though it may have had wide distribution. There is, thus, strong reason for considering that the names appearing in it were not validly published and are hence unavailable as of that date. If this stand be taken, the next chronological appearance of the names must be considered. This was the 1911a paper, which seems to have suffered from all the faults of its predecessor except anonymity. (The Pangoniinae may be excluded from further consideration, as the new genera of this division were all validly proposed with definitions or species in recognized journals in 1909, so that they date from this year in any case). If the 1911a paper be excluded from consideration nomenclatorially, the next in chronological order is 1912, where *Dicladocera*, although not defined as a genus, is accompanied by the description and figure of a valid species in a nomenclatorially acceptable publication. The difficulty here is that this species, *unicolor* Lutz, appears not to be congeneric with the species previously included, as Bequaert and Rengifo (1947 Psyche, 53 [3-4]:68) have pointed out, necessitating the use of Enderlein's *Dasychela* for the species placed by Lutz in *Dicladocera*.

Lutz' 1913a paper validates *Stigmatophthalmus* and adds *Himantostylus*. Then, also in 1913, comes the first exposition of Lutz' scheme for the classification of the Tabaninae. Here appear all the remaining names of the 1909c list, plus four additional new ones. They are not formally proposed as new genera and are not ac-

accompanied by specific names or references to previous publications, but they are recognizably defined by being placed in a key. They appear in an acceptable publication and would seem certainly available nomenclatorially as of this date. This paper was published twice, the first time above, and a year later, 1914b, where it is accompanied in parallel columns by a German translation, a common custom at that time in this journal. I can find no changes whatever in the later edition. Between the appearances of these two "editions", the 1914a paper appeared. In lists of species all the remaining 1909c names appear and are accompanied by valid specific names except *Macrocormus* while several of the names first published in 1913 are here accompanied by valid specific names for the first time. *Macrocormus* does not appear with a valid specific name in an acceptable publication until 1918, where it is listed as "*T. (Macrocormus) rubescens* Bigot" and "*Macrocormus sorbillans*".

It is thus seen that if the names appearing in the 1909c and 1911a papers are not considered nomenclatorially available as of these dates, they became available in 1913 when they were defined, or in 1912, 1914, or 1918 when they were accompanied by valid specific names. This change in dates appears to affect but two of these names, *Di cladocera*, which changes its sense as mentioned above and *Neotabanus* which becomes a homonym of *Neotabanus* Ricardo 1911 (Rec. Ind. Mus. 4:363, Type *N. ceylonicus* Ric. 1911). No new proposal of name for *Neotabanus* Lutz is necessary, since *Taeniotabanus* Kröber 1930 (Dipt. Pat. S. Chile P. 140, Type *T. occidentalis* Linn.) is already available. In any event the group is hardly of subgeneric rank and may eventually prove undefinable.

The author has hitherto been inclined to take a liberal view of the case and accept the 1909 dating, though for the sake of forestalling possible future controversy, it might be well to adhere to a stricter interpretation of the rules and accept 1913 as the date for these names.

Amphichlorops, Lutz 1909c, p. 29, with *A. flavus* Wied., and *A. variegatus* n. sp. 1913b, defined in key. 1914a, with *flavus* Wied., Type *T. flavus* Wied. 1828 (Bequaert 1924).

Bombylopsis Lutz 1909a, p. 31, with *nitens* (Bigot), *? analis* (Fab.) and *leonina* n. sp. 1909b, p. 646, with *erythronotata* Big., *pseudoanalis* n. sp., *analis* Fab. 1805 and *leonina* n. sp. 1909c, p. 28, with *erythronotata* Big., *? analis* Fab. and *leonina* n. sp. Type *erythronotata* Big. (Borgmeier 1933).

Bombylomorpha Lutz 1911a, p. 33, with *erythronotata* Big., *pseudonalis* n. sp., *analisis* Fab. and *leonina* n. sp. Type *erythronotata* Bigot (Borgmeier 1933).

Bombylomyia Lutz 1911b, p. 69 with *B. splendens* n. sp. descr. *Bombylopsis* changed to *Bombylomyia*. 1914a with *nitens* Big. The status of these names is confusing. *Bombylomorpha* and *Bombylomyia* may have been created to replace *Bombylopsis*, thought to be preoccupied. I have been unable to find that this name is preoccupied and Lutz and Castro 1936 have reverted to its use. The selection of *erythronotata* Big. as type of *Bombylopsis* is incorrect, as it was not included in the original publication. The only species available as genotype for *Bombylopsis* is *nitens* Bigot 1892 and it is here selected. Since both *Bombylomyia* and *Bombylomorpha* were substitute names, they take the same genotype. *Ionopsis* or *Ionopsis* (q.v.) will fall as a synonym, as it has the same genotype. There is no need to replace the latter name until it becomes clear that the concept it was intended to cover is needed.

Catachlorops 1911a. emendation of *Katachlorops* (q.v.).

Chelotabanus 1913b, p. 5, in key, no species. 1914a, p. 72, with *fuscus* Wied., *impressus* Wied., *aurora* Macq., *cinerarius* Wied. 1918 with *aurora* and *impressus*. See *Odontotabanus*. Type *I. fuscus* Wied. 1819 (Bequaert 1924).

Chlorotabanus 1909c, p. 30, with *mexicanus* L. 1913b, in key, no species. 1914a, with *mexicanus* L. 1911a, with *mexicanus* L. Type *T. mexicanus* L. 1767 (Bequaert 1924).

Chrysochiton Lutz and Castro, 1936, with *auricinctus* (Lutz and Neiva) *bocainensis* n. sp., *nubiapex* (Lutz) and *rubrithorax* (Kröb.). Type by original designation, *Erephopsis auricinctus* Lutz and Neiva 1909.

Cryptotylus 1909c, with *unicolor* Wied. 1911a with *unicolor* Wied. 1913b defined in key (*Chryptotylus*). Monotypic for *T. unicolor* Wied. 1828 (Borgmeier 1933).

