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ON SOME CENTRAL AND SOUTH AMERICAN PTEROSTICHINI (COLEOPTERA, CARABIDAE) IN THE MUSEUM OF COMPARATIVE ZOOLOGY*

BY S. L. STRANEO
Gallarate, Italy

Some weeks ago I received for study from Dr. P. J. Darlington Jr. many undetermined Central and South American Pterostichini from the collection of the Museum of Comparative Zoology of Cambridge, Massachusetts. This material was so interesting that I decided to write the present notes on it and on a few examples of two of the same species in my collection. I have to thank Dr. Darlington for submitting these specimens to me and for permission to keep many duplicates for my collection.

Tichonia orientalis, n. sp.

Purplish violaceous, metallic color stronger in the holotype ♂ than in the allotype ♀; lower surface blackish, legs dark rufopiceous, antennae and palpi wholly ferrugineous. Length 11.6 mm.; width 4.4 mm. Head robust; eyes prominent and convex; frontal impressions wide and deep, narrow and strongly divergent behind, reaching the 2nd supraorbital seta; antennae long and slender, exceeding by the last three segments the base of the pronotum. Prothorax transverse in the ♂ (2.5 by 3.3 mm.) and nearly square in the ♀; sides rather strongly rounded and narrowed to apex (2 mm.), straight or a little subsinuate towards base (2.8 mm.); anterior angles obtuse, rounded; basal angles nearly square, with apices slightly rounded; basal impressions, one on each

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

side, deep, wide, more than one half the length of the prothorax; space between the basal impressions and the sides strongly sloping towards the impressions; lateral margin narrow, with the two usual setiferous punctures; base impunctate, unmargined, nearly straight; disc very depressed, with the median line deeply impressed, elongate, reaching the base, not reaching the anterior margin. Elytra oval (7.4 by 4.4 mm.), strongly convex; shoulders square, each with a distinct tooth; basal margin strong, nearly straight; striae deep, impunctate; interstices strongly convex, base of the second with an umbilicate pore, third without dorsal punctures, sixth and seventh a little raised near the shoulders; apical declivity rather strong. Underside wholly impunctate; prosternum with a moderate depression before the coxae; prosternal process not margined at the extremity; metepisterna very short; abdominal segments strongly sulcate across the base; anal segment with a single puncture on each side in the ♂ and two in the ♀. Aedeagus with apical blade peculiarly formed (Fig. 1). Anterior tarsi of ♂ moderately dilated.

Holotype ♂ from Hansa Humboldt, Sta. Catharina, Brazil, in my collection (from E. Reitter); allotype ♀ from Nova Teutonia (27° 11′-52° 23′), 3500 m., Brazil (F. Plaumann, 20-X-1948) (Museum of Comparative Zoology, Type No. 28,441).

This new species has, like *T. catharinae* Tschit., the base of the prothorax distinctly narrower than the base of the elytra, but the sides of the prothorax are slightly subsinuate toward the base and the size is much smaller (11.6 instead of 16 mm.).

Tichonia paraguayensis, n. sp.

Purplish violaceous on prothorax and elytra; head blackish; lower surface black, shiny, a little iridescent; legs blackish; antennae and palpi dark rufopiceous. Length 15.2 mm.; width 5.7 mm. Head robust and strongly sculptured; eyes wide and prominent; frontal grooves rather narrow, not elongate, reaching only the anterior supraorbital puncture; antennae rather robust, exceeding the base of the prothorax by the two last segments. Prothorax moderately transverse (3.4 by 4.3 mm.), with sides strongly rounded and narrowed anteriorly (width of apex 2.3 mm.), only a little rounded and nearly straight towards base (4.1 mm.), which is wider than base of elytra; anterior angles obtuse, rounded; basal ones raised, nearly square, not dentate; basal impressions much longer than in any other species of the genus, reaching ¾ of the length of the prothorax, very deep; lateral margin narrow, with the two usual punctures; base impunctate, strongly depressed, as is the whole disc. Elytra oblong-oval (9 by 5.7 mm.), convex, with the sides slightly rounded behind the shoulders and widest near middle; shoulders square, dentate; striae deep, impunctate; interstices very convex, the sixth and seventh a little raised near shoulders. Prosternum with a moderate longitudinal groove; prosternal process not margined; metepisterna short; ventral segments strongly sulcate across base and with deep depressions at sides; anal segment with one fovea on each side in ♂ and two in ♀. Aedeagus with apical blade rounded, without apical spine.

Holotype ♂ and 2 ♂♂ paratypes from Rio Confuso, Paraguay (from Institut Fabre, through Prof. Porta), in my collection; allotype ♀ from Villarica, Paraguay (Museum of Comparative Zoology, Type No. 28,440).

This new species is colored like *T. superba* and *festiva* Tschit. but belongs to the group of *depressicollis* Dej., with the tip of the aedeagus simply rounded, without spine. It differs from every previously known species of the genus by the very long, strong basal impressions of the prothorax, which reach three fourths the length of the prothorax, while in the other species they do not exceed half the length.

Oxycrepis parvula, n. sp.

Black shining, with apex of elytra slightly brownish; antennae with segments 1-3 ferrugineous brown, 4-6 darker, 7-11 wholly white; ventral segments brownish, iridescent; anal segment ferrugineous. Length 5.6 mm.; width 2.2 mm. Head elongate; eyes wide, moderately convex, temples very short; frontal grooves deep, wide, short; antennae long.

Pronotum as in the other species of the genus, nearly as long as wide (1.3 by 1.4 mm.), with base (0.7 mm.) narrower than apex (0.8 mm.); latter with a strong, entire margin; base impunctate, with sides strongly oblique, so that the basal angles are obtuse; lateral margins very narrow; disc strongly convex, with median line deeply impressed from anterior margin nearly to base. Elytra subrectangular (3 by 2.2 mm.); shoulders widely rounded; striae deep, wide, and strongly punctate; interstices convex; striae 4-9 not reaching base of elytra. Underside impunctate; metepisterna elongate, strongly grooved inwardly; anal segment of ♂ with one setiferous puncture on each side.

Holotype ♂ from Rio Frio (S. of Santa Marta), Prov. of Magdalena, Colombia (Museum of Comparative Zoology, Type No. 28, 436); and allotype ♀ from Sevilla (near Rio Frio), August 28 (in my collection). Both specimens collected by P. J. Darlington Jr.

This new species is near *gracilis* Bts. but is less narrow, with apex of elytra darker, and with base of prothorax wholly impunctate.

Loxandrus minimus, n. sp.

Head and pronotum brown, more or less infuscate; elytra blackish brown with humeral margins, suture, and lateral margins ferrugineous; epistoma, legs, palpi, and first three antennal segments ferrugineous, the other segments darker. Length 4.2 mm.; width 1.8 mm. Head normal; eyes moderately convex; frontal grooves short and wide; antennae rather long. Prothorax transverse (1 by 1.4 mm.), slightly emarginate anteriorly, with an anterior submarginal line not interrupted at middle; sides moderately rounded, slightly subsinuate before base; anterior angles rounded, not or very little prominent; anterior margin a little narrower (0.95 mm.) than base (1.2 mm.); hind angles square, with their apices sharp and dentate; basal impressions rather deep, moderately elongate; spaces between them and lateral margins nearly flat; lateral margins rather narrow, each with the two usual punctures; base a little depressed, not margined at sides, evidently punctate at middle; disc slightly convex, with median line rather deep but short. Elytra subrectangular (2.6 by 1.8 mm.); sides rounded just behind shoulders, thence parallel for ¾ of length; shoulders widely rounded; striae deep and well punctate; interstices moderately convex. Underside smooth; metepisterna twice as long as wide. Hind tarsi not carinate above; onychium glabrous beneath, nearly as long as the first segment. Aedeagus as figured (Fig. 2).

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,438), allotype ♀ (in my collection), and one paratype (M.C.Z.) from Rio Frio (S. of Santa Marta), Prov. of Magdalena, Colombia; and 4 additional paratypes (M.C.Z. and my collection) from Aracataca (S. of Rio Frio). All specimens taken by P. J. Darlington.

L. minimus is the smallest species of the genus. The small size and the color distinguish it at once.

Sierrobius, n. gen.

Not winged; glabrous. Head with clypeus bisetose; two supraorbital setae each side; supraorbital ridges regular; labrum transverse, 6-setose; mandibles rather elongate, sharp, hooked at tip, the external scrobes without setae; mentum rather deeply incised, median tooth more or less prominent, excavated at apex, lightly incised in some species, truncate or rounded in others, lobes rounded at sides, apices of epilobes barely projecting as a short tooth on each side; ligula short, wide, apex bisetose; paraglossae narrow, membranous, with apical halves free; palpi with penultimate segments bisetose, the apical ones slightly attenuate and subtruncate at apex, apparently glabrous, but actually with a few very short, very thin setae; maxillae sharp, hooked at apex, inwardly fringed with bristles, outer lobe jointed; maxillary palpi with last segment fusiform; antennae rather short, pubescent from and including segment 4. Prothorax with a setigerous pore near each basal angle and 1-3 such pores on each side in different species, in anterior half. Elytra with a basal margin, 9-striate, with a variable short scutellar stria between striae 1 and 2 and a setiferous puncture near base of 2; interstice 3 with 2-4 punctures; inner plica present and well developed. Underside glabrous; prosternal process glabrous, margined at apex; metepisterna short, very little longer than wide; abdominal segments sulcate and with series of deep punctures across base. Legs normal except for the hind tibiae of one species; protarsi of male with first 3 segments strongly dilated, triangular; basal segments of tarsi glabrous on the upper side, not sulcate or carinate externally; segment 4 not emarginate; onychium with a few setae beneath; claws smooth. Aedeagus with the apical blade characteristically modified in the different species.

Genotype: *Sierrobius smaragdinus* Straneo (below)

Sierrobius could be considered a subgenus of the great genus *Pterostichus* (*sensu lato*), but the five new species I refer to it are very homogeneous generically, though very different from each other, and from other previously known species, and I prefer to consider it a distinct genus, confined to the Sierra Nevada de Santa Marta, Colombia.

Key to the Species of *Sierrobius*

1 (8) Size over 8 mm.; hind angles of prothorax more or less blunt.

2 (3) Striae of elytra strongly but irregulary impressed; lateral margin of pronotum in anterior half always with 2-3 setae; aedeagus as in Fig. 3 *smaragdinus* n. sp.

3 (2) Striae of elytra either strongly but regularly impressed, or faint; lateral margin of prothorax in anterior half usually with a single seta.

4 (7) Elytra with all striae faint throughout, except that 2 and 3 are lightly impressed in one species and 7 is always rather deeply impressed; basal angles of prothorax wholly rounded.

5 (6) Size smaller (12 mm.); striae 2 and 3 slightly but distinctly impressed; extremity of stria 7 deeply and irregularly impressed, with two conspicuous setiferous punctures; aedeagus with apex strongly asymmetrical (Fig. 4). .*bistriatus* n. sp.

6 (5) Size larger; all striae faint; aedeagus with apex nearly symmetrical (Fig. 5) ...... *laevigatus* n. sp.

7 (4) All striae deeply and regularly impressed; basal angles of prothorax obtuse but well formed. *uniformis* n. sp.

8 (1) Size 8 mm.; hind angles of prothorax square. *parvulus* n. sp.

Sierrobius smaragdinus, n. sp.

Head bright green; prothorax green with golden reflections; elytra green with bluish reflections chiefly at sides; mouth piceous black; femora brown with metallic reflections; underside slightly greenish; antennae brown; palpi blackish with apices ferrugineous. Length 12.8 mm.; width 4.1 mm. Head smooth and shining; eyes moderate, temples short and little convex; frontal impressions very short and very little impressed; antennae moderately elongate, hardly reaching base of prothorax, with segments 4-11 pubescent. Prothorax subquadrate (3.1 by 3.8 mm.), anteriorly a little emarginate, with sides very little rounded, nearly parallel at middle, briefly narrowed to apex (width 2.6 mm.) and base (width 3 mm.) ; anterior angles only a little prominent, rounded; basal ones a little obtuse, with their apices rounded; basal impressions foveiform, elongate, deep, and rather wide; spaces between them and lateral margins convex; side margins narrow, nearly linear, with two setigerous pores in anterior half (♂) or three (♀) and also the usual pore near each basal angle; base nearly impunctate, a little rugose at middle, slightly margined at sides; disc only a little convex; median line deep, abbreviated anteriorly and posteriorly. Elytra subparallel, convex (7.6 by 4.1 mm.) ; sides slightly rounded behind base; shoulders rounded, without teeth; basal margin strong, nearly right; scutellar stria very short, with a large puncture near base; striae very irregular, only slightly impressed, punctate; interstices only slightly convex, irregular, third with 4 large punctures, of which the first is near the third stria, the others near the second; seventh interstice with two apical punctures; umbilicate series of 16 punctures; apical sinuation strong.

Prosternum slightly depressed between coxae; pro-episterna smooth; metepisterna small, nearly as long as wide; prosternal process margined; abdominal segments sulcate and with series of coarse punctures across their bases; anal segment with one puncture each side (♂) or with two (♀). Microsculpture of elytra rather indistinct. Aedeagus as shown in Fig. 3.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,426) and allotype ♀ (my collection) from the northwestern Sierra Nevada de Santa Marta, Colombia, 12,000 ft., Feb. 11, 1929 (Darlington).[1] The specimens were taken in the *páramo* zone above the forest line.

Sierrobius bistriatus, n. sp.

Head and prothorax metallic dark blue; elytra greenish blue with slight metallic reflections; underside brown with metallic reflections; legs, antennae, and mouth ferrugineous brown. Length 11.2 mm.; width 3.7 mm. Head as in preceding species. Prothorax with sides more rounded, more narrowed posteriorly; only one seta on each side in anterior half of lateral margin. Elytra shaped as in the preceding species, but with the shoulders more rounded; striae very faint excepting the third and fourth ones, which are very lightly impressed; third interstice with three large punctures, of which the first is near the third stria, the others near the second. Underside as in *smaragdinus.* Hind tibiae simple. Aedeagus of wholly different shape (Fig. 4.)

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,428) from the northwestern Sierra Nevada de Santa Marta, Colombia, 8-11,000 ft., Feb. 10-12, 1929 (Darlington). The type is unique. It comes from the highest ("temperate") moutain forest.

Sierrobius laevigatus, n. sp.

Upper surface metallic violaceous red with greenish reflections, lightly alutaceous, moderately shining; underside blackish; appendages brownish piceous. Length 16 mm.;

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[1] All specimens taken in the Sierra Nevada de Santa Marta by P. J. Darlington Jr. were collected along the trail that ascends the Sierra from Rio Frio.

width 5.1 mm. Head stouter than in the preceding species, with shorter mandibles and less convex eyes. Prothorax of nearly the same shape as in *bistriatus* but more elongate (4 by 4.5 mm.), with a single seta on each side in the anterior half of the lateral margin as well as the usual one at each basal angle. Elytra smooth, striae all faint, not impressed (but ninth stria well impressed as usual); three punctures on each side in the third interstice; umbilicate series of 15 punctures. Underside as in the other species. Hind tibia with a stout tooth ventrally (Fig. 6). Elytral microsculpture very regular, isodiametric. Aedeagus with apex rather regular (Fig. 5).

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,425) from the northwestern Sierra Nevada de Santa Marta, Colombia, 4-8,000 ft., July 20, 1928 (Darlington). The type is unique. It was found on the ground in heavy "subtropical zone" forest.

Sierrobius uniformis, n. sp.

Brown; head, prothorax, and elytra without metallic reflections; scarcely shining, elytra alutaceous. Length 14 mm.; width 4.7 mm. Head as in preceding species, but with frontal impressions wide and deep, though short. Prothorax transverse (3 by 4.1 mm.), with sides regularly and equally narrowed and rounded anteriorly and posteriorly; anterior margin distinctly emarginate; anterior angles little prominent, obtuse, well rounded; basal angles obtuse, with their apices scarcely blunted; basal impressions deep, rather elongate; spaces between them and lateral margins slightly impressed near base, as if there were poorly marked external basal impressions; basal margin vestigial, visible only at sides; lateral margin narrow, with a single puncture on each side in anterior half and the usual puncture at each basal angle; disc moderately convex, with median line rather deep, almost reaching base. Elytra convex, subparallel (8.1 by 4.7 mm.); scutellar stria distinct, without basal pore; striae well impressed, regular; interstices rather convex, third with three or four dorsal punctures. Underside as in the other species of the genus; anal segment of ♀ with two punctures on each side. Hind tibiae normal. Male unknown.

Holotype ♀ (Museum of Comparative Zoology, Type No. 28,427) from the northwestern Sierra Nevada de Santa Carta, Colombia, 12,000 ft., Feb. 11, 1929 (Darlington). The type is unique, and is from the *páramo* zone.

Sierrobius parvulus, n. sp.

Upper surface dark bronze; head and prothorax shining, elytra (♀) alutaceous; antennae, legs, and palpi ferrugineous; underside brown. Length 7.9 mm.; width 2.7 mm. Head robust; eyes small and little convex; temples half as long as the eyes; frontal impressions deep, parallel, moderately elongate. Prothorax elongate, subrectangular (2 by 2.2 mm.), truncate anteriorly; sides moderately rounded and narrowed anteriorly, nearly straight and slightly convergent towards base; anterior angles not or very little prominent, rounded; posterior angles square, with their apices not rounded; basal impressions slightly impressed, spaces between them and lateral margins little convex; lateral margins narrow, with one puncture on each side in anterior half and the usual puncture at each posterior angle; base not margined at sides; disc only a little convex; median line nearly reaching base. Elytra oblong-ovate (4.3 by 2.7 mm.) ; shoulders slightly obtuse, each with a minute tooth; scutellar stria very short, without apical pore; striae moderate; interstices not convex, the third with two punctures of which the first is at 1/5 and the other at 3/5 of the length; apical sinuation slight. Underside as in the other species of the genus. Hind tibiae simple. Male unknown.

Holotype ♀ (Museum of Comparative Zoology, Type No. 28,429) from the northwestern Sierra Nevada de Santa Marta, Colombia, 8-11,000 ft., Feb. 10-12, 1929 (Darlington). The type is unique, and is from the “temperate” forest zone.

Pachyabaris, n. gen

So closely allied to *Abaris* Dej., *Abaridius* Chaud., and *Pseudabaris* Chaud. that it is not necessary to give a full description. The peculiar characters of the new genus are;

shape of prothorax, differing from species to species; *third interstice of elytra with at least three conspicuous foveae;* ventral segments deeply grooved and with series of large punctures across their bases; tarsal claws not pectinate; onychium with setae beneath. This genus is most closely allied to *Pseudabaris,* which too has the ventral segments grooved and the tarsal claws not pectinate, but the new genus differs from *Pseudabaris* in having the third interstice of the elytra tri- or quadri-foveolate.

Key to the Species of *Pachyabaris*

1 (4) Sides of prothorax strongly rounded and narrowed anteriorly and posteriorly.

2 (3) Prothorax strongly transverse, with anterior margin rather deeply emarginate, and with sides rounded to basal angles; shoulders squarer. *darlingtoni* n. sp.

3 (2) Prothorax less transverse, with anterior margin less emarginate, and with sides evidently subsinuate before base, so that the basal angles are less obtuse .... *subcordata* n. sp.

4 (1) Sides of prothorax not much rounded, nearly straight and parallel.

5 (6) Striae rather strongly impressed, regular. *striolata* n. sp.

6 (5) Striae slightly impressed or irregular; interstices nearly flat.

7 (8) Prothorax widest before middle, its sides nearly straight, slightly narrowed towards base, with hind angles nearly square; all dorsal elytral punctures near 3rd stria; size smaller (6 mm.). *minuta* n. sp.

8 (7) Prothorax widest behind middle, its sides slightly but distinctly rounded towards base, with hind angles obtuse; only anterior dorsal elytral puncture near 3rd stria ;size large (7.5 mm.). *laevis* n. sp.

Pachyabaris darlingtoni, n. sp.

Dark bronze, scarcely shining; underside brown; legs, antennae, and palpi ferrugineous brown. Length 8.6 mm.; width 3.3 mm. Head moderately elongate; eyes wide, moderately convex; frontal impressions very short and deep; antennae scarcely exceeding base of prothorax, with segments 4-11 pubescent. Prothorax transverse (2.1 by 2.9 mm.); sides strongly and regularly rounded; anterior angles obtuse, prominent; anterior margin distinctly emarginate; hind angles very obtuse, rounded at tips (the hind angles are not rounded in the paratype); anterior width 1.7 mm.; basal width 2.3 mm.; one basal impression each side, deep; spaces between the impressions and the lateral margins each with a slight depression reaching lateral margin near middle of length; lateral margins narrow, each with the two usual setae; base impunctate, depressed between basal impressions, straight; disc only a little convex, with median line short, moderate. Elytra oblong-ovate (4.7 by 3.3 mm.); shoulders square; basal margin moderately incurved towards shoulders; scutellar stria rather long; striae deep, impunctate; interstices slightly convex; third interstice with four deep, distinct foveae, the first at basal ¼ near third stria, the others near second stria (the number of foveae varies from 3 to 4); apical sinuation very strong. Prosternum not sulcate, sometimes slightly depressed; prosternal process margined; metepisterna not longer than wide, sulcate along anterior and interior sides; abdominal segments transversely sulcate, with series of strong punctures in the sulci; anal with one (♂) or two (♀) setae each side. Hind tarsi with only first segment slightly sulcate externally. Aedeagus as in Fig. 7.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,433), allotype ♀ (my collection), and one ♀ paratype (M.C.Z.) all from the northwestern Sierra Nevada de Santa Marta, Colombia, 12,000 ft., Feb. 11, 1929 (Darlington), taken of course in the *páramo* zone.

Pachyabaris subcordata, n. sp.

Color as in *P. darlingtoni.* Length 11.3 mm.; width 3.9 mm. Head as in *darlingtoni.* Prothorax same in shape but with sides briefly but distinctly subsinuate before base; length of prothorax 2.5, width 3.3, width of apex 2.5, width of base 2.5 mm. Elytra with shoulders more rounded; basal margin very thick, straight, not incurved; striae deeper and with indistinct vestigial punctation; scutellar stria shorter. Male unknown.

Holotype ♀ (Museum of Comparative Zoology, Type No. 28,435) from northwestern Sierra Nevada de Santa Marta, Colombia, 12,000 ft., Feb. 11, 1929 (Darlington). The type is unique.

Pachyabaris striolata, n. sp.

Upper surface bronze, moderately shining; underside brown, with slight bronze reflections; antennae, palpi, and legs ferrugineous red. Length 7.7 mm.; width 2.5 mm. Head as in *P. darlingtoni.* Prothorax rectangular (1.9 by 2.2 mm.); sides slightly narrowed anteriorly, nearly parallel or very slightly narrowed towards base; anterior width 1.5, basal width 2 mm.; basal angles square, with tips not rounded; basal impressions narrow, rather deep; spaces between them and lateral margins moderately convex; lateral margins narrow, linear, each with the two usual pores; base nearly impunctate, not depressed between the impressions; disc little convex, with the median line moderately deep, reaching base. Elytra elongate (4.1 by 2.5 mm.); shoulders square, each with a minute tooth; basal margin straight, not thick; striae moderately impressed; interstices nearly flat, third with a puncture at basal ¼ near third stria and two more punctures behind middle near second stria; apical sinuation moderate. Underside as in the other species; metepisterna with a few indistinct punctures. Microsculpture of elytra not very distinct. Aedeagus as shown in Fig. 8.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,430), allotype ♀ (coll. Straneo), and one ♀ paratype

(M.C.Z.) all from the northwestern Sierra Nevada de Santa Marta, Colombia, 12,000 ft., Feb. 11, 1929 (Darlington), from the *páramo* zone.

Pachyabaris minuta, n. sp.

Upper surface rather dark bronze; antennae, legs, and palpi darker than in the other species of the genus. Length 6.1 mm.; width 2.3 mm. Prothorax subrectangular, shaped as in *striolata* (1.4 by 2 mm.); basal width 1.7, apical width 1.3 mm. Elytra oblong (3.4 by 2.3 mm.); shoulders each with a minute tooth; basal margin slightly sinuate, not thick; striae lightly impressed, with vestigial punctation; interstices almost flat, third with 3 or 4 large punctures, all near third stria; apical sinuation slight. Hind tarsi stouter than in any other species of the genus. Microsculpture of elytra and of base of prothorax distinct, isodiametric. Aedeagus as shown in Fig. 9.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,434), allotype ♀ (coll. Straneo), and two paratypes (♀ in M.C.Z., ♂ in coll. Straneo) all from the south side of the Sierra Nevada de Santa Marta, Colombia, 8-11,000 ft. (T. D. Cabot).

Pachyabaris laevis, n. sp.

Upper surface as in preceding species; legs, antennae, and palpi reddish brown. Length 7.6 mm.; width 2.9 mm. Form stouter than in preceding species. Prothorax wide (2.1 by 2.7 mm.); sides moderately narrowed anteriorly, very little so basally; anterior width 1.7, basal width 2.5 mm.; basal angles obtuse, with tips moderately rounded; basal impressions faint, spaces between them and lateral margins convex; base narrowly margined at sides; disc little convex, with median line moderately impressed, subpunctate, not reaching base. Elytra convex, moderately elongate (4.1 by 2.9 mm.); shoulders nearly square, each with a minute tooth; scutellar stria variable; striae faint; interstices flat, third with 3 or 4 punctures, the anterior one near third stria, others usually near second stria. Underside as in the other species of the genus. Microsculpture of elytra fine, isodiametric. Hind tarsi more slender than in *minuta.* Aedeagus as shown in Fig. 10.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,431), allotype ♀ (coll. Straneo), and 8 paratypes (M.C.Z. and coll. Straneo) all from northwestern Sierra Nevada de Santa Marta, Colombia, 11-12000 ft., July 21, 1928 (Darlington), taken in the *páramo* zone.

Pseudabaris montanus, n. sp.

As the species of this genus are very closely allied among themselves and not well characterized, I give only a short preliminary description of this new one. Color aeneous, a little greenish, elytra slightly cupreous; underside dark brown; legs reddish brown; antennae wholly ferrugineous. Length 6.6 mm.; width 2.7 mm. Prothorax with sides regularly rounded, only a little narrower at base than anteriorly; base wholly impunctate, with the inner basal impression rather slightly impressed and the outer one very short, nearly evanescent; spaces between basal impressions and lateral margins not depressed. Elytra short and convex, rather strongly dilated behind shoulders, which are minutely dentate; scutellar stria rather long. Apex of aedeagus shown in Fig. 11.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,432) and allotype ♀ (coll. Straneo) from Rio Frio, south of Santa Marta at the foot of the Sierra Nevada, Colombia, May 15, 1928 (Darlington); and 4 paratypes from northwestern foothills of the Sierra Nevada de Santa Marta, Colombia, not above 3,000 ft., May 22, June 2, and June 17, 1928 (Darlington).

This new species differs from *columbicus* Chaud. by smaller size; prothorax narrowed toward base; and elytra shorter, more rounded behind shoulders.

Marsyas minutus, n. sp.

Whole upper surface more or less greenish or coppery bronze; underside and legs blackish brown; antennae, tarsi, and palpi ferrugineous. Length 10 mm.; width 3.4 mm. Head robust, with neck a little constricted; eyes wide, moderately convex; frontal sulci narrow and elongate; antennae slender, reaching the base of the prothorax. Prothorax moderately elongate (2.4 by 2.8 mm.); sides regularly rounded; anterior angles near neck, rounded; basal angles nearly square, their tips moderately rounded; basal sulci narrow and moderately elongate; disc smooth, little convex; median line little impressed anteriorly, deep between the basal sulci, nearly obsolete near base; base impunctate, margined at sides; lateral margins very narrow, linear. Elytra oblong, elongate (5.6 by 3.4 mm.); sides little narrowed towards shoulders; latter rounded, not dentate; striae deep, lightly punctate; interstices convex; third interstice with three punctures, the first at basal ¼ near third stria, the others near second stria. Underside smooth, impunctate; metepisterna 1.5 times long as wide, sulcate along inner and anterior sides. Legs normal; onychium with fine setae beneath. Aedeagus as shown in Fig. 12.

Holotype ♂ (Museum of Comparative Zoology, Type No. 28,439), allotype ♀ (coll. Straneo), and 14 paratypes (M. C.Z. and coll. Straneo) all from vicinity of Horqueta, Paraguay, January 21 and 27 and February 1 and 4, 1934 (A. Schulze).

This new species, because of the position of the dorsal punctures of the elytra, belongs in the group of *M. viridiaeneus*. It differs from *M. bahiae* Tschit. by the shape of the prothorax, which is considerably narrowed towards base, and by the color of the upper side.

Genus *Cynthidia* Chaud.

Five species belonging to this genus have been described. There are probably several undescribed species, but I can give only a preliminary description of one of them. I have not yet secured males of *planodisca* Perty and *cancellata* Brullé necessary for comparison with the other new ones.

Key to the Species of *Cynthidia*

1 (8) Third interstice of elytra with 2 or 3 impressed punctures.

2 (5) Frontal furrows deep and irregularly wide, the space between them carinate at middle.

3 (4) Prothorax with two basal impressions of subequal depth on each side; aedeagus as figured (Fig. 13) .... *crocipes* Perty

4 (3) Prothorax with only the inner basal foveae (spaces between latter and lateral margins flat or very slightly impressed); aedeagus as figured (Fig. 14) .... *majorina* n. sp.

5 (2) Frontal furrows only moderately deep, not irregularly wide, the space between them regularly convex but not carinate at middle.

6 (7) Interstices of elytra flat; dorsal pores on third interstice more distinct; elytra more or less opaque; prothorax shorter; frontal sulci wider *planodisca* Perty

7 (6) Interstices of elytra subconvex; dorsal pores on third interstice less distinct; elytra not opaque; prothorax longer; frontal sulci narrower *cancellata* Brullé

8 (1) Third interstice of elytra with wide foveae.

9 (10) Elytra damasked .... *octocoela* Chaud.

10 (9) Elytra not damasked .... *foveata* Chaud.

Cynthidia majorina, n. sp.

Very near *C. crocipes*. The new species differs from the latter as follows: head with a light, minute, oval fovea near middle of front, between frontal sulci; prothorax less narrowed anteriorly, without distinct external basal impressions; elytra with dorsal punctures more conspicuous. Length 11 mm. Aedeagus with different apex (Fig. 13).

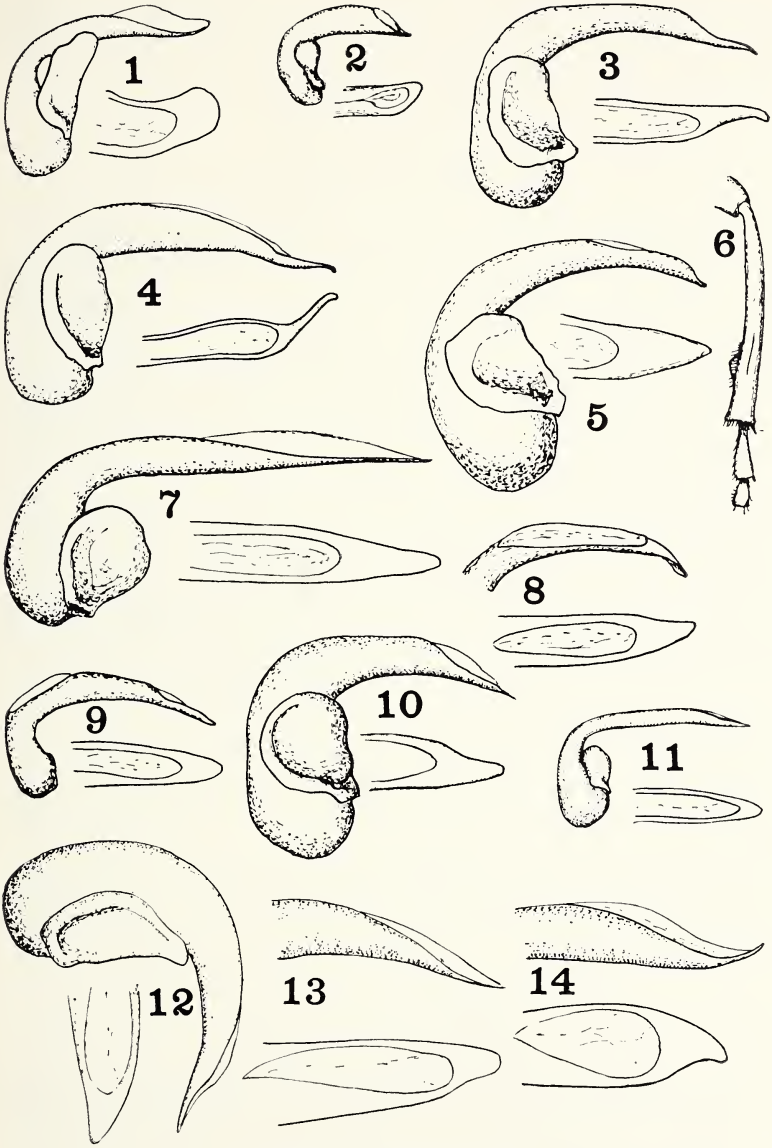
Holotype ♂ (Museum of Comparative Zoology, Type No. 28,424) and allotype ♀ (coll. Straneo) from Mafra, Sta.

Catharina, Brazil, 780 m. (A. Maller); one ♂ paratype from 5 km. south of Sta. Maria, Rio Grande do Sul, Brazil (Th. White); and one ♂ from Villarica, Paraguay (F. Schade). A dark ♀ example from S. Bernardino (Paraguay) probably belongs to this species.

The specimens I have attributed to *C. crocipes* are from Paranà (♀, in my collection); Villarica, Paraguay (5 specimens in M.C.Z.); and S. Antonio (Paraguay) (3 specimens from Institut Fabre, through Prof. Porta, in my collection).

EXPLANATION OF PLATE 1

1. Aedeagus of *Tichonia orientalis* n. sp. 2. Aedeagus of *Loxandrus minimus* n. sp. 3. Aedeagus of *Sierrobius smaragdinus* n. gen. et sp. 4. Aedeagus of *Sierrobius bistriatus* n. sp. 5. Aedeagus of *Sierrobius laevigatus* n. sp. 6. Hind tibia of *Sierrobius laevigatus* n. sp. 7. Aedeagus of *Pachyabaris darlingtoni* n. gen. et sp. 8. Aedeagus of *Pachyabaris striolata* n. sp. 9. Aedeagus of *Pachyabaris minuta* n. sp. 10. Aedeagus of *Pachyabaris laevis* n. sp. 11. Aedeagus of *Pseudabaris montanus* n. sp. 12. Aedeagus of *Marsyas minutus* n. sp. 13. Aedeagus of *Cynthidia crocipes* Perty. 14. Aedeagus of *Cynthidia majorina* n. sp.



STRANEO — PTEROSTICHINI

NOTES ON SOME NEW ENGLAND PHRYGANEIDAE (TRICHOPTERA)[1]

By Nathan Banks
Holliston, Mass.

Among the caddice flies taken by Prof. Brues at Petersham, Mass., and also by the State Forest Service in Maine, there are many specimens of *Banksiola.* More than half are *selina,* but many are *dossuaria,* and there are (from Petersham) six specimens of *smithi* (both sexes) and two males and two females of *cava,* previously known to me by only one specimen. Also from various localities there are many *canadensis* and some of the similar (in appearance) *Neuronia angustipennis.*

In *B. selina* I note that there is much variation in the processes on the hind margin of the genital cavity, and frequently the two sides are unlike.

Of the *dossuaria* six are from Petersham, the others from Maine; Tim Pond, Holeb, Ashland, Hardwood Mt., Oquossoc, Camp Colby, Round Mt., Seeboomook.

The *smithi* are all from Petersham, except one from Holliston. Leonard has recorded *B. smithi* from Michigan. The *canadensis* are mostly from Ashland and Gibson, one Tramway, Jonesboro, and Kellyland. (These are the ones pinned, others were put in alcohol, and many more discarded, mostly *selina.*)

In the M.C.Z. collection there is a new species of *Banksiola* from eastern Massachusetts, noticeable for its four subequal horns.

Banksiola cornuta, n. sp.

Figures 3, 4, 12, 15, 19

The tip of the abdomen shows four large spines, the upper pair with a double tip, inner edge a little irregular, the lower

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

pair of horns simple, and no teeth along the hind margin of the last abdominal segment. From the side one sees the long upper tooth and the lower, and between is an upward extension of lower part, terminating in a rounded tip, just below the upper horn; this tip is provided with numerous long bristles.

From behind one sees the lower tooth of each side, and between, the inner membrane with a large deep excision, much longer than broad. The apical margin of the last dorsal segment has a row of bristles extending over the median process.

Head and thorax pale yellowish, without dark marks. The basal joint of antennae also pale, but beyond largely black; toward tip the joints are banded. The wings have the yellowish tint of *B. smithi* and *B. cava.* The fore pair are marked much as in *B. selina,* but not as heavily, the narrow bands rather further apart, and the two large costal spots toward tip are smaller than usual in *selina,* no other large marks; the subcosta near the large spots is curved about as *selina.* In the hind wing the stigmal spot is prominent and beyond are some faint irrorations, much as in *selina*; more irrorate than in *smithi.* Length of forewings 12 mm. One male from Cohasset, Mass. 20 June, 1908, Type M.C.Z. no 28,557.

Betten and Mosely in the Walker Trichoptera, 1940, have a *Neuronia childreni* (page 90) based on a female without locality. They mention dark marks on vertex and on mesonotum, while the pronotum is very pale and with pale bristles; the new specimens of *B. cava* agree closely with this coloration. Their figure of the wing is broader than any of the *B. cava* I have seen, but the figure of the female genitalia is like *B. cava.* Unless another species is found with the same markings I think *B. childreni* must be *B. cava.*

For my *Neuronia canadensis* which has the radius not only curved near stigma, but often united to the subcosta for at least a point, I propose a new genus **Alleodes** (*Alleodes canadensis*). The male genitalia occupy only the lower half of the tip of the abdomen, and are very different in structure from *Banksiola.* In *Banksiola* the head is broader than in

Alleodes, and each hind ocellus about its diameter from the eye; in *Alleodes* the head not so broad, and the hind ocelli closer to the eyes and look more laterally. The apical area of the wing is proportionally longer in *Alleodes* than in *Banksiola,* and some apical veins almost parallel to its fellow.