Dicladocera 1909c, p. 29, with *immaculata* Macq., *furcata* Wied. (*macrodonta* Macq.), *potator* Wied., *guttipennis* Wied., *macula* (*scutellata*) Macq., *luctuosa* Macq. and *rufipennis* Macq. 1911a, p. 34, with same species. 1912, with *D. unicolor* Lutz n. sp. descr. 1913b, defined in key (*Dicladocera*.) Type *T. guttipennis* Wied, 1828 (Enderlein 1922). The designation of *unicolor* Lutz by Bequaert (1924) and his subsequent restriction

- (1946 p. 68) rest on the assumption that Lutz' 1909c names were invalidly published. See introductory discussion above.
- Dyspangonia* 1905, p. 22. defined and with *fuscipennis* Wied., *clari* n. sp., *fasciata* Macq., *lugubris* Macq., *ferruginea* Macq. 1909b p. 625=*Esenbeckia* Rond. Type *Pangonia fuscipennis* Wied. 1828 (Bequaert 1924).
- Epipsila* 1909b, p. 648 with *eriomera* Macq. and *erimeroides* n. sp. descr. Type *E. erimeroides* Lutz (Enderlein 1925).
- Himantostylus* 1913a, p. 183, defined and with *intermedius* n. sp. descr. Monotypic (not *Himanthostylus* Borgm. 1933).
- Ionopsis* 1909c, p. 28 with *nitens* n. gen. (sic) and *Foetterlei* n. sp. 1909b, p. 650 defined and with *nitens* Bigot and *Foetterlei* n. sp. described (*Ionopis*). The spelling will depend on which of these publications appeared first. Neave's Nomenclator gives *Ionopis*, while Borgmeier (1933) maintains that *Ionopsis* was the original spelling. Type *nitens* Bigot 1892 (Enderlein 1925). The type species was originally included in *Bombylopsis* Lutz 1909a (q.v.) which has some months priority.
- Katachlorops* 1909c, p. 29, with *fuscipennis* Macq., *rufesceus* Fab. *intereuns* Walk., *capreolus* Wied. and *bitinctus* Walk. 1911a, p. 34. with same species. 1913b, defined in key only (*Cathachlorops*, *Gatachlörops*) Type. *Dichelacera fuscipennis* Macq. 1847 (Bequaert 1924). The emended spelling *Catachlorops*, has largely prevailed.
- Laphriomyia* 1911b, p. 70. defined and with *mirabilis* n. sp. descr. The erroneous variant *Laphriopsis* appears on p. 71. 1911a p. 34 (*Laphromyia*) Monotypic for *L. mirabilis* Lutz 1911.
- Leptotabanus* 1914a, p. 72, with *nigrovenosus* Lutz in list of Tabanidae from Xerem. 1918, in list only, no authority. 1921, in list only, no authority. The species seems never to have been described, though it is possible that *Melanotabanus fuliginosus* Lutz and Neiva (q.v.) was based on the same specimen. It is described in the same paper from a single specimen from Xerem, Rio de Janeiro, and the authors state in the paragraph preceding their list of Tabanidae from Xerem that the list includes a new species based on one specimen from Xerem. *Leptotabanus nigrovenosus* is the only new species in this list. Since the name is invalid, a nomen nudum, as listed by Neave, it does not preoccupy *Leptotabanus* Kröber 1931 as believed

- by Miller (1945), who proposed the unnecessary name *Neoleptotabanus* (Proc. Roy. Ent. Soc. London (B) 14:72).
- Leucotabanus* 1913b, defined in key. 1914a, p. 71, with *leucaspis* Wied. in list. 1914b, defined in key. Type *Tabanus leucaspis* Wied. 1828 (Bequaert 1924)).
- Macrocormus* 1909c, p. 29, with *badius* n. sp. *sorbillans* Wied., *pseudosorbillans* n. sp. and *trizonophthalmus* n. sp., 1911a, p. 35 with same species. 1913b, defined in key. Type *Tabanus sorbillans* Wied., 1928 (Bequaert 1924).
- Melanotabanus* 1914a, p. 76. defined and with *fuliginosus* n. sp. described. Monotypic.
- Micropangonia* 1922, p. 5, defined briefly by comparison with *Erephopsis*. Said to contain two species, but none named. I believe this to be a *lapsus* for *Neopangonia* Lutz (q.v.) as the characters mentioned (open first posterior cell, long proboscis and small size) are those used earlier to separate *Neopangonia* from "*Erephopsis*". Since the name could be construed as having been defined, and hence valid, I hereby select *Neopangonia pusilla* Lutz 1909 as genotype, as it agrees with the definitions, thus making *Micropangonia* a synonym of *Neopangonia*.
- Microtabanus* 1922, p. 9, defined only by having unicolorous eyes and being small. No species. This can hardly be construed as a "definition" under the rules, and I consider the name invalid and not preoccupying *Microtabanus* Fairchild 1937.
- Myiotabanus* 1928, p. 59, with *sarcophagoides* n. sp. descr. and fig. Although there is no statement that the genus is proposed as new, it is combined with a valid specific name and I believe should be considered valid. Monotypic.
- Neopangonia* 1909b, p. 651, defined and with *pusilla* n. sp. descr. and fig. Monotypic. See also *Micropangonia*.
- Neotabanus* 1909c, p. 29, with *trilineatus* Latr., *modestus* Wied. and 16 other named species. 1911a, with same species. 1913b, defined in key. 1914a, with *obsoletus* Wied., *comitans* Wied., *ixyostactes* Wied., *ochrophilus* Lutz, *triangulum* Wied., *trilineatus* Latr. and others in list. Type *Tabanus trilineatus* Latr. 1814 (Bequaert 1924).
- Odontotabanus* 1918 Lutz, Araujo and Fonseca, with *aurora*, *cinerarius*, *fuscus*. 1926 Bequaert, Exped. Amazon, p. 233, cited

- in synonymy with *aurora*. Lutz 1928, p. 56-57, with *cinerarius* Wied., *testaceus* Macq., *olivaceiventris* Macq., and *importunus* Wied. in list. Type *aurora* Macq. 1838 (Borgmeier 1933). Doubtfully distinct from *Chelotabanus*; Lutz used both names interchangeably in 1918.
- Orthostylus* 1914a, p. 74, defined and with *ambiguus* n. sp. descr. Monotypic. Preoccupied. See below.
- Orthostyloceras* Lutz in Borgmeier 1933, p. 298. New name for *Orthostylus* Lutz and Neiva, not *Orthostylus* Beck 1837 *Mollusca*. Type *ambiguus* Lutz and Neiva 1914.
- Phaeoneura* 1909a, p. 645, defined in key and with *basilaris* Wied. sole species. 1909c, p. 29, with *basilaris* Wied. in list. 1911b, with *basilaris* in list (in German translation the name is *Phaeomyia*, evidently a *lapsus*).
- Phaeotabanus* 1913b, defined in key. 1914a, in list with *litigosus* Walk., *aphanipterus* Wied. Type *Tabanus litigosus* Walk. 1850 (Bequaert 1924).
- Poecilosoma* 1909c, in list with *punctipenne* Macq., *quadripunctatum* Macq., *histris* Wied., and *cinereum* Wied. 1911a, same species. 1913b, defined in key. Type *Tabanus quadripunctatus* Fab. 1805 (Bequaert 1924). (The name is four times preoccupied).
- Poeciloderas* 1921, in list with "*quadripunctatum*". Type *T. quadripunctatus* Fab. 1805 (Borgmeier 1933).
- Poecilochlamys* 1922, briefly defined and in key. 1928, in list with *quadripunctatus* Fab. Type *T. quadripunctatus* Fab. (Borgmeier 1933). The key is the same as the 1913 key, and this name replaces *Poecilosoma* in it.
- Pseudocanthocera* 1913b, in key, no species. 1914a, in list with *marginata* Macq., *Silveirii* Macq. Type *Silvius Sylveirii* Macq. 1838 (Enderlein 1925).
- Plesiophthalmus* 1911a (not seen), with *fenestratus* Lutz undescribed. Monotypic. Nomen nudum. Preoccupied by Motschoulsky 1858 *Coleopt.* (Borgmeier 1933).
- Pseudoscione* 1918, in list as *Pseudoscione longipennis* Ricardo. No description. 1928, p. 54, proposed for *Diatomineura longipennis* Ricardo and an unnamed species from Ecuador. Species said to resemble *Scione* but have venation like *Diatomineura*. No statement that genus is proposed as new. Genotype *Diatomineura longipennis* Ricardo 1902 here designated.