Neuronia angustipennis Hagen

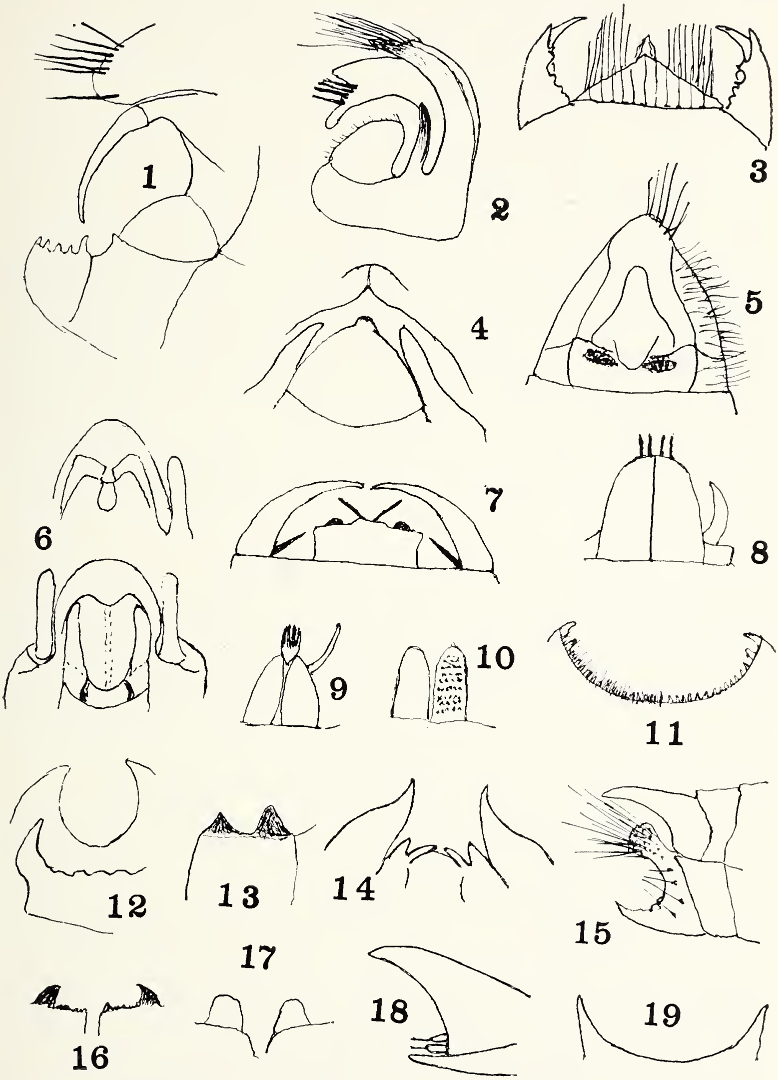
Figures 1, 9, 11

This species is well separated from the usual *Neuronia* by a much more narrow wing and the details of the male genitalia; the costal margin of forewing only very slightly concave. The ocelli are proportionally much further apart than in the other species of *Neuronia.*

I make the new subgenus, **Neuronella,** for *Neuronia angustipennis* (*Neuronella angustipennis.*)

EXPLANATION OF PLATE 2

Fig. 1. *Neuronia angustipennis,* side, genitalia. Fig. 2. *Banksiola dossuaria,* genitalia, side. Fig. 3. *Banksiola cornuta,* tip of abdomen, above. Fig. 4. *Banksiola cornuta,* female, below. Fig. 5. *Neuronia angustipennis,* female below. Fig. 6. *Banksiola cava,* female, below, of two specimens. Fig. 7. *Banksiola cava,* male, tip, above. Fig. 8. *Banksiola dossuaria,* male, tip, above. Fig. 9. *Neuronia angustipennis,* male, tip, above. Fig. 10. *Banksiola dossuaria,* male, dentate processes. Fig. 11. *Neuronia angustipennis,* margin of last ventral segment. Fig. 12. *Banksiola cornuta,* from behind. Fig. 13. *Banksiola selina,* processes on hind margin, Clare Co. Mich. Fig. 14. *Alleodes canadensis,* male above. Fig. 15. *Banksiola cornuta,* side. Fig. 16. *Banksiola selina,* processes, Tim Pond, Me. Fig. 17. *Banksiola selina,* processes, Petersham. Fig. 18. *Alleodes canadensis,* side of male. Fig. 19. *Banksiola cornuta,* hind margin from below.



BANKS — NEW ENGLAND PHRYGANEIDAE

NOTES ON ALASKAN COLLEMBOLA
I. A NEW GENUS AND SPECIES OF THE FAMILY ISOTOMIDAE[1]

By Kenneth A. Christiansen
Biological Laboratories, Harvard University

This is the first in a series of papers on the Collembola fauna of northern Alaska. The material on which this paper is based was collected by Dr. Neal A. Weber while holding a contract with the Office of Naval Research and while stationed in the Alaskan Arctic under the support of the Arctic Research Laboratory.

I wish to thank Dr. Marie Hammer and Dr. Harlow B. Mills for their helpful suggestions concerning this work.

Weberacantha, n. gen.

Anurophorini, facies superficially proisotomid. Body somewhat elongate. Head prognathous, slightly narrower than second thoracic segment; antennae four-jointed, fourth joint about twice as long as third and slightly swollen, without retractile apical bulb, and with well-developed blunt olfactory setae; eyes eight on each side on a pigmented field; P.A.O. elongate, elliptical, with flap-like margins.

First thoracic segment reduced, not imbricate. All other body segments clearly imbricate. No marked ankylosis of of abdominal segments. Sometimes division between fifth and sixth segments obscure; all other intersegmental membranes clearly visible. Fourth abdominal segment distinctly longer than third, and longer than fifth and sixth taken together. Sixth abdominal segment downwardly skewed from fifth, and almost completely hidden by the latter when viewed from above. Fifth abdominal segment dorsally with a number of short stout spines. Anus ventrally directed. Furcula

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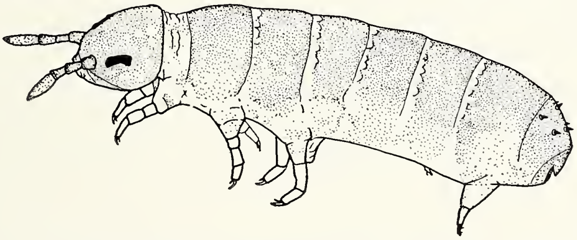
with mucro, dens, and manubrium all distinct. Manubrium ventrally with a few large setae, dorsally with many short setae; dens dorsally with a few broad humps, and a few scattered setae; mucro with several teeth. Dens about twice as long as mucro. Rami of tenaculum quadridentate, corpus with a single stout seta. Legs stout; tibiotarsus possessing minute distal subsegment; claw simple, all feet with well-developed empodial appendage. Externally at the base of each leg a single large, straight seta; on legs two and three there are in addition two slightly smaller curved setae.

Integument finely reticulate, that is, possessing a network of thin, flat ridges, with the intervening areas slightly depressed. Head, antennae, and imbricate areas of the abdomen and thorax well pigmented, with scattered pale spots. Intersegmental membranes, legs, and furcula unpigmented. Clothing of smooth, short, slightly curved and appressed setae; a few longer, upright setae on the sides and posterior regions of the body. Bothriotrichia absent.

Weberacantha octa, n. sp.

Holotype. Pigment blue with scattered white spots, larger and more numerous on the head and anterior borders of segments than elsewhere. Intersegmental membranes, legs, and dentes white. First thoracic segment white, with scattered pigmented areas. Antennae slightly paler than body; anal spines and mucro yellow. Reticulations on the imbricate areas of the thorax and abdomen more or less uniform, those on the head region being slightly larger and more irregular in shape; reticulations of intersegmental



Text-figure 1: *Weberacantha octa,* habitus, holotype (setae omitted).

membranes, first thoracic segment, and body appendages distinctly smaller, in many cases so small as to be indistinguishable from granulation. Fourth antennal segment with roundly conical apical projection; a distinct subapical pit with a small spherical papilla on a short stalk; numerous blunt sensory hairs of varying lengths starting just below the level of the subapical pit and continuing about three-fourths of the length of the segment. These hairs are of two lengths, the larger being about twice as large and somewhat thicker than the smaller ones. The distal and proximal hairs are all of the smaller type. Between these limits both types occur, rather irregularly scattered among numerous pointed hairs, the larger, blunt hairs being more numerous than the smaller. Sense organ of third antennal segment consists of two short, slightly swollen, erect rods set in shallow connecting pits, and with two longer, blunt guard hairs, one directly internal of the rods, the other positioned somewhat below and to outer side of the rods. Remainder of clothing of third antennal segment consists of four irregular transverse rows of more or less curved, pointed setae about twice the length of the guard hairs. Second antennal segment, three such rows, plus a single pair of very small pointed setae dorsal on the base of the segment. First antennal segment with one row of normal setae and ventrally about midway in the segment two short blunted setae set in shallow depressions. The outer of these is somewhat less than half the length of the normal pointed setae, and about twice as large as the inner blunt seta of that segment. Eyes eight on each side, on an elongated pigment spot which is somewhat attenuated in the middle. The two inner posterior eyes smaller than the rest. P.A.O. with flap-like margin especially marked on anterior edge, which is indented at about the middle.

Clothing of many short stout setae, smooth and mostly curved, so as to be pointing posteriorly. Setae on head mostly uniformly short, curved rearward. Head with a set of four slightly longer setae directly along the posterior margin of the P.A.O., curved forward so as to overhang the P.A.O.; a few scattered short, straight setae also present, mostly along the posterior and lateral margins of the head.

Longer straight erect setae (two to three times as long as the normal setae) positioned as follows: second thoracic segment with a pair, one near each anterior lateral corner of the imbricate area; third thoracic segment with a similar pair, more posterior in position; abdominal segments 1 and 2 with a median lateral pair of somewhat shorter setae; abdominal segment 3 with a median transverse row of four setae, with the more lateral setae being longer; abdominal segment four with an anterior and a posterior row of four setae each, with the more lateral setae again being the longer, anterior row of long setae about one-third of the way back from anterior border of the segment and the second row of somewhat shorter setae just before the posterior border of the tergite; on the fifth segment a single median transverse row of setae; and sixth segment with four long setae and numerous short straight ones. Fifth abdominal segment dorsally with eight small spines on short papillae, arranged in two transverse rows of four each.

A very small internal tooth is visible about midway up on the first pair of claws. No other teeth present. Empodial appendage stout, acuminate, with a broadly rounded inner lamella, and a well-developed apical filament.

Manubrium with two ventral setae near the bases of the dentes and dorsally with twenty straight smooth setae arranged in two irregular double rows, confluent basally, then running down the outer sides of the manubrium so as to leave a distal, central, triangular, naked area. Dens dorsally with a single low, broad hump and five setae, positioned as follows: one at base of the dens, three forming a centrally positioned triangle, and a fifth short curved setae ventrally just before the mucro. Dens abruptly narrowed at the end and distinctly wider than the mucro. Mucro distinctly separated from dens, tridentate, slightly curved and somewhat larger basally. Basal tooth distant from the apical and subapical teeth. Subapical tooth pointed upward and distinctly larger than the apical and basal teeth which are subequal. Apical tooth pointed forward and only slightly curved. Genital plate of male simple, not clearly demarcated, and lacking setae. Two large setae are present near each lateral edge, and a pair of small setae near the anterior border.

VARIATION

The P.A.O. of some specimens shows no indentation in the anterior margin, while others have both anterior and posterior margins indented. The flap-like nature of the anterior margin can be seen in all specimens, although sometimes only with difficulty.

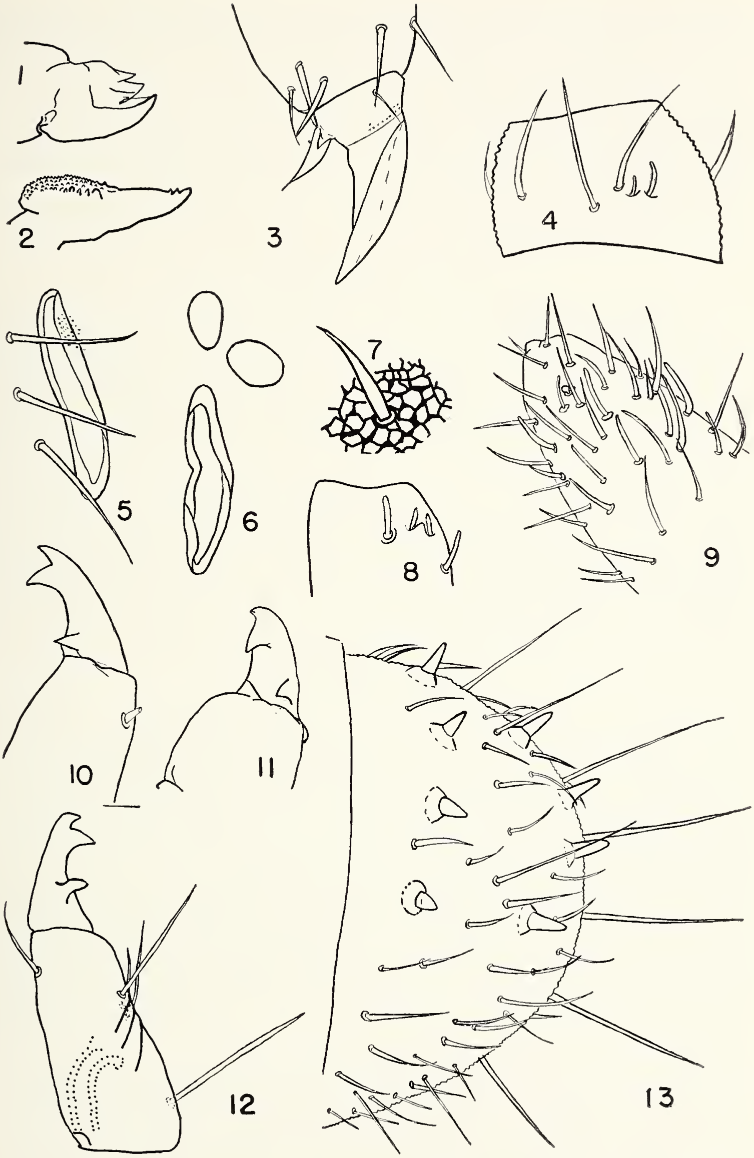
In some specimens the pigmented patch bearing the eyes is so constricted in its central portion as to give the effect of two separate patches.

In a few cases the second antennal segment has more than a single small seta at its base, as many as three having been observed.

The straight setae on the body vary somewhat. There is often present a single transverse row of short erect and straight setae on the second and third thoracic and on the first abdominal segment. These rows vary in their position, and one or more of them may be lacking. The long straight setae vary somewhat in number, some specimens having none on the first abdominal segment and only one pair on the third abdominal segment. The median pairs on the third and fourth abdominal segments may not be erect and are often only slightly longer than the common setae.

EXPLANATION OF PLATE 3.

Weberacantha octa. Magnifications are approximate. Fig. 1. Right maxilla of paratype seen from above (900 X). Fig. 2. Right mandible of paratype seen from above (900 X). Fig. 3. Right hind claw of holotype (800 X). Fig. 4. First antennal segment of holotype, ventral view (800 X). Fig. 5. Left postantennal organ of holotype seen from above (800 X). Fig. 6. Left postantennal organ and anterior ocelli of paratype seen from above (800 X). Fig. 7. Single cephalic seta of paratype, showing the surrounding integumentary reticulations (900 X). Fig. 8. Sense organ of the right, third antennal segment of holotype seen from above (800 X). Fig. 9. Apical region of the fourth antennal segment of paratype seen from above (800 X). Fig. 10. Left mucro of holotype, external view (800 X). Fig. 11. Left mucro of paratype seen from above and slightly to one side (800 X). Fig. 12. Left dens and mucro of paratype, external view (800 X). Fig. 13. Posterior portion of abdomen of paratype seen from above and slightly to one side (350 X).



CHRISTIANSEN—ALASKAN COLLEMBOLA

The low, broad humps on the dorsum of the dentes may be as many as three in number or they may be absent, and the short ventral seta is often reduced, or (rarely) absent.

The apical tooth of the mucro and the apical filaments of the empodial appendages are often broken off so as to give a truncate appearance to these structures. The very small internal tooth on the first pair of claws may be absent in some specimens.

RELATIONSHIPS

The general appearance and structure of the furcula of this species gives it a superficial resemblance to the *brevidens* group (Stach, 1947) of the genus *Proisotoma*; however, the reticulate integument, ventrally directed anus show that it is in reality allied to the tribe Anurophorini. Of the genera in this group it would appear to be most closely related to *Isotomodes* (Axelson, 1907), *Cryptpygos* (Willem, 1902), and *Subisotoma* (Stach, 1947). The body form and segmental ratios appear to be closest to *Subisotoma,* but the reticulate integument and presence of anal spines serve to separate it from all three genera.

MEASUREMENTS

The pattern for measuring used in this paper requires some explanation. The only absolute measurements given are those of the holotype. All other measurements are given in the form of ratios. These ratios are taken for each tagmatal group as a comparison of all parts involved to one part, which is considered as a standard number, i.e., 10. Then the average deviation of each of the non-standard ratio numbers is calculated. It is hoped that this will make for easier comparison, as well as give some idea of the variation involved. In all cases, the ratios were taken from those specimens within the given size range, and, because of the heterogonic growth of these animals, can only be applied to specimens of similar size. All individual segmental measurements are those only of the imbricate or setaceous area, eliminating the highly variable intersegmental membranes. The total size measurements, however, included these parts.

Holotype measurement (in mm.). Total length (excl.

antennae) — 1.26, cephalic diagonal — .26, thoracic segment 2 — .17, seg. 3 — .15, abdominal seg. 1 — .12, seg. 2 — .12, abdmn. seg. 3—.12, abdmn. seg. .4—.17, abdmn. seg. 5—10, abdmn. seg. 6—.05, antennal segment 1—.03, ant. seg. 2 — .04, ant. seg. 3 — .04, ant. seg. 4 — .08, unguis 1 — .026, empodial appendage 1 — .012, unguis 3 — .031, emp. app. 3 — .015, manubrium — .08, dens — .04, mucro — .026.

Segmental ratios for size range 1.18 — 1.30 mm.:

(standard, thoracic segment 2=10)

	cephalic diagonal	thoracic segment		abdominal segment					
		2	3	1	2	3	4	5	6
mean ratio	14.9	10	3.8	6.4	6.7	7.1	9.6	5.3	2.2
average deviation	.5	X	.4	.3	.3	.3	.4	.3	.4

(standard, antennal segment 4=10)

	antennal segment			
	1	2	3	4
mean ratio	3.5	5.7	5.5	10
average deviation	.2	.2	.2	X

(standard, unguis 3=10)

	unguis		empodial appendage	
	1	3	1	3
mean ratio	9.1	10	4.2	4.5
average deviation	.7	X	.4	.3

(standard, manubrium=10)

	manubrium	dens	mucro
mean ratio	10	4.9	3.0
average deviation	X	.3	.3

Type locality: 68°, 20′ N., 151°, 30′ W., Anaktuvuk, Alaska, July 7, 1949. The holotype (mounted on a slide in Salmon's mixture) and seven paratypes are being deposited in the United States National Museum, Washington, D.C. Five paratypes are being deposited in the Museum of Comparative Zoology, Cambridge, Mass.

This species has also been taken by Dr. Marie Hammer from Mount Richardson, just west of the Mackenzie Delta in Arctic Canada.

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THE STRUCTURE AND RELATIONSHIPS OF *OLIARCES* (NEUROPTERA)[1]

By Frank M. Carpenter
Harvard University

Somewhat more than forty years ago, Dr. John B. Smith, while traveling in California, collected a conspicuous neuropterous insect, which was subsequently described by Banks (1908) as *Oliarces clara.* Efforts to find additional individuals were unsuccessful for many years, but a second specimen has at last been secured. Mr. P. A. Adams, of the University of California, who received the insect from the collector and who has already published a note on its discovery (1950), kindly loaned me the new specimen for further study and for comparison with the type. I am indebted to him for this courtesy and for the opportunity of clarifying, to some extent, the systematic position of this remarkable insect.

The type locality, "Walters Sta., Calif.", has been the subject of much speculation and its location not generally known. According to Mr. Banks (personal communication) Smith collected the specimen while the train on which he was traveling was stopped at Walters Station for water. Current maps do not include this place, but the 1901 edition of the Century Atlas shows a "Walters" on the Southern Pacific Railroad, about ten miles northwest of the Salton Sea bed; and the engineering department of the Southern Pacific Company informs me that this was a station around 1900. It is also listed in Gannett's "Dictionary of Altitudes" (1906), which further states that the "point on base under water tank" is 191 feet below sea level. There is no doubt in my mind, therefore, that this Walters is the type locality of *clara.* The new specimen was collected near Parker Dam, San Bernardino County, about 70 miles from Walters and in the same kind of environment.

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

The following account of the structure of *Oliarces clara* is based on the holotype (male) and the new specimen (female), which is here designated the allotype:

Frons and vertex dark brown to black; clypeus, mouthparts and antennae light reddish brown; pronotum and mesonotum dark brown to black; metanotum dark reddish brown, lighter near wing bases; legs yellow-gray to medium brown; abdominal tergites medium brown, membranous areas yellow-brown; last two abdominal segments dark reddish brown above; abdomen yellow from beneath. Wings hyaline, the bases tinted with reddish brown. Antennae (broken away at second segment in holotype) with 40 subequal segments. Body in general covered with long brown or black hairs. Fore wing of holotype 16 mm. long and 5 mm. wide (maximum) ; that of allotype 20 mm. long and 7 mm. wide. Both pairs of wings are of similar texture, being colorless and hyaline. Each wing bears two distinct nygmata. The wing venation of the allotype is shown in text-figure 2; that of the holotype has already been figured by Banks (1908). As Adams has pointed out, the venational differences in the wings of the two specimens are well within the limits of variation occurring in other Neuroptera. A discussion of the generic features of the venation is included below.

The terminal abdominal segments of the male, briefly described by Banks, are illustrated here (Plate 4, fig. 2) in detail because of their significance in determining generic relationships. The ninth tergite is much longer laterally than dorsally, being reduced to a narrow strip in the mid-dorsal region. The ninth sternite has migrated posteriorly so that it is ventral to the tenth tergite; it is long laterally but constricted medially. The tenth tergite is conspicuously extended to form the anal plates, which are directed more dorsally than ventrally and which appear from above like hairy knobs. A posterior-dorsal view of the abdomen clearly shows the anus, as well as a pair of sclerotized structures which are apparently the modified tenth sternite.

The terminal segments of the female abdomen are shown in figure 3B, drawn from Mr. Adams' specimen. Although these were not removed and softened, as was done with the holotype, the sclerites are clearly defined. The eighth tergite extends further ventrally than the preceding tergites, and the ninth extends to the ventral surface. The eighth sternite is not visible externally, but is presumably reduced to sclerotized rods or plates encompassed by the ninth tergite. The tenth tergite is small and tapering, with conspicuous trichobothria near the margin of the ninth tergite. The ninth sternite is represented by a pair of very small plates, more or less fused, each bearing a minute papilla distally. These two plates are apparently the homologues of the psammarotrum or sand-plow of the Australian ithonids.

Holotype (♂): Walters Station, California; April (J. B. Smith); in M.C.Z.

Allotype (by present designation): 3 mi. southwest of Parker Dam, San Bernardino Co., April 25, 1949 (C. M. MacNeill), taken at light; in collection of P. A. Adams.

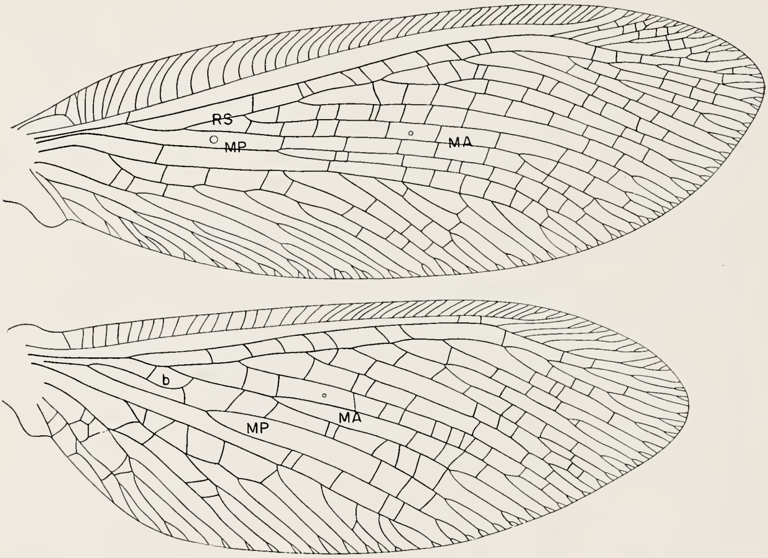
Since only one species of *Oliarces* is known, any diagnosis of the genus is probably tentative. However, considering the characteristics involved in the classification of other Neuroptera, I propose the following: the hyaline nature of both pairs of wings; in the fore wing the presence of a recurrent costal vein, of about five (probably variable) branches of Rs, and of relatively few cross-veins in the wing as a whole, as well as the absence of connecting cross-veins between costal veinlets; in the hind wing the transverse position of the basal part of MA (see below); in the male abdomen, the dorsally directed anal plates; and in the female, the absence of a distinct psammarotrum. The presence of two nygmata in the hind wing is of doubtful generic value, although only one is present in the specimens which I have seen of *Ithone, Heterithone* and *Varnia.*

The relationships of *Oliarces* with other Neuroptera have been very uncertain. Although originally placed by Banks (1908, 1913) in the family Hemerobiidae, as broadly conceived, it does not fit into the current and more restricted definition of that family. Tillyard, who noted this in 1916, suggested that a new family might be needed for it, but did not formally establish one. On the other hand, Brues and

Melander (1932) listed the genus under the family Ithonidae, otherwise known only from Australia; and Lameere (1936) has placed it in the Polystoechotidae. Since the uncertainty of the systematic position of *Oliarces* has been due in part to our very limited knowledge of the species on which it was based, the discovery of the female has given us additional information useful in comparisons.

It is at once clear, of course, that several superfamilies (Tillyard, 1925) of the Neuroptera—–specifically the Coniopterygoidea, Nemopteroidea and Myrmeleontoidea — are so far removed structurally from *Oliarces* as to be eliminated from further consideration. The superfamily Hemerobioidea is not so readily disposed of, but many of the included families (i.e., Dilaridae and Mantispidae) can have only the remotest affinities with *Oliarces*. The Osmylidae, although superficially resembling *Oliarces* more than most hemerobioids, have a radically different abdominal structure, as can be seen by comparing Killington's figures of *Osmylus* (1936, p. 56 and 58) with those of *Oliarces* in the present paper. The Polystoechotidae, to which Lameere assigned *Oliarces*, and which were reviewed in my 1940 revision, have wings with definite gradate veins, absent in *Oliarces*; and the terminal abdominal segments (Carpenter, 1940, figs. 70 and 72) of both sexes bear no resemblance to those of *Oliarces*, there being no anal plates in the male and no indication of a psammarotrum in the female. The Hemerobiidae, being a much larger and diversified family than the Osmylidae and Polystoechotidae, exhibit a greater range of structural differences (Killington, 1936-37; Carpenter, 1940). In all, however, there are gradate veins and a venational pattern basically unlike that of *Oliarces*. The terminal abdominal segments of the males of some genera are surprisingly suggestive of those of *Oliarces*, but this is not true of the females.

I have passed over these hemerobioid families very briefly because I believe that anyone who examines the specimens of *Oliarces* or studies the figures included here will not seriously consider assigning the genus to any of them. The family Ithonidae, however, deserves much more detailed consideration. As now known, it consists of three Australian genera: *Ithone* (New South Wales) with one species; *Heterithone* (eastern Australia) with three species; and *Varnia* (central and Western Australia) with a single species.[2] *Ithone* is the only one of these that has been collected in large numbers, the others being known by very few individuals. Specimens of all of these genera are contained in the Museum of Comparative Zoology, and have been studied for the present paper. Since no detailed drawings have been published showing the arrangement of the terminal abdominal sclerites in the Ithonidae, I include here a series of such drawings of *Ithone fusca,* and, to facilitate comparison with *Oliarces,* a drawing of the wings of the same species.



Text-fig. 1. *Ithone fusca* Newman. Fore and hind wings of male specimen in M. C. Z. (Woy Woy, N. S. W., Nov. 4, 1918, R. J. T.). Rs, radial sector; MA. anterior media; MP, posterior media; b, basal piece of MA between MP and Rs.

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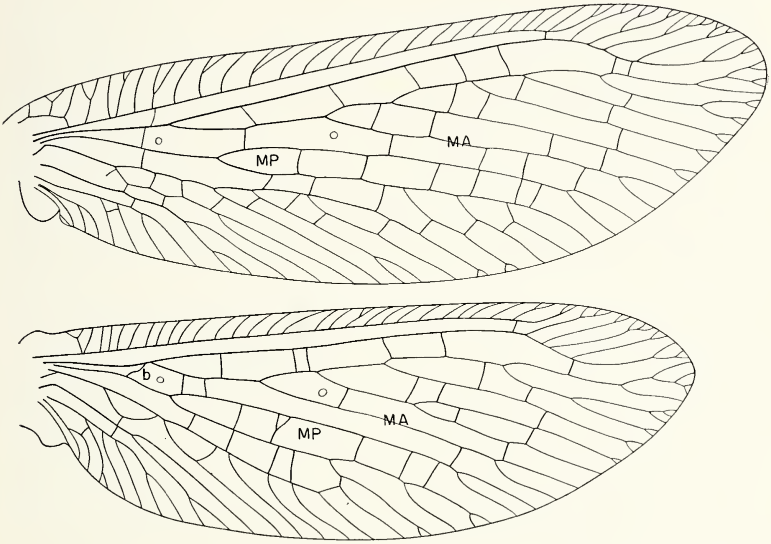
[2] The monotypic genus *Rapisma,* from the Malay Peninsula, has been doubtfully referred to the Ithonidae by some workers, but was excluded from there by Tillyard (1916). It will be treated in another article.

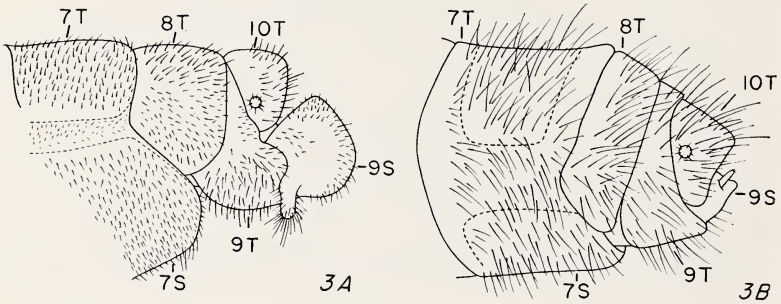
In comparing the venation of these genera with that of *Oliarces,* I have found it helpful to use the interpretation of neuropterous venation that was originally proposed by Martynov and that I employed in my revision of the Nearctic Hemerobioidea (1940, pp. 193-194). According to this concept, the most anterior branch of the media (labeled MA) is anastomosed in part with the radial sector or its last branch. In the fore wing, the actual separation of MA from MP is not apparent, but in the hind wing the basal piece of MA may extend a considerable distance before coalescing with the radial sector. Such is the case in *Ithone* (text-figure 1), *Heterithone* and *Varnia.* In *Oliarces* this segment of MA is very short and transverse, though it retains the sigmoidal form present in the Australian ithonids. This difference should not be regarded as more than of generic significance, however, since the several genera of Hemerobiidae exhibit a comparable diversity in the length of this segment. The same may also be said of the density of the



Text-fig. 2. *Oliarces clara* Banks. Fore and hind wings of allotype. Lettering as in text-figure 1.

venation, for although there are fully twice as many terminal branches in the ithonids as in *Oliarces*, such diversity likewise occurs within the Hemerobiidae.

The general body structure of *Oliarces*, including the small, retracted head, and the large abdomen, strongly resembles that of the ithonids. The terminal abdominal segments, however, present some interesting differences. In the male of *Ithone*, as well as of *Heterithone* and *Varnia*, the ninth abdominal tergite is entire dorsally, even though much constricted (Plate 4, fig. 1A). The ninth sternite (hypandrium of Tillyard's terminology) of these genera, as in nearly all Planipennia, is extended further posteriorly than the tergite, but it is not nearly so modified here as in most Neuroptera. The tenth tergite, which includes the trichobothria, bears a pair of conspicuous anal plates, extending posteriorly and slightly curved inwardly. The tenth sternite is apparently reduced to internal plates, as in nearly all other Neuroptera. The homologues of the sclerites are readily found in *Oliarces*. Its ninth tergite is more constricted medially than in *Ithone*, but it is still undivided. The ninth sternite has migrated further posteriorly, and is smaller than in *Ithone*, but is otherwise similar. The anal plates of the tenth tergite, though directed upwards instead



Text-fig. 3. A, Terminal abdominal segments of female of *Ithone fusca* Newman. Drawn from specimen in M. C. Z. (Woy Woy, N. S. W., Nov. 3, 1918, R. J. T.). Lettering as in text-figure 1. B, Terminal abdominal segments of female of *Oliarces clara* Banks. Drawn from allotype. Lettering as in text-figure 1.

of posteriorly, could easily be modifications of those of *Ithone*.

The terminal abdominal segments of the female of *Ithone* are shown in text-figure 3A. Tillyard, in describing these (1919, p. 426), states that the eighth, ninth and tenth abdominal segments "are more or less fused together, forming the projecting end of the abdomen." In alcoholic specimens, however, the segments are perfectly distinct. The eighth tergite extends further ventrally than the seventh; and the ninth, as in nearly all Planipennia, reaches all the way to the ventral surface. The eighth sternite is not visible externally. The ninth sternite in all the ithonids is posterior to the ninth tergite and is enlarged to form the sand-plow or psammarotrum. Its two lateral plates are fused dorsally by membranes but are, of course, separated posteriorly in the region of the gonopore. The psammarotrum bears a pair of conspicuous processes, directed ventrally; these were thought by Tillyard to be used as tactile organs during oviposition. The tenth tergite is short, hood-shaped and bears the trichobothria. In *Oliarces* (Figure 3B) the ninth tergite is not so long ventrally as in *Ithone* and the ninth sternite is reduced to a pair of very small plates, scarcely extending beyond the tenth tergite. That these plates do comprise the ninth sternite is indicated by the presence of a pair of small distal papillae, which, although they project dorsally, are clearly homologues of the longer, ventral processes in *Ithone*. No true psammarotrum, comparable to that of *Ithone,* is formed, but the structure is there in reduced form. The tenth tergite of *Oliarces* is similar to that of *Ithone,* except for a slight difference in its shape.

From the evidence reviewed above, *Oliarces* appears to be closer to the Australian ithonids than to any other Neuroptera. This resemblance is, in fact, so close that only one modification need be made of Tillyard's definition of the family; this is the recognition that the psammarotrum may be very small or vestigial.[3] It is noteworthy in this con-

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[3] Tillyard also stated in his definition of the Ithonidae that the fore wings were of tougher consistency than the hind, being somewhat leathery; but this is certainly not true of *Heterithone pallida,* which Tillyard himself described as having very transparent and colorless wings.

nection that the reduced psammarotrum in *Oliarces* and many of its other features (e.g., the short basal piece of MA in the hind wing) appear specialized as compared with the corresponding structures of the Australian ithonids. The inclusion of *Oliarces* in the Ithonidae certainly makes an unusual distributional pattern for the family, but the paucity of specimens of most species implies that the group might well have a much wider distribution than is now known. Of course, since the larvae of the Neuroptera provide the only completely satisfactory basis for their family classification, the systematic position of *Oliarces* will not be truly solved until its immature stages have been discovered.

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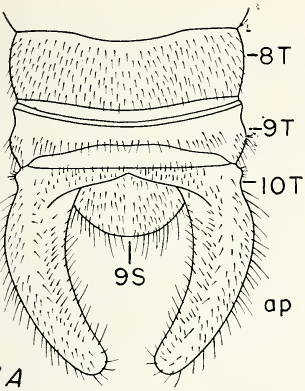
EXPLANATION OF PLATE 4

Fig. 1. Terminal abdominal segments of male of *Ithone fusca* Newman. Drawn from specimen in M. C. Z. (Woy Woy, N. S. W., Nov. 5, 1918, R. J. T.). 1A, dorsal view; 1B, lateral view; 1C, ventral view; ap. anal plate; 8T, 9T, 10T, abdominal tergites; 8S, 9S, abdominal sternites. Fig. 2. Terminal abdominal segments of male of *Oliarces clara* Banks. Drawn from holotype (M. C. Z.). a, anus. Other lettering as in figure 1.



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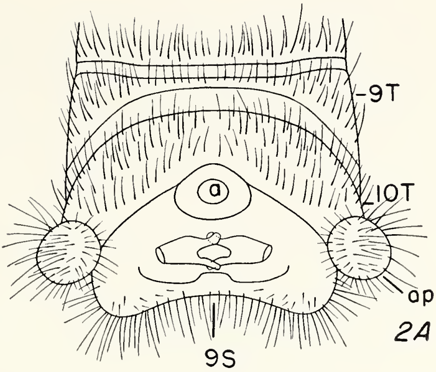

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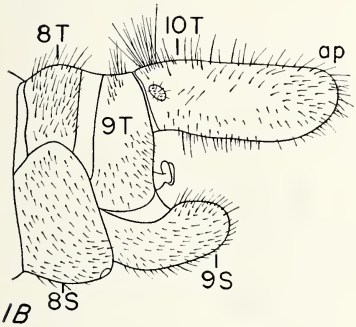

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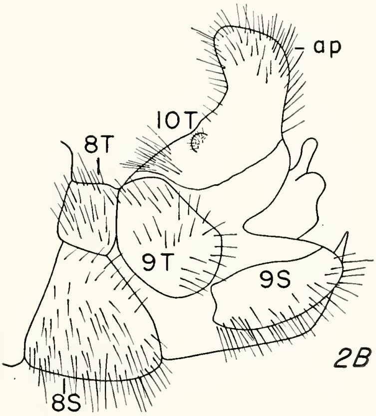

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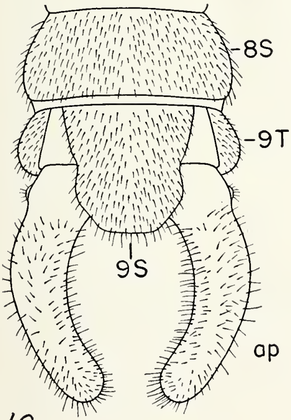

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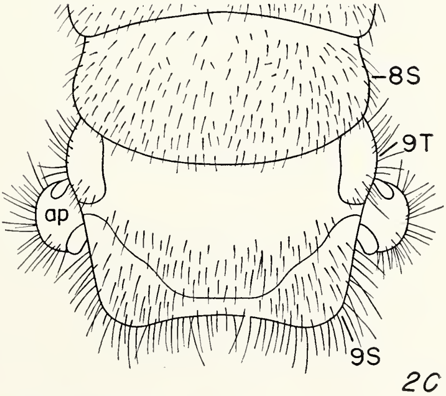

2C

CARPENTER — OLIARCES

DESCRIPTIONS OF SOME NEW CALLISTINAE (COLEOPTERA, CARABIDAE) FROM EAST AFRICA[1]

By P. Basilewsky
Belgian Congo Museum, Tervuren, Belgium

Through the kindness of Dr. P. J. Darlington, Jr. of the Museum of Comparative Zoology at Harvard College, Cambridge, Massachusetts, I have been able to study certain Carabidae collected by Mr. Arthur Loveridge during his trips in East Africa. I sincerely thank Dr. Darlington for this opportunity. In the material I have found three new forms belonging to the subfamily Callistinae. I here give their descriptions.