- Rhabdotylus* 1909c, p. 29, with *viridiventris* Macq. and *planiventris* Wied. 1913b, defined in key. 1914a, with *viridiventris* Macq. in list. Type *T. planiventris* Wied. 1828 (Bequaert 1924).
- Stenotabanus* 1913b, defined in key. 1914a, with *taeniotes* Wied. in list. Type *T. taeniotes* Wied. 1828 (Bequaert. 1924).
- Stictotabanus* 1914, in list with *anonymous* n. sp. and *maculipennis* Macq. 1918 in list with *conspicuous* n. sp., no description. 1922, defined as having unicolorous eyes and a spot on the transverse veins; no species. Borgmeier 1933 gives type as *T. maculipennis* Macq. 1834, but this is unjustified, as there are two Macquart species of this name and Lutz did not specify. See also Bequaert 1924, Enderlein 1925. *Maculipennis* Macq. is invalid. (nec Wied. 1828). The name is very doubtfully valid.
- Stigmatophthalmus* 1909c, with *altivagus* n. sp. in list. 1911a. (not seen). 1913a, with *altivagus* n. sp. descr. and fig. Monotypic.

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A NEW *LEPTOTHORAX* FROM ALABAMA
(HYMENOPTERA: FORMICIDAE)¹

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Leptothorax (Myrafant) *tuscaloosae*, new species

Holotype worker. - Total length approximately 1.9 mm.; length of alitrunk, measured from the dorsal base of the pronotal collar to the tip of the posterior propodeal flange, 0.554 mm.; length of head, measured in profile from the anterior margin of the clypeus to the extreme occipital border, 0.512 mm.; cephalic index 93.5. (All measurements except total length given in this description with a maximum error of ± 0.016 mm.)

Eye oval, moderately prominent, with nine ocelli across its greatest length, located nearer the anterior than the posterior border of the head. Head subrectangular, with weakly convex posterior border, rounded posterior angles, and weakly convex, subparallel sides. Clypeus depressed, 1.2 times longer than broad, its anterior border rounded and entire. Antenna eleven-segmented; scape failing by approximately its greatest width to meet the occipital angle; funicular club three-jointed, as long as the remainder of the funiculus, the apical segment longer than the preceding two combined. Mandible with five teeth, the apical tooth the largest. Alitrunk slender, seen from above 0.272 mm. across its greatest width at the pronotum, evenly arcuate in profile, sloping to the base of the propodeal spines; humeri well rounded; pro-mesonotal and mesoepinotal sutures absent; other thoracic sutures weak or absent. Propodeal spines slender and acute, slightly and gradually curved inward and downward, approximately as long as the declivious face of the propodeum, the basal portions in profile forming an angle of approximately 120° with the basal face of the propodeum, their bases 0.096 mm. apart. Femora and tibiae noticeably incrassated. Petiolar node in profile with anterior face concave, and meeting the dorsal face in a bluntly rounded angle. Dorsum of postpetiole 1.5 times broader than long, not constricted in posterior half, with subparallel sides.

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Mandibles covered dorsally by close-set, longitudinal striae. Clypeus with a dark median carina running from anterior to posterior border; the remainder of the clypeus more or less longitudinally rugulose. Frontal area, frontal lobes, and cheeks rugulose. Remainder of head, most of the thorax, and the gaster moderately shining, with extremely fine punctures. Propodeum and meso- and metasternal regions of thorax rugulose, the rugulae of the declivious face of the propodeum transverse. Petiole and postpetiole densely and coarsely granulose.

Body covered by moderately abundant, long, coarse, grayish, erect hairs. Antennae with moderately abundant, short, very fine hairs over entire surface; many of these hairs on funiculus and a small number on scape suberect to erect but the majority appressed. Legs with a sparse growth of hairs similar to those on antennae; most of these appressed by a scattered few suberect to erect.

Body dark brown; mandibles, antennae, and legs pale yellow; femora infuscated over entire surface except for ends.

Gynetype. - Differing from the worker in the usual characters separating these two phases. Total length approximately 2.7 mm., length of alitrunk 0.912 mm., greatest width of alitrunk 0.576 mm., length of head 0.568 mm., cephalic index 100. Propodeal spines short and robust, their length less than the distance between their bases and approximately half the length of the declivious face of the propodeum. Sculpturing, pilosity, and color essentially the same as in the worker.

Type locality. - Tuscaloosa, Alabama.

The holotype worker, the gynetype, and forty-two paratypes consisting of seven dealate queens and thirty-five workers were collected by the author August 20, 1947, in a small patch of woods directly north of Guthrie's Nursery, which is at the Tuscaloosa Memorial Cemetery near the outskirts of the city.

Additional locality: Elrod, Tuscaloosa Co., Ala. Thirteen paratypes consisting of two dealate queens and eleven workers were collected by Barry D. Valentine and the author May 10, 1949, in the Sipsey River swamp several miles east of the town.

The paratypes of this small species vary from the holotype and gynetype noticeably in color and size. Callows are pale yellow, with infuscated head, gaster, and femora. The other specimens in the type series vary from medium to dark, almost piceous, brown. The mandibles, antennae, and legs of all are pale yellow, the femora

infuscated. Total length in the workers varies (approximately) from 1.9 mm. to 2.1 mm.; length of alitrunk varies from 0.554 mm. to 0.684 mm.; with a mean of 0.609 mm.; length of head varies from 0.505 mm. to 0.570 mm., with a mean of 0.530 mm. Total length in the queens does not possess variability sufficient for measurement, which is somewhat dependent on the degree of distention in the gaster; length of alitrunk varies from 0.929 mm. to 0.962 mm., with a mean of 0.942 mm.; length of head varies from 0.570 mm. to 0.603 mm., with a mean of 0.590 mm. The workers from Elrod are notably larger on the average than the ones from Tuscaloosa: mean length of alitrunk 0.649 mm. as opposed to 0.600 mm., mean length of head 0.549 mm. as opposed to 0.524 mm.

The holotype, the gynetype, and twelve paratypes have been deposited in the United States National Museum under U. S. N. M. No. 60339. Paratypes are in the collections of the author, the Museum of Comparative Zoology at Cambridge, and the University of Alabama.