Pachydinodes raffrayi (Chaudoir) **darlingtoni** subsp. nov.

Length 15-17mm. Differs from the typical form, widely distributed in Tanganyika Territory and the southern part of Kenya Colony, as follows: Size larger; color lighter green, antennae and legs lighter ferrugineous; form more elongate and slender. Prothorax with sides very distinctly narrowed toward base, widest near middle of length; posterior angles more rounded; base nearly same width as anterior margin; punctation of upper side the same. Elytra more ovate, distinctly widened behind the shoulders; latter less prominent; greatest width of elytra near middle of length; striae strongly impressed, punctured (lightly) only in anterior half, intervals more convex, especially in basal part. Lower side similar, but meta-episterna longer and with several large punctures. The two specimens seen have no trace of a preapical yellow spot.

Portuguese East Africa: Lumbo (A. Loveridge, 1.IX. 1918, 2 ♀♀). Holotype in the Museum of Comparative Zoology (Type No. 28,233); paratype in the Musée du Congo Belge, Tervuren.

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

The differences given above completely change the appearance of the beetle as compared with typical *raffrayi.* It is possible that the new form is in fact a distinct species; but, as I have seen only two females, I prefer to wait for more material before deciding the degree of relationship more precisely.

Epomis loveridgei n. sp.

Length 18.5; greatest width 7.2 mm. Upper side dark violaceous, very shining; scutellum black; lower side black, without metallic reflections; legs ferrugineous, femora very dark, nearly black; antennae brown.

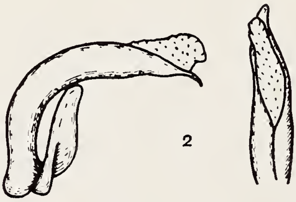
Head wide and short; eyes large, moderately prominent, temples very short, almost enclosed by the anterior margin of prothorax; upper surface smooth at middle, with some large scattered punctures posteriorly and laterally; labrum small, with anterior margin straight; palpi elongate, last segment (♂) of maxillary ones straight at tip, last segment of labial ones faintly enlarged, next to last segment with several setae; maxillary ones pubescent; antennae with 4th segment pubescent, 3rd a little longer than 4th.

Prothorax large, faintly convex, slightly cordiform; anterior angles rounded; sides gently rounded in first two-thirds, then narrowed and sinuate; posterior angles right; base straight, not margined, nearly same width as anterior margin; greatest width slightly before middle; median line fine and short but well marked; lateral troughs narrow; inner basal foveae rather deep, fairly long, nearly linear; upper surface flat, with faint longitudinal median depression in which is the median line; surface covered with irregularly spaced large punctures; anterior lateral setae missing, the posterior ones in the lateral troughs distinctly before the angles.

Elytra sub-ovate, faintly convex, with greatest width near middle; basal margin angulate at shoulder; apical truncation oblique and rounded; shoulders faintly developed; striae strongly impressed, well punctured, nearly reaching base, the scutellar one long and straight; intervals strongly convex, very shining, without microsculpture, punctate only at sides against the striae; 8th interval covered with spaced punctures, but 9th entirely punctured-shagreened; seven dorsal punctures on the 3rd interval.

Lower side shining, nearly glabrous; prosternal process not margined, hastate, with a tuft of setae at tip; pro-episterna with some large punctures anteriorly, near the internal suture; meso-episterna smooth; meta-episterna as wide as long, with numerous punctures; abdomen punctured-shagreened at sides; aedeagus as figured (Fig. 1).

1



2

Figure 1. *Epomis loveridgei,* n. sp., aedeagus. Figure 2. *Chlaenius* (*Platychlaenius*) *uzungwensis,* n. sp., aedeagus.

TANGANYIKA TERRITORY: Bagil, Uluguru Mountains (A. Loveridge, IX. 1926). Holotype ♂ in the Museum of Comparative Zoology (Type No. 28,234). The type is unique.

This new and remarkable species is allied to *Epomis violaceipennis* Chaud., of West Africa and the Belgian Congo, by the smooth and convex intervals punctate only against the striae, by the same convexity of body, by the prothorax little widened anteriorly, and by the absence of a yellow elytral margin. It differs from *violaceipennis* in color of head and prothorax, in elytra being more shining, and in other ways. The prothorax of the new species is more transverse, distinctly cordiform, with sides strongly sinuate posteriorly, and with stronger but more widely spaced punctures. The elytra are more distinctly ovoid in shape, with shoulders more obliterated and interstices more convex, more shining, and without microsculpture. The lower side has less, but coarser, punctation; the prosternal process is less acute at tip; the meso-episterna are smooth; and the meta-episterna are shorter, not longer, than wide. Finally, the last segment of the labial palpi is less dilated than in any other form of the genus, that of the maxillary palpi being simple. The aedeagus is different too.

Chlaenius (Platychlaenius) uzungwensis n. sp.

Length 13 mm. Head and prothorax reddish brown, the latter a little lighter; elytra black, scutellum reddish; lower side of head and prosternum reddish brown, other sterna and abdomen black; legs and antennae dark ferrugineous.

Head long, with very fine punctation, chiefly on disk, nearly obliterated on vertex; eyes large and prominent, temples short, faintly narrowed posteriorly; anterior margin of labrum barely concave; antennae long, barely exceeding basal third of elytra, 3rd segment much longer than 4th.

Prothorax nearly as long as wide, faintly convex; anterior margin weakly emarginate; anterior angles prominent, broadly rounded at tips; sides gently rounded, not more narrowed posteriorly; greatest width a little before middle; posterior angles blunt, widely rounded at tips; base faintly concave, as wide as anterior margin, not emarginate; median line fine, superficial, reaching neither anterior margin nor base; marginal gutters strongly widened posteriorly where sides are broadly explanate and slightly elevated; basal foveae very broad; upper surface with roundish, rather large but not very deep punctures, very numerous at sides especially near posterior angles, more widely spaced on disk; each puncture with a long, yellowish white seta; anterior lateral setae missing, posterior ones before angles.

Elytra sub-ovate, weakly convex; greatest width behind middle; shoulders rounded; apical truncation oblique, indistinctly sinuate; striae fine but rather deep, not very distinctly punctured, the scutellar one long; intervals weakly convex, with reticular microsculpture plain under strong magnification, and covered with rather large, rounded, not very deep punctures from which rise long setae, longer at the apical declivity than elsewhere.

Lower side with relatively reduced punctation and pubescence; prosternal process rounded at tip, weakly margined, punctured and pubescent; pro-episterna nearly smooth, with some rather faint punctures near anterior margin; meta-episterna slightly elongate, narrowed posteriorly, strongly punctate, without external groove; abdomen punctate and pubescent at sides, nearly smooth at middle.

Legs long; protibiae of male without tooth near base; upper side of tarsi glabrous; 5th tarsal segment with a double row of spines; aedeagus as figured (Fig. 2).

TANGANYIKA TERRITORY: Uzungwe Mountains, Dabaga (A. Loveridge, 4. XII. 1929). Holotype ♂ in the Museum of Comparative Zoology (Type No. 28,416). The type is unique.

This is a very distinct species, sharply set off by its coloration. I place it, provisionally at least, in subgenus *Platychlaenius* Jeannel, because of its nearly smooth pro-episterna, but it is strongly differentiated from the other forms of this group by characters given above. The sculpture of the elytral intervals is not granular as it is in most species of *Platychlaenius*.

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PSYCHE

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STUDIES ON ARIZONA ANTS.
1. THE HABITS OF *CAMPONOTUS ULCEROSUS* WHEELER AND ITS IDENTITY WITH *C. BRUESI* WHEELER.

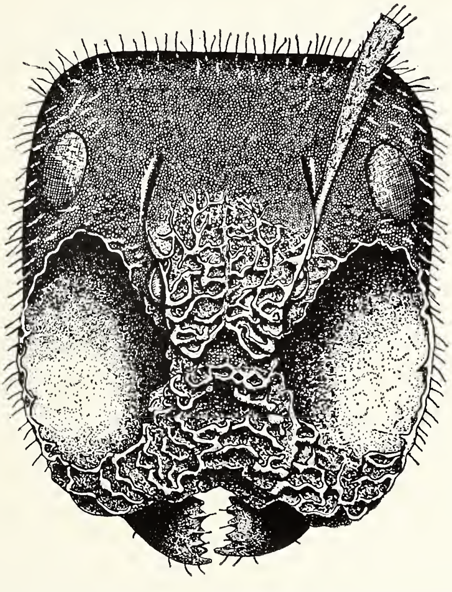
By Wm. S. Creighton
Department of Biology
College of the City of New York

During the summer of 1950 the writer enjoyed the privilege of spending three weeks in the Huachuca Mountains of Arizona. This was made possible through the courtesy of Mr. Charles Bogert, Curator of Herpetology at the American Museum of Natural History. Mr. Bogert permitted us to use a four wheel drive jeep and trailer belonging to his department. We met Mr. Bogert and his party in the Huachucas and there we collected reptiles and insects. July 1950 was a very wet month in the Huachucas and the collecting, as far as the ants were concerned, was all that could have been asked. I was able to study the habits of several species which I had previously known only from cabinet specimens. I wish to express my thanks to Mr. Bogert and to the American Museum of Natural History for their part in making these studies possible.

One very surprising result of this work was the discovery that *ulcerosus* and *bruesi* are specifically identical. The insects to which these two names have been applied have hitherto been regarded not only as separate species but as representatives of separate subgenera in the genus *Camponotus*. This unusual situation has resulted from attempts to deal with wholly inadequate material. The error was, therefore, unavoidable for, as I shall show, the structure of this ant is very peculiar and no amount of logic applied to fragmentary material could have given a correct concept of the species. Before discussing these peculiarities it seems advisable to present an account of the earlier taxonomy of *ulcerosus* and *bruesi*. Several of the proposals carried in this paper depend upon previous studies on this remarkable insect.

The original description of *ulcerosus* and that of *bruesi* were both presented in a paper by W. M. Wheeler which appeared in 1910 (1). At that time the subgenera of *Camponotus* were in a rather fluid state, hence it is not surprising that Wheeler made no attempt to assign either of his species to a particular subgenus. Instead he related *bruesi* to the *novogranadensis* group and left *ulcerosus* in a group of its own. It is instructive to note that Wheeler felt that *ulcerosus* formed a link between *bruesi* and species in the subgenus *Colobopsis*. Although this view is incorrect, it shows that Wheeler was aware of a basic structural similarity in the specimens which he assigned to *bruesi* and to *ulcerosus*. With adequate material for study the importance of this similarity would have been appreciated and subsequent confusion avoided. But the material upon which Wheeler based his original descriptions was far from adequate. There was a single major worker and five or six minors of *bruesi*, all strays taken by Wheeler at Ft. Davis, Texas. In addition to these types Wheeler had six more minor workers coming from two stations in Mexico. The paucity of type material was even more acute in the case of *ulcerosus*. This species was described from a single major worker taken by C. Shaeffer at Palmerlee in the Huachuca Mountains of Arizona.

In both of Wheeler's species the major worker possessed a striking, oblique truncation at the front of the head. But in the type of *ulcerosus* each cheek bore a large, deep, ulcer-like depression. The outer edge of each depression was bounded by a ridge along the lateral border of the head. Its inner edge lay close to the clypeus and the frontal lobe. These depressions, the clypeus and the frontal lobes were covered with very coarse, uneven, irregular rugae. In contrast, the type of the major worker of *bruesi* showed no depressions on the cheeks. The truncated anterior part of the head formed an almost flat plane which rounded into the lateral borders of the head through a blunt angle. The cheeks, clypeus and frontal lobes were coarsely but unevenly punctato-rugose (Text-fig. 3). It is not surprising that Wheeler considered these very different insects as distinct species or that Emery should later have placed them in separate subgenera. With nothing more than the structure of the types for a guide, this procedure required no justification. The accumulation of additional material of *ulcerosus* and *bruesi* was slow. Wheeler took two colonies of *ulcerosus* containing both major and minor workers in the Huachuca Mountains after he had described that species but before the paper carrying the description was printed. This material, which was referred to in a footnote, seems never to have been mounted for study. I believe that it must have been subsequently lost for I have never seen any of it in the collections which I have examined. It was not until nine

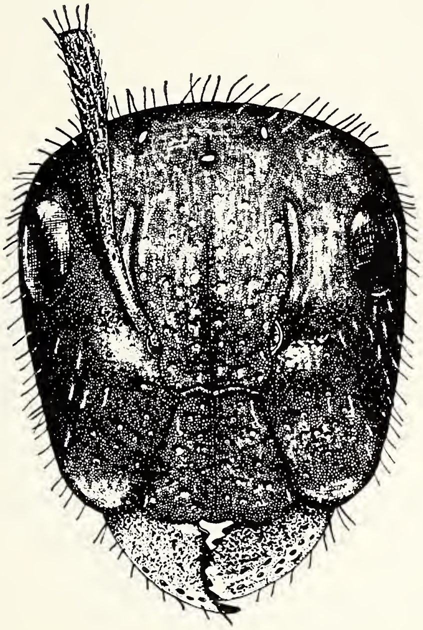


Text-fig. 1. *Camponotus* (*Myrmaphaenus*) *ulcerosus* Wheeler, head of major worker with fully developed ulcers.

years later that additional material of *ulcerosus* came into Wheeler's hands. In March 1919 he collected, at Oracle, Arizona, a small nest of *ulcerosus* containing both major and minor workers. Two years later Wheeler set up the subgenus *Manniella* (2) but he did not assign *ulcerosus* to it. This transfer was made in 1925 by Emery (3) who placed *bruesi* in the subgenus *Myrmaphaenus* at this same time. Emery's treatment has been followed by students of North American ants to the present, although in my 1950 publication (4) I expressed doubts that *ulcerosus* could properly be included in the subgenus *Manniella.*

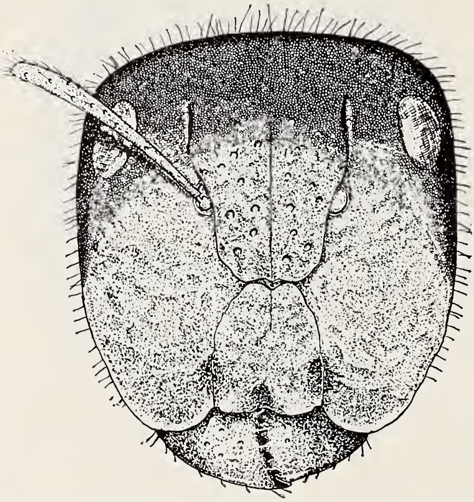
A fixed idea often has an extraordinarily tenacious hold. When I collected six colonies of this ant in Garden Canyon in 1950 I still attempted to assign them either to *ulcerosus* or to *bruesi.* I had studied these colonies in the field as carefully as I could. I had examined a considerable proportion of each under a small binocular microscope. I knew that the four females which had been taken with them were all extremely similar and not at all like the major workers with which they had been secured. I knew that in every case the structure of the nest was the same. Yet it was not until I mounted up this material and studied it in detail that I realized that *ulcerosus* and *bruesi* are the same insect. Since others may have equal difficulty in believing that two such dissimilar major workers can belong to the same species, I have presented here the steps by which this conclusion was reached. The altogether unexpected structure of the female may be considered first. Except for very minor details of color, pilosity, and sculpture all four females are identical. Only their cephalic structure need be considered at this point. The front of the head of the female shows nothing comparable to the oblique truncation of the major. The clypeus and the cheeks are, perhaps, a trifle flatter than is usual but, in general, the head of the female shows the customary, convex curvature found in many species of *Camponotus* (Text-fig. 2). The cheeks show no sign whatever of ulceration. The sculpture of the clypeus, frontal lobes and cheeks consists of moderately coarse, oval or rounded punctures which are irregularly spaced. The surface between these punctures is finely and densely granulose.

Between some of the punctures it is thrown up into a low mound. There are no rugae on the front of the head unless one chooses to regard the mounds just mentioned in this light. As may be seen the head of the female does not resemble that of the major of *bruesi* and still less that of the major of *ulcerosus*. There is, however, a very close resemblance between the head of the female and that of the larger media workers which were taken with them.



Text-fig. 2. *Camponotus* (*Myrmaphaenus*) *ulcerosus* Wheeler, head of female. Scale as in text-fig. 1.

We may now consider the structure of the major workers taken with these females. The first female to be secured came from a colony which had been scattered by improper collecting methods. Only two majors were taken in this case. Both are transitional in the degree of development of the ulcers on their cheeks. That is to say, the ulcers are much shallower than those of the type of *ulcerosus* but still clearly recognizable as ulcers. The second female was taken in association with six major workers. Of these one had moderately prominent ulcers on the cheeks, three had shallow ulcers on the cheeks, one had small and very feeble ulcers and one was non-ulcerate. The two remaining females came from the same colony. In this colony were seven major workers. Three of these have a cephalic structure far more extreme than that of the type of *ulcerosus*. The ulcers on the cheeks of these fantastic insects are so deep that the bottom of the depression must be almost in contact with the gula. Each depression extends clear to the lateral border of the head, where it is bounded on the outside by a thin, vertical sheet of chitin. The sculpture of the depressions, the clypeus and the frontal lobes is extraordinarily rough and uneven, so much so that these parts have a peculiar shrivelled or crumpled appearance (Text-fig. 1). The remaining four majors belonging to this colony closely approximate the condition found in the type of *ulcerosus*. There may be added here the cephalic characteristics of the majors taken



Text-fig. 3. *Camponotus* (*Myrmaphaenus*) *ulcerosus* Wheeler, head of non-ulcerate major worker. The head has been tilted backwards slightly to show the anterior truncation as fully as possible. Scale as in text-fig.1.

from colonies in which the female was not secured. Only one of these three colonies represented the majority of the nest. In this colony there were ten majors. Three of these majors have no trace of ulcers on the cheeks. Six of them have very shallow ulcers which are, nevertheless, covered with very coarse rugae. These rugae tend to obscure the ulcers but each depression has a low, distinct, lateral ridge which bounds its outer edge. One major worker in the above colony has somewhat deeper ulcers, although they are not as deep as those of the type of *ulcerosus*. Both the remaining colonies were fragments of nests in which the passages were lost during the course of excavation. The first contained two non-ulcerate majors. The second contained two majors with shallow ulcers having rather feeble rugae.

The facts just presented permit the following statements concerning this insect:

1. The female of this species is normal in every respect and there is no correlation between the cephalic structure of the female and that of the major worker.

2. The same type of female may produce widely different sorts of major workers.

3. The range of variation in the head of the major worker extends well beyond the condition found in the type of *ulcerosus*, which stands about midway in the series of transitional forms.

4. The full range of variation in the cephalic structure of the major is seldom, if ever, present in a single nest series. But in every nest series there is sufficient variation in the head of the major to make ulceration useless as a separatory character.

5. The non-ulcerate majors always have low and comparatively obscure rugae on their cheeks. Those with shallow ulcers may have the rugae either feebly developed or coarse and prominent. The majors with very deep ulcers invariably have extremely coarse rugae on the front of the head. Cephalic sculpture, like the ulceration of the cheeks, cannot be used as a separatory character.

There is but one conclusion to be drawn from the above data: *ulcerosus* and *bruesi* are the same insect. The most immediate effect resulting from the recognition of this fact involves the choice of the valid name. Either name is available since both appeared in the same publication. It has been the practice of myrmecologists to use page precedence in deciding cases of this sort. In this instance the name *bruesi* has page precedence but I have selected *ulcerosus* as the valid name for two reasons. In the first place the fully ulcerate major worker of this ant is a most extraordinary insect and it seems well to retain a name which refers to this striking peculiarity even though it is not shown by all the major workers. In the second place the type locality of *ulcerosus* is in the Huachuca Mountains of Arizona. Since this ant appears to be much more abundant in the Huachucas than at Ft. Davis, Texas (the type locality of *bruesi*) it is advantageous to have the Huachuca Mountains as the type locality.

It would be gratifying if the subgeneric affinities of this insect could be as easily handled as can the choice of its specific name. Since *bruesi* was assigned to *Myrmaphaenus* and *ulcerosus* to *Manniella*, the inconsistency of a species split between two subgenera cannot be allowed to stand. The problem is to rectify this inconsistency with the least damage to the subgenera involved. In a previous publication (4) I have shown that the constitution of *Myrmaphaenus* is unusually heterogeneous. This is entirely due to Emery who, without giving any valid reason for the change, reversed his earlier views in 1925 and combined in one group species which he had formerly assigned to three subgenera. This circumstance makes it impossible to select a clearly definitive character by which all the species belonging to *Myrmaphaenus* may be recognized. But it may be stated that there are some species in *Myrmaphaenus* that have a major worker in which the front of the head is obliquely truncated. There are some species in which the worker caste is polymorphic. There are some species known to have a normal female. If, therefore, we are dealing with a species which combines these three features, its inclusion in *Myrmaphaenus* causes no increase in heterogeneity on any of the above counts. As to whether this species shows the 'subgeneric characteristic' of *Myrmaphaenus* is not the question for, as things stand at present, there is no uniformly applicable characteristic which will define the members of this ill-conceived and conglomerate subgenus.

The situation in the subgenus *Manniella* is simpler, but this is mainly because it contains a much smaller number of species than *Myrmaphaenus*. For this subgenus is also cursed with heterogeneity. When *Manniella* was first set up by Wheeler in 1921 it contained only the Cuban species *sphaericus* and its subspecies *sphaeralis*. This species had previously been assigned to *Colobopsis* by some workers and to the subgenus *Myrmeurynota* by others. Wheeler's move was a sound one, for it recognized the peculiar structural features which mark the major worker of this species. The major worker of *sphaericus* possesses ulcerate cheeks and peculiarly modified frontal lobes. Each frontal lobe is large, laterally expanded and with its anterior half distinctly concave. The two concavities are separated by a prominent median septum where the lobes join. While this configuration of the frontal lobes may be nothing more than the specific characteristic of *sphaericus* it seems to have no close counterpart in any other species in the genus *Camponotus*. Hence the subgenus *Manniella* can if necessary, be based upon the unique structure of the frontal lobes of *sphaericus* as long as the subgenus is limited to that species. With this auspicious start it is most unfortunate that Emery and Wheeler should have subsequently added to *Manniella* species which do not agree in the characteristics just mentioned. In 1925 Emery transferred *ulcerosus* to *Manniella* and in 1934 Wheeler placed *linnaei* and *championi* in this subgenus (5). Each of the species transferred to *Manniella* has a major worker with ulcerate cheeks but none of them has frontal lobes comparable to those of *sphaericus*. Emery was clearly aware of this discrepancy, for he commented on it when he transferred *ulcerosus* to *Manniella*. No doubt Wheeler was also, but by 1934 the structure of the frontal lobes had been subordinated to the presence of ulcers on the cheeks as the definitive characteristic of the subgenus *Manniella*. It is instructive to note that both Emery and Wheeler tried to bolster this character with others which would give a better definition to *Manniella*. Thus Emery postulated that the worker caste in *Manniella* is strictly dimorphic and Wheeler later added the concept that there is no normal, winged female in this subgenus, her place being taken by a fertile major worker. The point in these distinctions is that they give a certain degree of separation from *Myrmaphaenus*, where at least some of the species are known to possess a polymorphic worker caste and a normal winged female.

It should be clear that the data presented in this paper destroys the subgenus *Manniella* as defined by Emery in 1925 and emended by Wheeler in 1934. For, if *ulcerosus* is retained in *Manniella*, as is quite possible since some of its major workers are far more heavily ulcerated than those of any other species in the subgenus, then it follows that *Manniella* must be expanded to include a species with a polymorphic worker caste and a normal female. Conversely if *ulcerosus* is transferred to *Myrmaphaenus*, where it fits on every count except the ulcerate major, then this same ulcerate major breaks down the one certain distinction between the two subgenera. It may be argued that the transitional character of *ulcerosus* defeats any attempt to separate *Myrmaphaenus* and *Manniella* and this is true as long as the separation is based on the presence or absence of ulcers on the cheeks of the major worker. But, as I have already pointed out, the separation need not be made on this basis. If the definitive subgeneric characteristic of *Manniella* is made the configuration of the frontal lobes of the major and not the ulceration of its cheeks, then a good separation can be secured. It is true that this procedure limits the representation in *Manniella* to the species *sphaericus* and that *ulcerosus*, *linnaei* and *championi* must be shifted to *Myrmaphaenus* as a result. But this transfer can do no damage to a subgenus whose constitution is already a monument of heterogeneity. Moreover, this method seems to be the only one which will preserve *Manniella*. I believe that there is a distinct advantage in maintaining *Manniella*, for *sphaericus* is a very singular species and if *Manniella* is fused with *Myrmaphaenus* there is every reason to expect that it will have to be resuscitated at a later date. I also feel fairly sure that it will be necessary in the future to set up a new subgenus to receive *ulcerosus*. I have not done so at present because of the possibility that *ulcerosus* may fit into one of the subgenera which Emery fused to make *Myrmaphaenus*. Since it is clear that *Myrmaphaenus* will have to be drastically revised if its constituent species are to be put on a sound taxonomic basis, any piecemeal attempt in this direction would be premature. One may earnestly hope that the next revisionary effort applied to *Myrmaphaenus* will be thorough enough to give us a workable version of this highly unsatisfactory group. In the meantime the plan which causes the least disarrangement is to transfer to *Myrmaphaenus* the species *ulcerosus*, *linnaei* and *championi* and to restrict the subgenus *Manniella* to *sphaericus* and its subspecies *sphaeralis*. I propose to follow this plan and trust that other myrmecologists will see the matter in the same light.

I wish to present here certain descriptive details to augment the figures of *ulcerosus* included in this paper. These will be restricted to the minor and media workers and the female. Both the ulcerate and the non-ulcerate phases of the major worker of this insect have been described elsewhere and need no further description here.

Worker minor: head (exclusive of the mandibles) 1.25 mm. long; thorax and petiole 2 mm. long; total length 5.5-6.5 mm. Erect hairs long, thin, white and usually with sharp tips; abundant on the rear of the head, the entire thorax and the abdomen. Hairs on the mandibles, clypeus, cheeks and gula for the most part notably shorter than those on the rear of the head. Femora with short erect hairs on their lateral and flexor surfaces. Those on the extensor surface mostly appressed and often largely limited to the outer half of the femur. Tibiae with abundant erect hairs. Those of the tarsi and antennal funiculi finer, shorter and semierect. Antennal scapes covered with very fine, appressed, yellow pubescence and with a few short, yellow, semierect hairs usually present on the outer half of each segment. Head and thorax finely and densely granulose (under high magnification this granulation may be seen to consist of close-packed, circular craters). Coxae and petiole with a delicate, even, reticulate sculpture. Gaster finely shagreened, somewhat more shining than the coxae and the petiole. Mandibles with elongate, oval punctures. A few feeble, coarse punctures are present on the clypeus and the cheeks. In some specimens these are so shallow that they can only be seen in oblique lights. Color black, the mandibles, antennae and tarsal joints light brown. The anterior edge of the clypeus and the area immediately behind the insertion of the mandibles often marked with brown. In many specimens the abdomen, and to a lesser extent the thorax, will show bluish reflections.

Worker media: head (mandibles excluded) 1.75 mm. long; thorax and petiole 2.5 mm. long; total length 6-7 mm. Pilosity as in the minor worker. Sculpture of the thorax and abdomen as in the minor worker. The head is a little more strongly granulose and less shining with numerous, conspicuous, oval punctures on the clypeus and cheeks and a few feebler punctures on the frontal lobes. Most of the clypeus, the anterior portion of the cheeks and the anterior half of the frontal lobes light brown. The color otherwise as in the minor worker.

Female: head (mandible excluded) 2 mm. long; thorax and petiole 4 mm. long; total length 9-10 mm. Erect hairs on the thorax sparser and a little shorter than those of the worker castes. Erect hairs elsewhere very similar to those of the worker. Sculpture of the head similar to that of the media worker but with the punctures more pronounced, particularly on the frontal lobes where they extend rearward to the level of the median ocellus. Scutum densely and evenly granulose, feebly shining with scattered, irregular punctures from which the erect hairs arise. The remainder of the thorax more strongly shining, particularly the lateral portions of the pronotum, the metanotum, the basal face of the epinotum and the mesothoracic sternite and episternite. On the above areas the granulation is reduced to a delicate and minute reticulate sculpture. Gastric sculpture heavier than in the media, particularly on the dorsum of the first gastric segment where the sculpture consists of a minute pattern of reticulations. Front of the head usually marked with brown as in the media but sometimes the entire head, except the mandibles and antennae, is black. The four females examined showed no bluish reflections on the gaster or thorax.

The above descriptions, as well as the figures were based upon material taken in Garden Canyon in the Huachuca Mountains of Arizonia. Garden Canyon, therefore, becomes the type locality for the female and media worker. In this connection it seems well to note that there is no good agreement as to the exact situation of Palmerlee, the type locality of the major of *ulcerosus*. I regret that this name was incorrectly spelled as "Parmerlee" in my 1950 publication on North American ants, for this adds further confusion to an already confusing situation. Mr. L. F. Byars, who is much interested in Arizona ants, writes me that the former postoffice of Palmerlee was situated on the Palmer Ranch at the mouth of Miller Canyon. But Will C. Barnes in his entertaining publication *Arizona Place Names*, (6) states that Palmerlee was at the Reef Mine on Miller Creek and that J. L. Palmerlee, on whose land the postoffice was established in 1904, was its first postmaster. Mr. Barnes secured his data from the records of the United States Post Office, hence the date and the postmastership appear beyond dispute. But it is very unlikely that the postoffice was at the Reef Mine. For the Reef Mine is now situated, and apparently has always been situated, at an elevation of 6700 feet near the head of Carr Canyon. This area is well above the ordinary vertical range of *ulcerosus*. The contradictions just discussed need occasion no difficulty if one is content to cite the Huachuca Mountains as the type locality for *ulcerosus*.

Since virtually nothing has been published on the habits of *ulcerosus*. I wish to present certain data which were secured last summer. The observations which follow were made in an area near the picnic grounds in Garden Canyon. At this level the canyon is divided by a low ridge into two roughly parallel valleys. The road to the picnic grounds runs through the larger valley which lies to the southeast of the ridge. This valley is clearly the better watered of the two, for it contains big sycamores and junipers along the stream bed. These are absent in the smaller valley which lies on the northwestern side of the ridge. The dividing ridge has many shrubby live oaks on its southeastern slope. These are very abundant at the base of the ridge but thin out toward its crest. A few oaks cross the crest of the ridge into the smaller valley but most of this valley, particularly its slope which faces southeast, is dominated by numerous plants of *Agave palmeri*. As the agave plants are much less abundant in the larger valley, the two sides of the ridge present a very different appearance. Despite this striking vegetational difference the two areas are part of the same plant association. Shreve has pointed out (7) that in the southern Arizona mountains the evergreen oak forest is an open community with many other plants present, among them *Agave palmeri*. Shreve's view is fully supported as far as the ants in this area are concerned, for the same ants occur in the dense oak thickets and on the open slopes where the agave plants grow. In both these areas the soil is very stony, with many of the stones partly projecting above the surface. The nests of *ulcerosus* are usually situated under such partially buried stones.

Considering the abundance of the foraging workers, the nests of *ulcerosus* are extraordinarily difficult to find. Mr. Luther Little, who was camping with us, first called my attention to the workers of *ulcerosus* on the agave leaves. So many of the plants were visited by foraging workers that I thought that there would be little trouble in tracing them to their nests. Most ants readily accept termites offered to them and carry them at once to their nests. I repeatedly offered termites to the workers of *ulcerosus* which they accepted readily enough. But, instead of taking them home, they usually sucked the juices from the termite and remained on the agave leaf. In a few instances a worker would start home with the termite, but nothing came of this for the ant would soon drop the termite and return to the agave leaf. Although the slope of the canyon was covered with agave plants in all stages of development, the ants chose only those plants which had recently bloomed. Young plants were never visited, nor were the shrivelled remains of plants which had bloomed in previous seasons. The heavy panicle of fruit, towering ten to twelve feet above the leaves seemed the part most likely to attract the foragers. But the ants rarely ascended the fruit stalk. Instead they confined themselves largely to the upper surface of the leaves. The areas around the bases of the lateral spines and particularly the area at the base of the long terminal spine seemed especially attractive. A worker would often stand for many minutes at the base of the terminal spine, apparently licking some substance from the surface of the leaf. The explanation which best fits this behavior is the assumption that, during the fruiting period, the leaves of the agave give off a sugary substance which attracts the ants. This secretion cannot be produced by the younger plants as otherwise they would also be visited by the *ulcerosus* workers.

Since feeding methods had failed to reveal a nest, it seemed advisable to examine the soil in the immediate vicinity of the agave plants in the hope of finding colonies there. The difficulty was to get at the soil immediately beneath the plant. Any one who attempts to uproot a full-grown plant of *Agave palmeri* will soon have a healthy respect for the needle-sharp terminal spines. To get close to the roots of the plant it was necessary to 'dehorn' all the leaves on one side with a pocket knife. The plant could then be wrenched out of the ground with a pick. But the violence of this operation defeated the purpose for which it was intended. Tearing the roots out of the ground disturbed a considerable area of soil and badly displaced the stones in it. The result was to obliterate any nest passages present. The one fragment of an *ulcerosus* colony which was exposed in this fashion was so badly scattered through the soil that, for reasons already explained, I doubted that the female was that of *ulcerosus*. It then occurred to me, as should have been obvious sooner, that if this species customarily nests under agave plants, the nest should be present for at least a while after the plant has died. There were many dozens of dead agave plants on the side of the canyon. These consisted of a rosette of dried and shrivelled leaves with a central hole where the fruit stalk had been. The whole thing was comparatively light and easily handled. With a little care it could be lifted entire and tossed to one side without disturbing the ground beneath. I removed a considerable number of these old plants and examined the soil beneath them. In no case did I find a nest of *ulcerosus*. But in fully half the cases the plant surmounted a flourishing colony of *Pheidole vaslitti arizonica*.

By this time I was convinced that *ulcerosus* does not usually found its nests beneath agave plants but as to where to look for them I had no idea. Then, largely through luck, I stumbled on five colonies. Three of these were situated in open areas on the agave slope but at some distance from the nearest agave plant. The other two were placed at the edge of oak thickets on the opposite side of the ridge. In every case the nest was situated on a slope that faced southeast . I was able to excavate three of these nests completely. I might have done so with the other two had I not lost contact with the passages through over-hasty excavation. Each nest consisted of a rather obscure entrance between stones which were embedded in the soil. In two cases there was a thin disc of excavated soil spread around the entrance but this was not present in the other nests. From the entrance a single, tortuous passage twisted through the soil between and under stones at a depth which was seldom more than six inches below the surface. At intervals, usually beneath the lower surface of a stone, the passage widened into a small, irregular chamber. In each of these were major, media and minor workers and some brood. The queen was usually taken in the last chamber at the inner end of the nest. As there was no telling which direction the passage would take, the soil had to be removed a bit at a time to avoid losing the passage altogether. However, the absence of any lateral passages considerably simplified matters. Because the excavation had to be made slowly, there was ample opportunity to secure foraging workers as they returned to the nest. I believe, therefore, that the figures for the three colonies given below represent most of the population in each case. In the first colony there were one hun-

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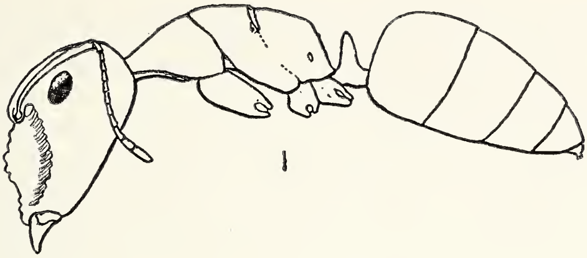
Explanation of Plate 5

Camponotus (*Myrmaphaenus*) *ulcerosus* Wheeler, Fig. 1. Ulcerate major worker. Fig. 2. Media worker. Fig. 3. Minor worker. Fig. 4. Female. Fig. 5. Non-ulcerate major worker. All figures to the same scale.



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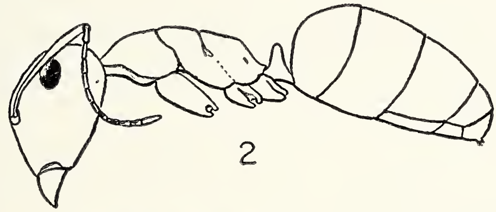

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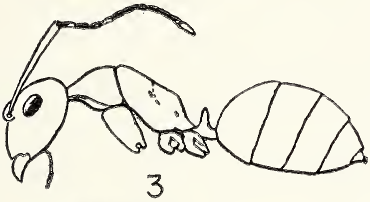

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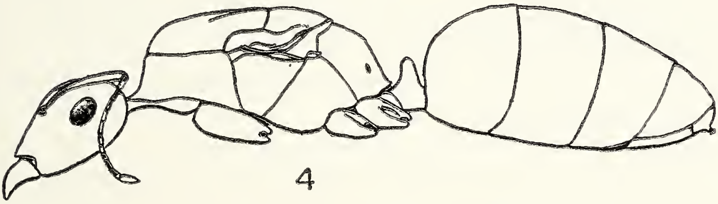

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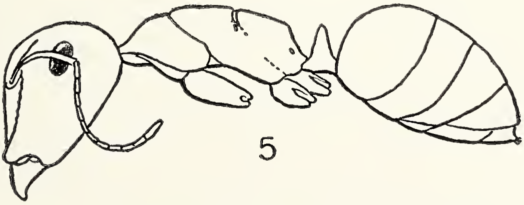

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CREIGHTON — ARIZONA ANTS

dred and sixty-five minors and medias, six majors and one female. In the second colony there were sixty-four minors and medias, seven majors and two females. In the third colony there were one hundred and thirty-four minors and medias and ten majors. Unfortunately the female of this nest escaped capture. From the above it would appear that the colonies of *ulcerosus* are small, even when more than one female is present. It is also worth noting that all the brood taken in the three nests was in a fairly young condition. No pupae were found and, since the last nest was taken on July 27th, it seems safe to conclude that the marriage flight of *ulcerosus* must occur at the end of the summer or in the early fall.