Dr. M. R. Smith has very kindly examined types of the new species and has expressed the opinion that its closest morphological affinities are apparently to *Leptothorax* (*Myrafant*) *curvispinosus* Mayr. It can be distinguished from that species by its differently shaped propodeal spines and petiole, its smaller size, much darker body coloration, and feebler cephalic and thoracic sculpturing. Because of the shining dorsal surface of the head, the new species runs down to *L. (M.) longispinosus* Roger in W. S. Creighton's recent key of the North American *Leptothorax* (*The Ants of North America*, Bull. M. C. Z., Vol. 104). It can be distinguished from *longispinosus* by its smaller size, different coloration (mandibles, antennae, and legs in *longispinosus* moderately brown), feeble thoracic sculpturing, and shorter and more elevated propodeal spines (the spines of *longispinosus* form an angle of nearly 180° with the dorsum of the propodeum when viewed in profile).

The Tuscaloosa colony was found in a small cavity in a bank of earth under a bed of moss. It was at the base of a large oak in an open area fringing a bay-gum swamp. The Elrod colony was found in a small cavity in the earth covered partly by an overhanging root and partly by thin leaf litter. It was in a densely shaded area also on the fringes of a bay-gum swamp. Stray workers were taken during the day on low bushes near both nests.

ADDITIONS TO THE NEARCTIC MELOIDAE (COLEOP.)¹

BY F. G. WERNER

Harvard University and University of Vermont

Among specimens sent for determination by several institutions and collectors are three striking additions to our fauna, which are described below.

Epicauta cicatrix sp. n.

Figure 5

This, the thirteenth member of the *caviceps*-group, is the only one of the group thus far known from the Big Bend region. It can be distinguished from the other members, and from all other Nearctic and Neotropical members of *Epicauta*, by the form of the second antennal segment (see fig. 5).

Length: 8 to 12 mm. Black, moderately densely clothed with cinereous to yellow-cinereous pubescence, except for the black markings at the base of the elytra and on the abdomen which are characteristic of the group, and a partially denuded spot on the temporal angles of the head.

Head broad, $\frac{2}{5}$ broader across the eyes than from vertex to clypeus, tapering from just behind the eyes to the broadly rounded temporal angles. Surface moderately densely punctured and strongly microreticulate, appearing fairly shiny. Median impressed line narrowly denuded, distinct down to the level of the eyes. Antennal calluses small, denuded, shiny. Eyes prominent, slightly oblique but unmodified, $\frac{3}{5}$ as wide as high, as seen from side, with a narrow denuded zone surrounding them. Pubescence short on top of head, very short and fine, black on the patch on the temporal angles. Rest of head with rather coarse pubescence.

Antennae tapering gradually, with the intermediate segments stouter and the apical segments more slender in the ♂ than in the ♀. ♂ antennae slightly more than three times as long as anterior tibia; segment I stout, reaching $\frac{1}{4}$ across eye; II $\frac{2}{3}$ as long as I, posteriorly flattened and smooth, the base of the flattened area

¹Published with a grant from the Museum of Comparative Zoology at Harvard College.

with a transverse oval scar-like area, slightly elevated from the rest of the surface. This scar-like area has the surface roughened and with some very short erect hairs. Segment III $1\frac{1}{2}$ times as long as I, almost circular in cross-section and slightly curved posteriorly; IV as long as I, almost tubular; rest decreasing gradually in thickness and almost imperceptibly in length; XI $\frac{2}{3}$ as wide as III, $\frac{1}{3}$ longer than X. ♀ antennae $2\frac{3}{5}$ as long as an anterior tibia; segment I reaching to just beyond the margin of the eye, the rest bearing approximately the same proportion to I as in the ♂ but more slender basally and not tapering as much, so that XI is only $\frac{3}{4}$ as wide as III.

Pronotum quadrate, $\frac{1}{10}$ broader than long. Sides straight, diverging slightly from base to $\frac{1}{3}$ from apex, then forming a fairly sharp angle, converging abruptly to the collar, which projects forward slightly. Surface densely punctured and microreticulate. Disc elevated in the center into a low hump; from the central hump a set of more or less well-defined ridges project as follows: anteriorly a strongly elevated ridge, sometimes higher than the hump near its base; laterally a weak pair tending anteriorly and ending in a pair of feeble elevations on the edges of the disc; posteriorly a weak pair directed toward the posterior angles, leaving the middle of the base more or less excavated. Pubescence of disc confused, directed generally away from the central hump, toward the lateral elevations and often in a pair of whorls anteriorly.

Elytra with black scutellar markings extending across the base and forming a very weak humeral spot of a few hairs. Suture elevated on the basal $\frac{1}{4}$ and apical $\frac{1}{3}$. Underside with antero-lateral black spots on sternites II to IV, sometimes also on I and V, posterior midventral spots on II to IV, often on V in the ♂, reduced to one spot, on III, in one ♀. Middle and posterior trochanters and femora of ♂ denuded behind, the denuded area having scattered short black hairs and margined above with long cinereous hairs; the femora slightly bowed, the middle femora more than the posterior. Posterior tibial spurs slender, sticklike.

Holotype: ♂, Presidio, Texas, Nov. 14, 1944, J. H. Russell (USNM).

Allotype: ♀, eutopotypical (USNM).

Paratypes: 27 eutopotypical, 3 topotypical, Nov. 6, 1944, 6 Nov. 8, 1947, 18 Nov. 27, 1948. Distributed in the USNM, MCZ, (No. 28502), in the collections of the author and F. H. Parker. All taken

about a mile from Presidio, in the valley flat of the Rio Grande, on flowers and leaves of a yellow-flowered composite, *Viguiera stenoloba*.

Lytta mirifica sp. n.

Figures 1,3

This is one of the most striking new species of *Lytta* to turn up in the United States since the revision of the genus by Fall. The type locality, Anthony, N.M., is in the Rio Grande valley, about ten miles north of El Paso, Texas. The species probably ranges over at least the adjacent area of Mexico but cannot be very widespread in the United States or it would certainly have been collected before.

Length: 16 to 25 mm. Stout, black, with brick-red pronotum. Almost glabrous above, with some short, erect black pubescence below. Elytra coarsely reticulate, as in *reticulata* Say. Intermediate segments of ♂ antennae somewhat lengthened and thickened. In Fall's key² this species would go to Group I, near *ulkei* Horn. However, it is unique in our fauna in combination of color pattern and elytral reticulation.

Head subquadrate, 9/10 as long from vertex to clypeus as wide just behind the eyes, with scattered coarse punctures, fine punctulation and deep microreticulation, appearing roughened but somewhat shiny. Median impressed line distinct above, becoming weak or obsolete toward the clypeus. Eyes half as wide as high as seen from the side. Clypeus and labrum sculptured like head but with denser pubescence; labrum feebly emarginate.