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CONCERNING SOME *HYDROMETRA* FROM AFRICA (HEMIPTERA)[1]

By H. B. Hungerford
University of Kansas

In the Annales Musei Nationalis Hungarici, Vol. XXVIII, 1934, there appeared an article entitled "The Hydrometridae of the Hungarian National Museum and other studies in the Family" by Hungerford and Evans. This paper contains drawings of most of the known species and keys for the separation of all of the species of the world known to the authors. Twenty-five of the sixty-six *Hydrometra* treated are described as new. Unfortunately there occurred a lapse of several years between the completion of the manuscript and its publication and in the interim three papers describing new *Hydrometra* appeared. However, only *H. ugandae* Jaczewski is from Africa. Since 1934 six more African species have been described, five of them by Poisson and one by Hoberlandt, and some specimens have been received by me for study, including two undescribed species.

I am indebted to my friends Dr. J. C. Bradley and Dr. F. X. Williams for the opportunity to study the *Hydrometra* taken by them during their recent trips in Africa. Dr. Bradley's material was sent to Cornell where Henry Dietrich was kind enough to forward it to me. Dr. Williams' material was promptly forwarded by Dr. Bequaert from the Museum of Comparative Zoology at Harvard and we have mounted and labeled this material to avoid any delay in its study.

In the material collected by Dr. J. C. Bradley are the following:

Hydrometra albolineolata Reuter

Tonga, Sudan, Oct. 28, 1948, White Nile, lat. 9°-28′ N., long. 31°-2′, J. C. Bradley, 1 ♂, 3 ♀♀ (Cornell); 1 ♂, 1 ♀ (F. H. Snow Coll.).

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

Malakal, Sudan, Oct. 27, 1948, J. C. Bradley, 1 ♂, 3 ♀♀ (Cornell).

Steamer on White Nile, Sudan, Oct. 26, 1948, lat. 10°-45′ N to 10°-26′ N, J. C. Bradley, 1 ♀ (Cornell).

Bahr el Jebel, Sudan, Nov. 3, 1948, Terakeka to Mongalla to lat. 5°-11′ N, J. C. Bradley, 1 ♀ (Cornell).

Hydrometra sp.

Bahr el Jebel, Sudan, Nov. 3, 1948, J. C. Bradley, Terakeka to Mongalla to lat. 5°-11′ N. (1 ♀). (Not but near *H. gracilenta* Horv.)

Dr. F. X. Williams sent the following four species, one of which is new:

Hydrometra africana H. & E.

Africa, Amani, Tanganyika Terr., Feb. 1948, F. X. Williams, 2 ♂♂, 1 ♀ (Mus. Comp. Zool., Harvard); 1 ♂, 1 ♀ (F. H. Snow Coll.). In these specimens the males have the large hair tufts on the sides of the first genital segment that were lacking in the type. The females have two hair tufts on rear margin of last dorsal abdominal segment that are partly effaced on the allotype but present on a paratype.

Hydrometra ugandae Jaczewski

Africa, Uganda, Kichwamba, Feb. 28, 1948, F. .X. Williams, 1 ♂ (Mus. Comp. Zool., Harvard); 1 ♂ (F. H. Snow Coll.).

Hydrometra chopardi Poisson

Africa, Kenya Col., 28 miles N. of Nairobi, Thika River Falls, Feb. 20, 1948, F. X. Williams, 4 ♂♂, 6 ♀♀ (Mus. Comp. Zool., Harvard); 1 ♂, 1 ♀ (F. H. Snow Coll.).

Hydrometra poissoni n. sp.

Size and color: Length 9.24 mm. to 9.54 mm. (males). The general color is dark brown. The head nearly black with a faint longitudinal frosted line on the postocular space; the pronotum with a narrow longitudinal median frosted line bordered successively on each side by a dark, nearly black, purplish-brown band, a brown band, another dark purplish-brown band, outside of which is a frosted line; the hemelytra have two longitudinal white lines, one slender near the costal margin and the other a broader median band which arises from it near its base. Both bands are broken by the dark veins that cross them. There is a streak of white on the hemelytra paralleling the sides of the scutellum. Underside of body somewhat frosted, the sides of the abdomen with a nearly black subconnexival band broken at the segmental junction by frosted spots.

Structural characteristics:

Head: Length 93 units; the ratio of the anteocular part of the head to the postocular part is given by the formula AO : PO : : 57 : 27. The dorsal interocular groove less than the diameter of the eye. The clypeus is quadrate, medianly depressed and slightly emarginate in front, its median length about three fifths its width, the rostrum surpassing two thirds of the postocular distance. The antennal segments: 1 : 2 : 3 : 4 : : 18 : 34 : 77 : X.†

Pronotum: Length 46 units*; the pitting very faint, almost indiscernible, only the curved row of pits behind the anterior acetabulum plainly marked.

Coxae: The distance between the first and second coxae is to that between the second and third as 34 : 62. The anterior acetabulum has a faint pit on each side of the cleft. The middle acetabulum with two faint pits on each side of the cleft; the posterior acetabulum is unpitted on the sides but faintly pitted above.

Femora: The anterior femora surpass the base of the antennal tubercles. The hind femora reach the tip of the abdomen.

Abdomen: The last abdominal segment and the first genital of the male without hair tufts or spines. The first genital segment ventro-laterally depressed, leaving a broad midventral longitudinal keel with some hairs on either side. Seen from above, the first genital segment is broadest about the middle; the terminal dorsal process is stout, slightly upturned and less than one third the length of the segment.

Comparative notes: This species is near *H. smithi* H & E., described from Sierra Leone, but both the shape of the ter-

† last segment missing.
* unit = .033 mm.

minal segments of the males and the color patterns are different. *H. smithi* has a more slender genital segment as seen from above and parallel longitudinal white bands on the last abdominal and genital segments. These are lacking in *H. poissoni.*

Described from two males labeled "Africa, Uganda, 60 miles west of Kampala, March 4, 1948, F. X. Williams," Holotype in the Museum of Comparative Zoology (No. 28493) at Harvard, the paratype in the F. H. Snow Collection. Named in honor of Dr. Raymond Poisson who has described several *Hydrometra* from Africa.

Hydrometra albolineolata Reuter

While the Hungerford and Evans paper of 1934 was in press, Dr. Jaczewski published his "Notes on the Aquatic Heteroptera of the Ethiopian Region"[2] in which he redescribed *H. albolineolata* Reuter and described as new a species which he called *Hydrometra ugandae.*

His conception of Reuter's species was based upon a male specimen from "Addah, Guinea," loaned to him by Dr. Horvath of the Museum in Budapest and presumably a syntype. However, I had previously studied the entire series of specimens in Budapest, two syntypes in the Museum at Perth, Scotland, and one in the U. S. National Museum at Washington, D. C., and my conception of the species (which differs from that of Dr. Jaczewski) is given on page 50 and Plate II of our 1934 paper.

Being puzzled by the difference in concept concerning this species, I have studied the question again and reexamined material which forces me to conclude that my conception of Reuter's species is the correct one. I am therefore selecting a male syntype that corresponds to the figures on Plate II of the Annales Musei Nationalis Hungarici XXVIII, page 48, as the lectoholotype.

I have examined a pair of specimens determined as *H. albolineolata* by Dr. Jaczewski and the male labeled "Zanzibar, H. J. Snell" runs to *H. africana* H. & E. The female

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[2] Stylops, Vol. 1, Part 5, pp. 100-104, 1932.

from "Uganda, Kampala, G. L. R. Hancock" is not quite the same.

Hydrometra ugandae Jaczewski

This species was described from Uganda: Bugomolo. The large brush of semi-erect brown hairs on the basal portion of the seventh abdominal tergite of the female and the short somewhat downward curving terminal spine makes the female readily distinguishable. I have examined the female paratype. Dr. China made a drawing of the male type in the British Museum and this drawing shows spiny tufts present on the last abdominal segment although Dr. Jaczewski's description says they are not present.

Hydrometra goodi n. sp.

Size and Color: Length 12.15 mm. (♂) - 12.96 mm. (♀). General color brown, the abdominal tergites, except the last one, shining, nearly black and contrasting with the much lighter connexivum. The pronotum with a narrow longitudinal median frosted line bordered successively on each side by a purplish-brown band, a brown band, another purplish band, outside of which is a curved frosted line above the anterior acetabula and another bordering the margin of the posterior lobe and continuing to the posterior acetabula. Under side of body somewhat frosted. Above, the connexivum has a small frosted spot at the segmental junctions. The last abdominal segment and genital segment covered with short hairs in both sexes.

Structural characteristics:

Head: Length 140 units; the ratio of the anteocular part of the head to the postocular part is given by the formula AO : PO : : 88 : 41. The dorsal interocular groove less than the diameter of the eye, the ventral interocular groove also short. The clypeus is quadrate, truncate in front, its median length slightly more than half its width, the rostrum surpassing two thirds of the postocular distance The antennal segments: 1 : 2 : 3 : 4 :: 27 : 56 : 130? : X (♂); 1 : 2 : 3 : 4 :: 25 : 58 : 135 : 65 (♀).

Pronotum: Length 60 units; pitting indefinite.

Hemelytra: Short, 90 units long, covering the first abdominal segment, surface uneven, veins conspicuous.

Coxae: The distance between the first and second coxae is to that between the second and third as 40 : 70. The anterior and middle acetabula have two pits on each side of the cleft. These are often obscure.

Femora: The anterior femora surpassing the head by half the length of the first antennal segment. The hind femora surpassing the end of the abdomen.

Abdomen: The last abdominal segment of the male without hair tufts. The first genital with hair tufts just laterad of shallow depressions which outline a faint median longitudinal ventral keel. Seen from above, the first genital is broadest at its base, the terminal dorsal process is caudally directed and short, only about one fifth the length of the segment in the male. In the female the terminal process is nearly one third the length of the segment and sharp pointed. The hair tufts on the caudal margin of the last abdominal tergite that are possessed by the females of several species are lacking in this one.

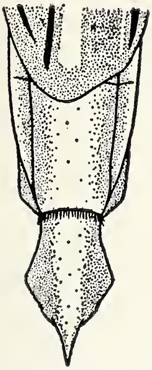
Comparative notes: This new species belongs to the typically African group that includes *H. ambulator* Stål, *H. albolineolata* Reuter, *H. africana* H. & E., *H. trans-*

EXPLANATION OF PLATE 6

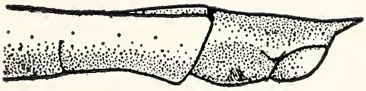
Figs. 1-3. *Hydrometra poissoni* Hungerford. Fig. 1. Dorsal view of last abdominal segments of male. Fig. 2. Lateral view of last abdominal segments of male. Fig. 3. Ventral view of last abdominal segments of male.

Figs. 4-8. *Hydrometra goodi* Hungerford. Fig. 4. Lateral view of last abdominal segments of female. Fig. 5. Lateral view of last abdominal segments of male. Fig. 6. Dorsal view of last abdominal segments of female. Fig. 7. Dorsal view of last abdominal segments of male. Fig. 8. Ventral view of last abdominal segments of male.

(Drawings by Thomasine Neering).

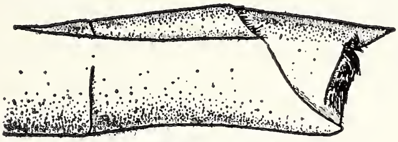


1 H.poissoni ♂

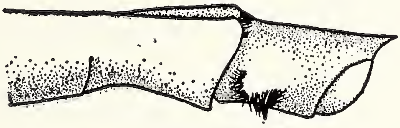


2 H.poissoni ♂

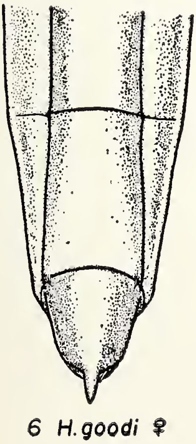
3 H.poissoni ♂



4 H.goodi ♀

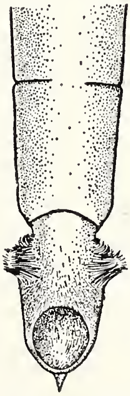


5 H.goodi ♂



6 H.goodi ♀

7 H.goodi ♂



8 H.goodi ♂

HUNGERFORD — AFRICAN HYDROMETRA

vaalensis H. & E., *H. ugandae* Jacz., *H. chopardi* Poisson, and *H. monodi* Poisson. It is more slenderly elongate than any of the above. The first antennal segment is relatively longer, plainly surpassing the head by more than half its length. The head itself is more elongate. It may be most nearly related to *H. ugandae* Jaczewski but the females lack the large brush of hairs on the last dorsal abdominal segment that distinguish *H. ugandae.*

Described from one male (holotype) labeled "Sangmelima, Cameroon, W. Africa, Oct. 17, 1934, A. I. Good," a female (allotype) labelled "Sangmelima, Cameroon, 4-16, 1932, A. I. Good." and two female paratypes, one taken with the holotype and the other with the allotype. These have been in the F. H. Snow Collections under a manuscript name for many years.

A MIGRATING ARMY OF SCIARID LARVAE IN THE PHILIPPINES

By Charles T. Brues
Harvard University

On the morning of June 15, 1949 we witnessed a mass migration of fungus-gnat larvae in the rain-forest zone of Negros Island at an altitude of about 4,000 feet. Close to a temporary shelter in which we were housed, my wife noticed a strange crawling object moving over the wet, muddy soil. Closer examination at once disclosed that this was an irregular, band-like mass of small dipterous maggots such as have been noted from time to time in scattered localities in the holarctic region. Originally known as Heerwürmer in Europe and as snake-worms in the United States, these when reared, have always proved to be members of the genus *Sciara*. *Sciara* is cosmopolitan in distribution and many species are known, but it appears that only a very few ever indulge in migrational processions.

In the present instance, the mass of larvae was moving slowly in a very irregular band about a foot in length, less than an inch in width and layered to a depth of about half an inch. As has been described in some previously observed cases, the individual larvae were moving on the slimy bodies of their fellows so that progression is accomplished by the forward motion of those on the top, while those at the rear, as they are uncovered, move with a sort of superficial, belt-like, rolling motion over the cramped individuals in the lower layers. Thus, the mass moves onward, but the larvae are continually changing position with reference to one another.

It had been raining during the night and the mountain was intermittently in the clouds. The wet soil was marked with numerous foot-prints and with a shallow drainage ditch to guide water away from the shelter, there was thus little opportunity to steer a straight course and the movement was very erratic, although consistently in the general direction of the drier ground under the shelter.

In the course of a few minutes while Mrs. Brues secured some motion pictures of their movements, the swarm had advanced several feet over the irregular terrain. We collected about one-third of the marching larvae and a subsequent count of these indicates that some 900-1200 larvae were taking part in the procession. This total is surprisingly small and far less than a rough estimate made at the time the swarm was observed.

No stragglers were seen in the neighborhood of the crawling swarm in spite of the very irregular surface over which it traveled. The band of larvae was by no means of uniform breadth or thickness, swelling and contracting constantly as movement was speeded or slowed by sudden ups and downs along the path. Even at points where there were very few larvae, those coming up from behind selected without hesitation the slime trail left by those in advance.

As all individuals were fully grown and of uniform size it appears that migration was not undertaken in search of food, but to find suitable conditions for pupation and transformation. We were unable to find any fleshy fungi from which the swarm might have come. In spite of the excessive moisture in the rain forest, large fungi are comparatively scarce, although diffuse mycelial growths are plentiful on the logs, bark and smaller vegetable debris that litter the forest floor. In general the insect fauna of this area is not rich in mycetophagous forms and very few fungus-gnats were present in sweepings made in the vicinity. In common with other Mycetophilidae (in the wider sense) the species of *Sciara* are mycetophagous, developing most generally in decaying mushrooms and in vegetable material such as tubers, large seeds, etc., that are disintegrating through the action of putrefactive bacteria and fungi. Like some of their relatives, the adult midges frequently appear in incredible numbers where such food is available under the moist conditions essential to their larval development.

As would be expected the earlier observations were recorded by European entomologists. These have been referred to in several American publications. Johannsen ('09) states that the European Heerwurm is probably *Sciara thomae* L. or *S. militaris*, probably the latter.

In the United States, a number of observations have been published, dealing with Nearctic species, at least one of which has been reared by Becker ('14) and described by Johannsen ('14) as *Sciara congregata.*

The first references to migrating sciarids in our own country appears to be one by Glover in 1872. Another early record was published by Linter in his tenth report as State Entomologist of New York. Later Riley and Howard ('91) refer to two cases reported by a correspondent who observed two "snake-worms", each some fifteen inches in length and half the diameter of a man's little finger. During the following decade Webster ('94) observed two instances at Lafayette, Indiana, of swarms a foot or two in length and from one-half to two inches in diameter. At about the same time, Jones ('93) saw at Oberlin, Ohio, a "rope of maggots" five feet in length and two inches in diameter. He was unaware of their identity, but shortly afterward Williston ('93) indicated that these were undoubtedly *Sciara* larvae. Felt ('01) described several from parts of New York State, referring to several strings seen on successive days near Franklin, N. Y. These were about fifteen or twenty inches in length. He also summarized a number of previously published observations.

Following the account by Becker, mentioned above, Notman ('21) recorded an interesting case observed by him in eastern New York, applying the term "compound larvae" to the procession.

Finally, after our return to America we found in the recently published book "High Jungle" by William Beebe ('49) an account of a parade of maggots which we surmised to be a migration of *Sciara* larvae in the American tropics. This is verified by the later description of *Sciara* (*Neosciara*) *beebei* by Shaw and Shaw ('50) as the larva in question. Dr. Shaw has kindly identified the Philippine larvae as a species of *Sciara, sens lat.*

It is therefore evident that this migratory habit is more widespread than had previously been supposed.

Beebe's account is the most careful and complete description of the migrating behavior of *Sciara* which has been published. His observations were made at his Rancho Grande laboratory in the Venezuelan Andes.

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TWO NEW SPECIES OF EXOTIC ANTS[1]

By Robert E. Gregg
Department of Biology, University of Colorado

The new forms described below were sent to me through the generosity of Dr. William L. Brown, Jr., and belong to the collections of the Museum of Comparative Zoology. I am indebted to Dr. Brown not only for the opportunity of describing and figuring these specimens, but for checking references and for comparing them with related species of ants in the Wheeler Collection.

Stictoponera posteropsis n. sp.

Female. Length, 5.25 mm., cephalic index, .80.