♂ antennae (fig. 1) half as long as body from vertex to tip of elytra, reaching basal fourth of the elytra. Intermediate segments elongate-moniliform, longer and stouter than in the ♀, particularly IV to VI. Segment I stout, reaching 1/4 across the eye; II short, 3/8 as long as I, strongly constricted at base, particularly externally; III 5/6 as long as I, normal; IV 1/5 longer than II, slightly swollen; V equal to IV or slightly longer, slightly thicker; VI to X decreasing slightly in length and thickness; XI 1/10 longer than I and slightly thicker than X.

♀ with first antennal segment stout, twice as long as broad and reaching 1/4 across eye; II short, 3/8 as long as I and constricted as in ♂; III 3/4 as long as I and 4/5 as thick; IV 9/10 as long as I; V to VII decreasing in length; VII to X approximately equal, 1/3 as long as I; III to XI gradually increasing in thickness, X being

²Fall, H. C., 1901, Trans. Am. Ent. Soc. 27:295.

1/3 thicker than III; XI stout, slightly thicker and almost 4/5 longer than X.

Pronotum 1/10 broader than long, hexagonal, angulate at the sides just before the middle, with scattered coarse punctures, fine punctulation and shallow microreticulation, appearing smooth and feebly shiny. Disc flattened, with a feeble median impressed line, a pair of feeble impressions laterally behind the middle and one in the center of the base. Basal impressed line distinct.

Elytra coarsely reticulate, with the ridges of the reticulations narrow. The entire surface is punctulate and microreticulate, appearing dull and roughened. Underside entirely black, more densely punctured and pubescent than above. Anterior tibiae with two slender apical spurs in both sexes. Middle tibiae bowed; posterior tibiae slightly bowed, with the inner apical spur slightly broadened, the outer broad and longer, both obliquely excavated. ♂ with the sixth abdominal sternite with a V-shaped notch which extends forward as a feeble groove; pygidium normal, rounded apically; aedeagus (fig. 3) flattened, with two recurved spines.

Holotype: ♂, Anthony, New Mexico, June 21, 1941, R. H. Crandall (MCZ No. 28500).

Allotype: ♀, eutopotypical (MCZ).

Paratypes: 20 ♂♂, 11 ♀♀ topotypical, May 23 to July 15, 1941, R. H. Crandall. In the collections of Cornell University, F. H. Parker and the author.

Lytta navajo sp. n.

Figures 2,4

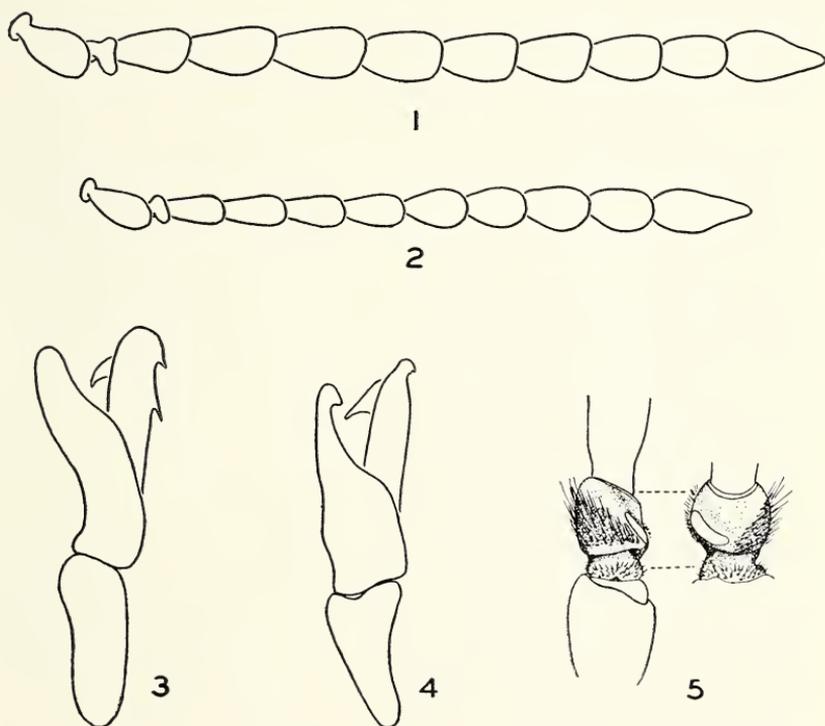
Length: 16 to 23 mm. Moderately stout, deep blue-black except for a small orange frontal spot on the head, semi-opaque and with the elytra scabrous. In Fall's key (footnote 2) this species runs to Group II, couplet 1, but differs from all of the species listed there in being all blue-black, having the elytra scabrous and the meta-trochanters of the ♂ not spinose. Entire surface deeply microreticulate, appearing dull. Head and pronotum with some short, erect pubescence; elytra almost glabrous; underside with slightly longer pubescence than head and pronotum.

Head triangular, widest at the temporal angles, 1/5 broader than long, with dense, moderately deep but small punctures, somewhat uneven on the disc. Median impressed line distinct down to the level of the hind margin of the eyes. Eyes slightly more than

half as wide as high as seen from side. Clypeus with a broad transverse basal impression, and with sculpture like head; labrum smoother, feebly emarginate.

♂ antennae (fig. 2) $2/5$ as long as body from vertex to tip of elytra, almost the same as in the ♀, becoming gradually stouter apically. Segment I moderately stout, reaching $1/3$ across eye, with the apex oblique; II short, $3/8$ as long as I; III $9/10$ as long as I; IV to X subequal to III in length, becoming moniliform: XI $2/5$ longer than I, sharply pointed. The antennae of the ♀ are essentially like those of the ♂.

Pronotum $1/7$ broader than long, about as wide as head, flattened and roughened on the disc, widest at apical third. Sculpture similar



Figs. 1-5. Fig. 1. *Lytta mirifica* sp. n., ♂, right antenna. Fig. 2 *Lytta navajo* sp. n., ♂, right antenna. Fig. 3. *Lytta mirifica*, ♂, genitalia, from right side. Fig. 4. *Lytta navajo*, ♂, genitalia, from right side. Fig. 5. *Epicauta cicatrix* sp. n., second segment of right antenna, dorsal and posterior views.

to head except toward middle of disc, which is smoother. Base with a strong transverse impression. Median impressed line feeble.

Elytra coarsely scabrous, with very feeble costulae, one near the margin, another arising one third of the way from the humeri to the suture and a third arising near the scutellum. Legs stout, with the tibiae flattened, the middle and posterior tibiae bowed in both sexes. Outer spur of the posterior tibiae broad, the inner slender. ♂ with sixth abdominal sternite deeply and sharply notched, fifth broadly and feebly notched; aedeagus (fig. 4) constricted near apex, and with a small double recurved spine.

Holotype: ♂, 22 mi. N. of Cameron, Coconino Co., Arizona, May 19, 1949, H. Epton, feeding on *Astragalus*. (MCZ No. 28501).

Allotype: ♀, eutopotypical (MCZ).

Paratypes: 1 ♂, 2 ♀ ♀, eutopotypical, in the collections of the University of Wyoming, F. H. Parker and the author.

RECORDS AND FLOWER PREFERENCES
OF MASARID WASPS
(HYMENOPTERA: VESPIDAE)

By

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and

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The observations which follow on the masarid wasps in Colorado are based largely upon collections made (by KWC) in the vicinity of the Science Lodge of the University of Colorado during the interval July 26—August 21, 1949. Additional flower records and information upon eleven species of *Pseudomasaris* from Arizona, California, Oregon, South Dakota, Texas and Utah, as well as from Colorado, are included (by JB) from previously unpublished notes. All records, therefore, rest on the authority of Dr. J. Bequaert if they are not initialled "(KWC)".

Science Lodge, it should be remarked, is located at the margin of Arapaho Moraine, below Mount Niwot, approximately eight miles NNW of the town of Nederland, Colorado, at an altitude of 9,528 ft., just three miles East of the Continental Divide. It is thus in the uppermost fourth of Ramaley's "Montane Zone", heavy stands of lodgepole pine characterizing the region. Road margins and clearings were frequently densely populated with flowers very attractive to aculeate Hymenoptera, and collecting could hardly have been better. The varied terrain with predominantly ponderosa pine-Douglas fir forests below, subalpine fir-Engelmann spruce stands and tundra above, all make Science Lodge located in the intermediate lodgepole pine forest ideally situated as a central base for the field naturalist.

The records which follow may be added to those of Bradley (1922) and Bequaert (1929, 1940, 1943). As many of the older records of *Pseudomasaris* flower preferences are today uncertain because of obvious misidentification of the plant concerned, it is very important that all new records be validated by authority. The

*Penstemon*¹ species recorded from Colorado (by KWC) were all checked or identified by the well known authority on the Scrophulariaceae, Dr. Francis W. Pennell of the Academy of Natural Sciences, Philadelphia, Pa. The Colorado *Phacelia* were likewise checked by Prof. Robert Prettyman of Butler University. *Phacelia sericea* and *Ph. ramosissima* were named by Dr. R. E. Schultes, of Harvard University, from dried specimens. Dr. C. D. Michener supplied the name *Phacelia popei* for the record of *Pseudomasaris texanus*, and Dr. J. Bequaert determined the *Ph. californica* from fresh material.

Of the 11 species mentioned below, the first three are all that are known from Colorado. The Colorado captures are set off from other records in separate paragraphs for ease of reference.

1. *Pseudomasaris (Toryna) vespoides* (Cresson)

COLORADO: Hill's Mill (directly above Science Lodge, 10,000 ft.), 1 ♂ sunning on open, gravelly ground, at 9 AM, July 26 (KWC); Rainbow Lakes, 10,000 ft., 7 ♂ and 6 ♀ at *Penstemon alpinus* Torr., 11 AM to 4 PM, and 1 ♂ at *Penstemon unilateralis* Rydb., 9 AM, July 30 (KWC); Gold Hill, 8,300 ft., 1 ♂ and 2 ♀ at *Penstemon alpinus*, 8:45 AM, Aug. 6 (KWC); vicinity of Science Lodge, 9,500 ft., 2 ♀ within flowers of *Penstemon alpinus*, 11:20 AM, Aug. 13, and 1 ♀ sunning at road margin, 8 AM, Aug. 14 (KWC); Poudre River Canyon, 9 ♂ (L. D. Anderson); Creede, 8,844 ft. (S. J. Hunter); Pike's Peak, 1 ♀ and 1 ♂ (L. Bruner); Ute Creek, Sage Flats (L. Bruner); Grand Junction, 1 ♂ (L. Bruner); La Junta, 1 ♀ (Lantz); Florissant, at *Penstemon* sp. (S. A. Rohwer).

OREGON: Hood River, 1 ♂ (J. Nottingham); Milton, 2 ♂, June 22, 1938 (K. Gray and J. Schuh); 10 miles West of Bend, 1 ♂, June 21, 1939 (K. Gray and J. Schuh); Hart Mountain, 1 ♀, June 17, 1938 (K. Gray and J. Schuh); Cornucopia, 6,200-7,000 ft., 1 ♀ at *Penstemon* sp., July 25, 1936 (H. A. Scullen). CALIFORNIA: Auburn, many ♂ ♀ (L. Bruner); San Jacinto Mts., 1 ♀ (R. M. Beamer); Altadena, 2 ♂ (KWC); Pasadena, 1 ♀ at cultivated *Penstemon azurea* Benth. (tentative determination by A. H. Sturtevant), June 9, 1945 (KWC). UTAH: Provo (T. Spalding). SOUTH DAKOTA: Custer; Whitewood; Spearfish, 1 ♂, July 15, 1924. WYOMING: about 10 to 15 miles W. of Cheyenne, on the highway to Laramie, 8,500 ft., Albany Co., August 11, 1949, and August 10,

¹We follow Pennell (1935, Ac. Nat. Sci. Philadelphia, Monograph 1, p. 200) in using *Penstemon*, rather than *Pentstemon* or *Pentastemon*.

1950, at *Penstemon unilateralis* (R. R. Dreisbach); flower determined by Dr. F. W. Pennell; both ♀ and ♂ very numerous while the sun was shining, visiting the flowers; none were at the flowers while it was cloudy.

This species is one of the most widely distributed of the genus, being known at present from Oregon, California, Nevada, Wyoming, Idaho, South Dakota, Utah, Colorado, Nebraska, Arizona and New Mexico. Its true foodplants appear to be several species of *Penstemon*, as discussed elsewhere. In this connection, Cresson (1864) states that Ridings collected *Ps. vespooides* near Empire City, Colorado, at flowers of "a plant allied to the genus *Lobelia*, growing abundantly on the roadsides." This was evidently a *Penstemon*.

The extent of the yellow marking varies greatly. Females from California are often more yellow than those from Colorado, sometimes even showing short yellow longitudinal streaks on the mesonotum before the scutellum. Some females are nevertheless practically colored alike in both geographic regions, so that it does not seem possible to segregate the very xanthic specimens as a distinct geographical subspecies. Moreover the specimen with the greatest extent of yellow is a female from Arizona (White Mesa, Kayenta), which not only has very wide abdominal bands, but also has most of the pronotum, scutellum, postscutellum, propodeum and pleura yellow, curved yellow lines along nearly the entire notauli and side lines near the tegulae on the mesonotum. Such extreme variants are very similar to *Ps. wheeleri*. If the need were felt for a special name, they should be called var. *robertsoni* Cockerell.

2. *Pseudomasaris (Pseudomasaris) marginalis* (Cresson)

COLORADO: Moraine below Hill's Mill, 9,800 ft., 1 ♀ at *Phacelia heterophylla* Pursh, 10 AM, July 27 (KWC); Rainbow Lakes, 10,000 ft., 3 ♂ and 2 ♀ at *Phacelia heterophylla*, 9 AM to 2 PM, July 30 (KWC); vicinity of Science Lodge, 9,500 ft., 1 ♀ sunning on open, sandy bank of road, 9:25 AM, Aug. 5 (KWC); Sierra Blanca (L. Bruner); Ute Creek (L. Bruner); Cascade Lodge, Rocky Mountain National Park; Echo Lake, 12,000 ft., 1 ♀ (R. R. Dreisbach and R. K. Schwab).

UTAH: Bear River, North slope of Uinta Mts., 8,000 ft., 2 ♂ and 3 ♀ at *Phacelia sericea* (Graham) Gray, June 27, 1949 (F. Werner and W. Nutting).

Known from British Columbia, Alberta, Utah, Colorado and New Mexico. The food plants are species of *Phacelia*.

3. *Pseudomasaris (Ps.) zonalis* (Cresson)

COLORADO: vicinity of Science Lodge, 9,300 ft., 2 ♂ and 3 ♀ at *Phacelia heterophylla* Pursh, 7:45 to 11:30 AM, July 28, and 2 ♂ and 1 ♀ at *Phacelia heterophylla*, 10:15 to 10:45 AM, Aug. 5 (KWC); Rainbow Lakes, 10,000 ft., 3 ♂ at *Phacelia heterophylla*, 1 PM, July 30 (KWC); Gold Hill, 8,300 ft., 1 ♀ at *Phacelia heterophylla*, 8:50 AM, Aug. 6 (KWC); Mont Alto, 8,000 ft., 1 ♀ at *Phacelia heterophylla*, 1 PM, Aug. 6 (KWC); Boulder, 1 ♀ at *Besseyia plantaginea* (Benth.) Rydb., May 15, 1908 (S. A. Rohwer).

OREGON: Cornucopia, 6,200 to 7,000 ft., 1 ♀, July 25, 1936 (R. E. Reider); Mt. Hood, 1 ♂ (J. Nottingham); 5 miles west of Suttle Lake, 1 ♂, July 8, 1939 (K. Gray and J. Schuh). CALIFORNIA: Lassen National Park, 1 ♂ (C. T. Brues); Emigrant Gap, 1 ♀ (M. Cazier).

Known at present from British Columbia, Washington, Oregon, California, Nevada, Idaho, Utah, Colorado and Nebraska. The normal foodplants appear to be species of *Phacelia* and possibly *Besseyia*. Aside from Cresson's (1864) remark that Ridings discovered *Ps. zonalis* in August "on a plant most likely to be of the genus *Phacelia*," the above flower records appear to be the first definite observations on the flower choice of this species. It is of interest that Ridings also found *Ps. marginalis* on the same "*Phacelia*" as *Ps. zonalis*.

4. *Pseudomasaris (Ps.) occidentalis* (Cresson)

Known from Kansas, New Mexico and Texas. Its only known foodplants are *Penstemon*.

5. *Pseudomasaris (Ps.) coquilletti* Rohwer

CALIFORNIA: Marsh Creek, Mount Diablo, 1 ♂ and 1 ♀ at *Phacelia californica* Cham., April 20, 1949 (R. M. Bohart). ARIZONA: Upper Basin, Sabino Canyon, Sa. Catalina Mts., 4 ♀ at *Phacelia ramosissima* Dougl., April 22, 1949 (JCB).

Known only from California and Arizona thus far. The foodplants are species of *Phacelia* and *Eriodictyon*.

6. *Pseudomasaris (Ps.) wheeleri* J. Bequaert

CALIFORNIA: Yosemite, 1 ♀, June 12, 1925 (A. L. Melander); Big Pine Creek, Inyo Co., 1 ♀ at *Penstemon* sp. (R. M. Bohart); Charleton Flats, 6,000 ft., Los Angeles Co., 1 ♂ and 1 ♀ (KWC);

Chilao, 6,000 ft., Los Angeles Co., 1 ♀, July 23, 1944 (A. H. Sturtevant).

Known only from California. It seems to use as foodplants both *Eriodictyon* and *Penstemon*.

7. *Pseudomasaris* (*Ps.*) *edwardsii* (Cresson)

CALIFORNIA: San Jacinto Mts. (R. H. Beamer); Deep Creek, at edge of Mohave Desert, at *Eriodictyon tomentosum*. UTAH: Eureka.

Known from Washington, California, Nevada and Utah. Visits both *Eriodictyon* and *Phacelia*.

8. *Pseudomasaris* (*Holopticus*) *texanus* (Cresson)

TEXAS: Big Bend National Park, Chisos Mts., 3 ♀ at *Phacelia popei* Torrey and Gray, April 11, 1949 (C. D. Michener and R. M. Beamer).

Typically *Ps. texanus* has part of the thorax (particularly on the pronotum) and part of the abdomen ferruginous-red; but the extent of this color varies. It is usually more developed in the females, and even in Texas some males are almost without reddish coloration. The other pale markings are decidedly yellowish. *Ps. texanus* appears to occur only in Texas and New Mexico. The published records from California and Arizona, and probably also those from Utah, should be referred to *Ps. rohweri*, which is possibly only a subspecies of *texanus* (see below). The normal foodplants are most likely species of *Phacelia*, although there is as yet but one definite observation.

9. *Pseudomasaris* (*H.*) *rohweri* Bradley

CALIFORNIA: Westgard Pass, Inyo Co., many ♂ and ♀, at *Phacelia* sp., June 18, 1942 (R. M. Bohart). ARIZONA: Upper Basin, Sabino Canyon, Sa. Catalina Mts., 1 ♀ at *Phacelia ramosissima* Dougl., April 22, 1949 (JCB).

Ps. rohweri is known from California and parts of Arizona (the published records of *texanus* for Tempe, Globe and Phoenix refer to *rohweri*). *Ps. rohweri* has been taken at *Phacelia* only. It is very closely related to *Ps. texanus*, differing mainly in the pure white, not yellowish, markings.

10. *Pseudomasaris* (*H.*) *bariscapus* Bradley

More information is urgently needed for this species which is known only from the male holotype collected at Quartzite, Arizona.

11. *Pseudomasaris* (H.) *phaceliae* Rohwer

More information is needed for this species also. It is known only from New Mexico where it was collected attending *Phacelia*.

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AN ASIATIC TINGID NEW TO NORTH AMERICA
(HETEROPTERA)

BY NORMAN S. BAILEY

Boston University

In studying a collection of Tingidae from the New Haven Connecticut Agricultural Experiment Station, two somewhat damaged specimens of an unfamiliar *Stephanitis* were noted. Since no description of the species could be found in the literature dealing with American species, they were sent to Dr. Reece I. Sailer for determination. They proved to be *Stephanitis globulifera* (Matsumura) when compared with specimens in the National Museum. The species was first described by Matsumura as *Tingis globulifera* in 1905. Later Horváth (1912) properly transferred it to the genus *Stephanitis* and redescribed it in some detail. In a 1930 publication Matsumura supplied an English translation of the description which is not very satisfactory and a very small, unsatisfactory figure is also given. Since these three references are not generally available, it seems desirable to include a brief comparative description of this recent addition to our insect fauna.

The two specimens mentioned above were sent to the Experiment Station by Mrs. L. B. Winton of Greenwich in late October of 1946. Therefore, correspondence was initiated to gather more details of their occurrence. Mrs. Winton kindly kept me well informed concerning the appearance and development of the population in her garden during the summer of 1950. However, it was after mid-August before many adults were observed. On August twenty-third I visited her garden and found a heavy infestation of nymphs and adults (mostly somewhat teneral) on a splendid specimen of *Pieris japonica* (Thunb.) Don planted in a sheltered corner between the house and an open porch. More than 150 adults were collected in a few minutes and a score or so more were kept alive for further study.

Mrs. Winton reported that the lace-bugs were first troublesome on the *Pieris* in 1945. By the following year they were destructively abundant. For a time she considered removal of the host plant because it was so seriously injured by them. However, by frequent

spraying, continued intermittently even throughout the mild winter of 1949-50, the population was somewhat controlled and the plant was still vigorous at the time of my visit.

The late appearance of the adults suggests that this species overwinters in the egg stage as do the other two species of *Stephanitis* that occur in New England and that also infest members of the plant family Ericaceae. Of added interest is the fact that *Stephanitis pyrioides* (Scott) was collected on a deciduous azalea on the opposite side of the house. This species was not found on *Pieris*. However, a few specimens of *S. globulifera* were associated with *S. pyrioides* on the azalea. Such other ericaceous plants as *Kalmia* and *Rhododendron* in her garden supported no lace-bugs at that time.

It is evident that this recently introduced species may become a serious pest of *Pieris* and possibly of other ornamental Ericaceae. Through Dr. C. L. Remington I learn that for two or three years the nurserymen of Fairfield County, Connecticut have complained of serious damage to *Pieris* by lace-bugs. Since other species are not known to feed on that host, it is apparent that *S. globulifera* is already well established. At this time it is only possible to suggest that eggs of the species were probably introduced before 1945 in the foliage of evergreens shipped from Japan or elsewhere. Mrs. Winton knew of infested plants in four or five gardens within three to eight miles of her home. She thought these infestations were probably of earlier origin than the one on her *Pieris*.

The following notes provide criteria for the identification of the three species of *Stephanitis* now established in the northeast. Both *S. pyrioides* (Scott) and *S. globulifera* (Matsumura) may be readily distinguished from *S. rhododendri* Horváth by their somewhat greater length, by their darker hood and hemielytral markings (which become intensely black in *S. globulifera*), by their much more inflated hoods (again extreme in *S. globulifera*), and by their much abbreviated lateral carinae. The paranota of *S. rhododendri* flare conspicuously. This species also differs from both the other species in the greater width of the hemielytra and in the abundance of silky setae on all the nervures of the membranous parts.

The differences between *S. pyrioides* and *S. globulifera* are less obvious, but, nevertheless, pronounced. The most noticeable distinguishing features include the conspicuously dark color pattern of *S. globulifera*. In this species the entire hood of mature specimens is black. All the pronotal (including paranotal) nervures, except

the apex of the median carina, are black as are most of the hemielytral nervures. Areolae of the hood, the discoidal, and the sutural areas are fumeus as are the cells of the basal and apical bands. Although the color pattern of *S. pyrioides* is similar, the paranota and the discoidal elevations are nearly colorless and in all areas the coloration is brownish and much less intense. Only the areolae of the hemielytral bands are fully infuscated.

Interesting differences are seen in the relative proportions of the hoods and pronotal carinae of these two species. In *S. globulifera* the much inflated, globose hood is twice as high at its peak as the crest of the median carina while in *S. pyrioides* the hood and carina are sub-equal in height. Both species have the lateral carinae much reduced in length as compared with *S. rhododendri*. However, in *S. globulifera* they are half again as long as the distance between their anterior ends and the back of the hood while in *S. pyrioides* they are about as long as the distance between their anterior ends and the back of the hood. In *S. globulifera* the hood is much wider than the distance between the lateral carinae while in *S. pyrioides* the hood is only slightly wider. Both species have the paranota almost vertical rather than flaring as in *S. rhododendri*. Although differences in the relative lengths of the antennites and differences in other features can be shown, they are slight and those indicated are adequate for the ready separation of the three species now occurring in New England.

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A BIBLIOGRAPHIC NOTE ON SAY'S TWO TRACTS OF MARCH, 1831, AND JANUARY, 1832.—In vol. 8 of "Psyche" (1899, pp. 306-308), S. H. Scudder called attention to the existence of a tract entitled "Descriptions of New Species of North American Insects Found in Louisiana by Joseph Barabino," by Thomas Say. This was published at New Harmony, Indiana, with the date March, 1831, printed on the title page, and has 19 numbered pages. Scudder pointed out that the text matter of this tract differed entirely from the one Say published, also at New Harmony, in January, 1832, under the similar title: "New Species of North American Insects Found by Joseph Barabino Chiefly in Louisiana" (16 numbered pages). The text of the 1832 tract was copied by J. LeConte in his edition of Say's "Complete Writings", 1859, vol. 1, pp. 300-309), but not that of the 1831 tract. Although this was made perfectly clear by Scudder, the matter was misunderstood by W. Horn and S. Schenkling, when they prepared their "Index Litteraturae Entomologicae." The entry No. 190018 in this work (1928, vol. 3, p. 1050) is erroneous in two respects. Both tracts are listed under this one item number and the 1831 tract is given as "separate" (or reprint) of the 1832 tract. In addition the text on pp. 300-309 of the LeConte edition is given as covering both tracts. An original of the March, 1831, tract was for many years in the library of the Boston Society of Natural History. Its present location is unknown to the writer. However, the library of the Museum of Comparative Zoology contains a photostat of the original (including a copy of the Boston Society's bookplate). It may be useful to point out that this tract has no introductory remarks nor any special information on localities additional to the statements given with the several descriptions. Furthermore the description of 3 of the 4 new species of Hymenoptera (*Polistes metrica*, p. 15; *Anthophora frontalis*, p. 16; and *Megachile pollicaris*, p. 17) are copied almost word for word in Say's later article in Boston Jl. Nat. Hist., vol. 1, pt. 4, 1837 (respectively on pp. 388, 409 and 406). The generic name *Megachile* is also misspelled *Megatchile* in 1837, but the specific name is now spelled *pollicaris*. The description of the fourth species, *Formica mellea* (p. 14) is copied in the first installment of the same article, *Op. cit.*, vol. 1, pt. 3, 1836, p. 286. The 1831 tract also contains a redescription of both sexes of *Xylocopa carolina* Fabricius (pp. 18-19), later reproduced by Say in 1837.—J. BEQUAERT, Museum of Comparative Zoology, Cambridge, Mass.

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