Head, excluding the mandibles, considerably longer than broad, the widest portion about midway between the mandibular insertions and the posterior corners; sides somewhat convex anterior to the eyes. Occipital border deeply and broadly concave, with sharp, upturned margin, and produced at the angles into pronounced occipital lobes which project upward. Clypeus rounded, convex, and with anterior margin entire. Frontal carinae remote, parallel, and possessing well developed lateral lobes covering the insertions of the antennae. Eyes very convex, almost hemispherical, set far back on the head in depressions just anterior to the occipital lobes; ocelli also far posterior on the head. Antennae 12-segmented; scapes long, nearly straight, increasing slightly in diameter toward the tips, and slightly surpassing the occipital lobes. Funiculi not clubbed, but segments gradually increasing in size, the terminal segment equal in length to the two preceding. Mandibles triangular; external border sinuate, basal border convex, and apical or masticatory border without teeth or denticles.

Thorax in profile strongly convex, promesonotal suture, meso-metanotal and the meta-epinotal sutures distinct, de-

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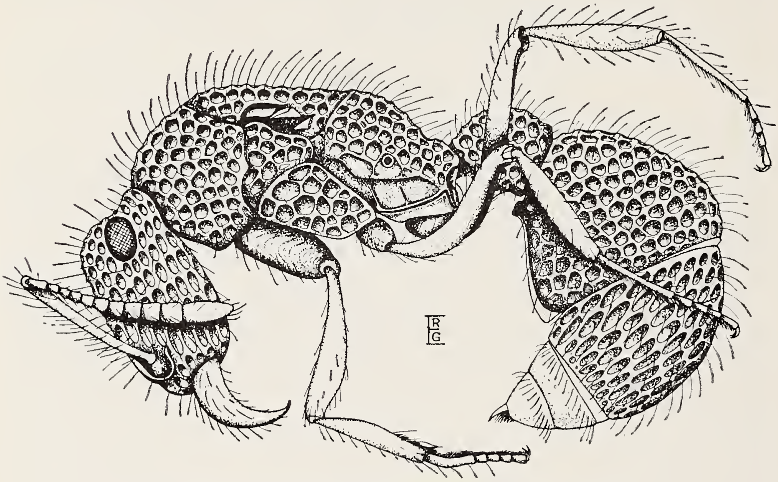
[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

spite the heavy sculpturing of the body. Epinotum with broadly rounded basal face passing abruptly into a deeply concave declivity which partially accommodates the node-like petiole. The declivity is bounded laterally by high, sharp, narrow ridges, each ridge having a very small, blunt epinotal spine, that almost blends with the general sculpture. Petiole subglobose or nodiform, narrower in front, expanding gradually behind, but sharply constricted where it joins the postpetiole or first gastric segment; convex dorsally and concave ventrally, provided with a long, flat, anteriorly projecting, ventral tooth. Postpetiole broad, globose, its ventral surface armed with a long, narrow keel which expands into an open, lip-like structure at the anterior margin and directly beneath the petiole. Remainder of gaster smaller than the postpetiole, and projecting downward and forward, and supplied with a well developed sting.



Text-fig. 1. *Stictoponera posteropsis,* profile.

Wings hyaline, straw-colored, extending beyond the tip of the gaster. One cubital cell, one discal cell, one large and one very small submarginal cell, is each present in the forewing.

Head, dorsal aspect of mandibles, thorax, petiole, postpetiole, and the first segment of the gaster, completely and heavily sculptured with coarse, deep pits or foveolae. The pits are rounded to hexagonal on most of the body, but are elongate and oval on the head and the gastric segment. The sculpture is so coarse that under the microscope the shining surfaces, especially of the ridges between the pits are not diminished, but to the unaided eye, the general body tone is subopaque.

Long, delicate, sharp-pointed hairs cover all parts of the body and appendages, and arise separately from the foveolae where these are present. Pubescence is practically absent on the body, but is abundant on the scapes, funiculi, coxae, legs, and the posterior region of the gaster.

Color reddish brown, with the funiculi, scapes and legs a lighter red; tip of gaster yellowish.

Holotype: winged female (M.C.Z. No. 28556).

This species is described from a single female specimen (worker caste unknown), taken on November 12, 1921 at Wai Lima, Prov. of Lampong, southern Sumatra, by H. H. Karny.

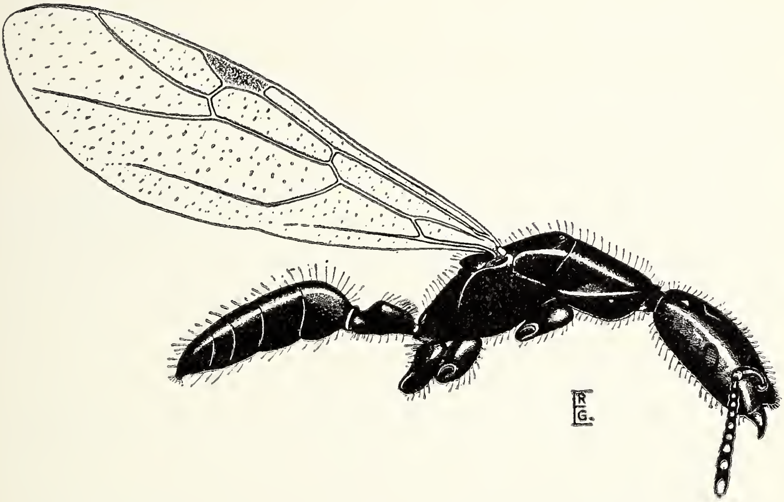
The ant belongs apparently to a rare group, and, according to Dr. Brown, there is only one other specimen in the Wheeler Collection very similar to it, a worker taken by Dr. Chapman in the Philippines. This worker was marked as new by Wheeler, but was left undescribed. The new species finds its place among other *Stictoponera* (namely, *rugosa* (F. Sm.), *coxalis* Rog., *menadensis* Mayr, *bicolor* Em., and *avia* Forel), a group which possesses a low, loaf-shaped or globular petiole. None of these, however, has the eyes so far back on the head as does *posteropsis*, a character which alone will distinguish it from the others. I have seen a specimen of *Stictoponera* bicolor, and two of *S. costata* Sm. (=*Ponera rugosa* F. Sm.?), and upon comparing them with *posteropsis*, have found that the latter differs from them in the following particulars. The eyes are not only placed far posteriorly on the head, but are very convex, whereas in *bicolor* they are much flatter. The antennal scapes reach or project but slightly beyond the occipital corners, though in *bicolor* they exceed the corners by a distance equal to the greatest width of the scape. No teeth are present on the mandibles, but minute denticles are present on those of *costata*; frontal carinae have broad lateral lobes, but this condition is absent in *bicolor*. The humeral angles seem to be less sharp and projecting than in either *costata* or *bicolor*, and the epinotal spines are practically absent, though they might prove to be present on the worker when it is found. The sculpture is similar to that of the other two species, but shows the first gastric segment to have elongate and oval foveolae, whereas on *costata* they resolve themselves into very long grooves running the full length of the segment, and in *bicolor* the sculpturing on this segment is almost completely absent, leaving the surface smooth and shining. The ventral blade on the petiole is rounded while in *costata* its apical edge is notched, and a midventral keel or ridge is present on the postpetiole of *posteropsis*, this structure being absent on the other species. The comparisons made are between a female and the worker caste of the other species, but the differences are sufficiently striking to support the description of a new form. In addition, there are important differences in size; *posteropsis* (♀), is slightly over 5 mm. in length, *costata* (♀), is over 8mm., and *bicolor* (♀), is over 5 mm. Although these ants are ponerines, undoubtedly, the worker of *posteropsis*, if known, would prove to be considerably less than 5 mm. long.

Camponotus (Myrmostenus) cooperi n. sp.

Female. Length, 6.25 mm., cephalic index, .55

Head, excluding the mandibles elongate, as indicated by the head index; rectangular in general shape, the widest point at the anterior angles where the mandibles articulate. Occipital angles abrupt, and posterior margin straight. Sides of head slightly concave, with the eyes medium sized and almost flat, located midway between the anterior and posterior ends. Ocelli about midway between the eyes and posterior border of the head. Clypeus convex, and produced anteriorly into a cone-like process. Frontal carinae low and indistinct, leaving the antennal insertions exposed. Antennae 10-segmented, scapes short, extending posteriorly only as far as the eyes; narrow at the base and expanding abruptly toward the apex. Funiculi gradually increasing toward the tips, the last three segments considerably enlarged, and each longer than broad, but not forming a club. Mandibles narrow, each with three apical teeth and one indistinct denticle.

Thorax long and narrow, gradually widening to the insertions of the forewings and tapering posteriorly from that point. Prothorax from above long and somewhat resembling a truncated isosceles triangle; mesothorax about as wide as long. Thorax in profile convex; pronotum flat but sloping upward to the mesonotum which is angled just behind the promesonotal suture; scutellum raised. Sides of thorax flat. Epinotum without distinct basal and declivious faces, the entire dorsum sloping away rapidly from the metanotum to the articulation with the petiole. Petiole convex, low in front and rising gradually to a low broad node (no scale), whose posterior slope is concave; ventral surface smooth. From above, the petiole is rounded and almost oval in shape, though narrower in front and widening gradually to the apex of the node.



Text-fig. 2. *Camponotus* (*M.*) *cooperi*, profile.

Gaster long, narrow, flat above, modified elliptical in shape, widest in the middle of the first segment, and tapering to a pointed posterior end. Entire body notably elongated and depressed.

All surfaces glabrous, very smooth and shining, the only indication of sculpture being the minute pits from which the hairs arise and a slight shagreening of the gaster. Hairs delicate, pointed, pale yellow, and present on the head, thorax, petiole, gaster, scapes, funiculi, and all segments of the legs. Pubescence very sparse but present on most surfaces; slightly denser on the gaster and thickest on the funiculi.

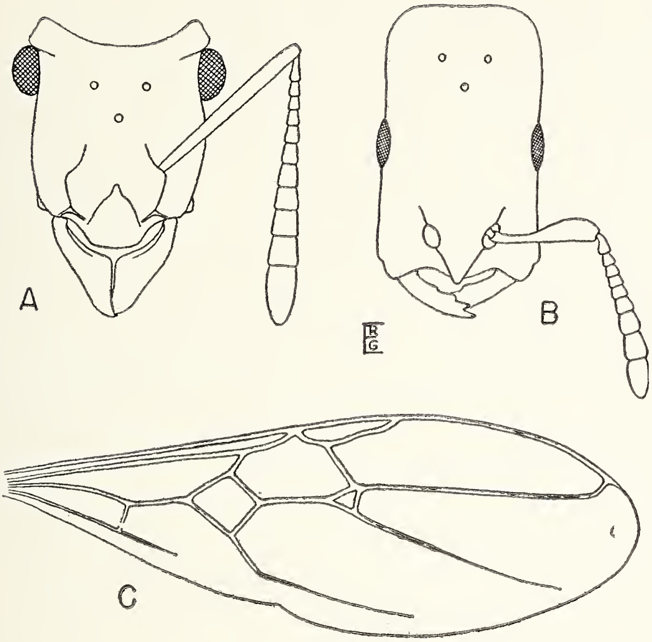
Forewing 5.4 mm. long, with one cubital cell and no closed discal cells; brownish in color.

Color of body black throughout, except tarsi, articulations of legs and antennae, and the mandibles which are dark reddish brown.

Holotype: winged female (M.C.Z. No. 28555).

Described from a single specimen collected by Dr. Kenneth Cooper at Turrialba, Costa Rica. Attached to it is the number Cr 49 F 13.

In 1903 Emery described *Camponotus mirabilis*, and later (1911), described two new species, *C. sphenocephalus*, and *C. longipilis*, with its variety *C. l. postangulata*, belonging to the same group. To-date these seem to be the only forms known, and are all from Peru. Emery placed these ants in the subgenus *Myrmostenus* in 1920, and they are so listed in the Genera Insectorum (1925, Fasc. 183, p. 161). They have in common a very large size, 16 mm. or more, with very straight and elongated bodies and for the most part shining surfaces, giving them a striking appearance. The new species differs from all these in its much smaller size and its color which is practically solid, shining black. Despite this, it appears to belong in the subgenus and to represent a diminutive type. As all forms of *Myrmostenus* are known only as females, it has been suggested that the workers when found will show them to be members of some other group of *Camponotus*, and although this was mentioned by Emery, it has so far not been demonstrated; consequently, the conclusion that these ants form the subgenus *Myrmostenus*, for the present must rest. The new ant from Costa Rica is certainly distinct from the others and deserves to be recorded. No others in the subgenus have been described, as far as I am aware, since 1925 when Emery listed the then known species.



Text-fig. 3. A. *Stictoponera posteropsis, head.* B. *Camponotus (M.) cooperi,* head. C. *Stictoponera posteropsis,* wing.

Camponotus cooperi differs from its above named relatives, which are elephantine by comparison, in a number of additional particulars. The head, though elongate, is not concave on the occipital margin, as in *mirabilis,* and the sides are straight to slightly concave, not converging posteriorly as in *sphenocephalus.* The eyes are placed in the middle of the head and very much to the sides, whereas in *mirabilis* they are moved partially to the dorsal surface. The frontal carinae converge to a blunt point on the anterior margin of the clypeus, the antennae are inserted quite near the anterior end of the head, and the scapes which are short, are greatly thickened, and do not reach beyond the level of the eyes. The mandibles have three teeth (not 7). The sculpture is almost absent, the whole body being very smooth.

Dr. Brown has compared the ant with types of *mirabilis* in the Wheeler Collection, and assures me there is every reason to consider it a new form. He states: "I am practically certain that no species of this subgenus has been described since the end of the war (1945 on). It should be described as new, since *Myrmostenus*, whether or not it is the female of some other subgenus, is very little known, and not recorded outside South America so far as I can tell."

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THE GENERIC NAMES *BLANKAARTIA* OUDEMANS, 1911, AND *TROMBICULOIDES* JACOT, 1938 (ACARI: TROMBICULIDAE)[1]

BY H. S. FULLER[2] and G. W. WHARTON[3]

The generic names of trombiculid mites have been studied recently by several acarologists. Two of the genera have been based on specimens that were incorrectly identified, so that they fall in the category of genera based on misidentified genotypes. The question of what to do concerning these names was referred to Mr. Francis Hemming, Secretary of the International Commission on Zoological Nomenclature. In a letter, he indicated that the concluding portion of Opinion 168 (namely, the portion which states that, where a genus is considered by specialists to be based on a misidentified type species, that name is to be regarded as of doubtful status pending a definite ruling being given by the Commission in the light of data submitted to it by interested specialists) will be omitted from the revision of the rules of zoological nomenclature in which the opinions will be incorporated with the rules. It is therefore necessary either to apply the principle established in Opinion 168 that designations of type species for genera must stand, or to refer the case to the Commission for use of their plenary powers to suspend the rules. Since the Commission can use its plenary powers only when strict application of the rules will result in greater confusion than uniformity, the type designations for the genera *Blankaartia* and *Trombiculoides* must be accepted.

Oudemans, 1911, designated *Trombidium niloticum* Trägårdh, 1904, as type of a new genus *Blankaartia* (Ent.

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[1] Done both at Harvard University and Duke University in connection with research supported by grants-in-aid from the Division of Research Grants and Fellowships of the National Institutes of Health, U. S. Public Health Service.

[2] Department of Microbiology, Harvard University School of Public Health.

[3] Department of Zoology, Duke University, Durham, North Carolina.

Ber. 3:123). His description of the genus was based on specimens purported to be the larvae of *Trombidium niloticum* by Trägårdh, although Trägårdh stated that the evidence associating these larvae with adults of *Trombidium niloticum* was circumstantial and therefore not conclusive. In fact, these larvae can now be recognized as belonging in a different family from the adults. However, according to the rules *Blankaartia* must retain as genotype *Trombidium niloticum* Trägårdh, 1904.

Berlese, 1912, proposed the subgeneric name *Trägårdhula* with the type *T. nilotica* (Träg.) (Redia 8:4). Since *Blankaartia* and *Trägårdhula* are based on the same type species they are synonyms.

Thor, 1936, proposed the generic name *Pentagonella* with *Trombidium ardeae* Trägårdh, 1904, as type. On the basis of morphological characteristics and geographical considerations it is quite possible that *T. ardeae* and *T. niloticum* are synonyms. However, only rearing experiments will be able to establish their identity. The work of Michener, 1946, has demonstrated that *T. niloticum* and *T. ardeae* are congeneric if not conspecific. Therefore *Pentagonella* Thor, 1936, is also a synonym of *Blankaartia*.

Michener, 1946, reports rearing specimens of *Trombicula* (*Megatrombicula*) *alleei* Ewing, 1926; *Trombicula* (*Megatrombicula*) *velascoi* Boshell and Kerr, 1942; and *Trombicula* (*Megatrombicula*) *attenuata* Michener, 1946. These species he places in the subgenus *Megatrombicula* Michener, 1946, with *Trombicula alleei* Ewing, 1926, as type. These three species are also congeneric with *T. niloticum.*

Womersley, 1948, added to the confusion by trying to settle the problem in his own manner without proper regard for the International Rules on Zoological Nomenclature. He accepts as the genotype of *Blankaartia* the species represented by the larva thought to be *Trombidium niloticum* Trägårdh by Oudemans. He refers to this species as *Blankaartia nilotica* (Träg.) on page 83 and as *Blankaartia nilotica* (Ouds.) on page 84. Actually the species represented by these larvae does not yet have a name. In the same paper Womersley used *Trägårdhula nilotica* as the valid name for *Trombidium niloticum* Trägårdh.

As for the generic names involved, strict application of the rules of priority leads to the following conclusion. *Blankaartia* Oudemans, 1911 (Type *Trombidium niloticum* Trägårdh, 1904) has priority over *Trägårdhula* Berlese, 1912 (Type *Trombidium niloticum* Trägårdh, 1904) ; *Pentagonella* Thor, 1936 (Type *Trombidium ardeae* Trägårdh, 1904) ; and *Megatrombicula* Michener, 1946 (Type *Trombicula alleei* Ewing, 1938). All of these names should be applied at the subgeneric level at the present time. The proper name of the species named *Trombidium niloticum* by Trägårdh is therefore *Trombicula* (*Blankaartia*) *nilotica* (Trägårdh), 1904.

The species represented by the larvae associated with *T. nilotica* (Trägårdh) has never been named. It is therefore necessary to name this species. It is a trombidiid and probably belongs to the subfamily Microtrombidiinae. The adult must be known before the species can be assigned with certainty to a subfamily.

Pseudoblankaartia n. gen.

Pseudoblankaartia is characterized by Oudemans, 1912, Zool. Jahrb., Supp. 14: 118-119 under the name *Blankaartia*. The type of *Pseudoblankaartia* n. gen. is hereby designated as *Pseudoblankaartia bequaerti* n. sp.

Pseudoblankaartia bequaerti n. sp.

P. bequaerti is characterized by Oudemans, 1912, Zool. Jahrb., Supp. 14: 119-122 + Figure H. As type of the species we designate the specimen from which Oudemans prepared Figure H.

A similar but less confusing condition exists in the case of *Trombiculoides* Jacot, 1938. Wharton, 1948, explains the details. Now that the portion of Opinion 168 mentioned above has been repudiated, Ewing's 1946 solution of the problem is correct and *Trombiculoides* Jacot, 1938 should be considered a synonym of *Sericothrombium* Berlese, 1910.

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STUDIES ON ARIZONA ANTS.
2. NEW DATA ON THE ECOLOGY OF *APHAENOGASTER HUACHUCANA* AND A DESCRIPTION OF THE SEXUAL FORMS

By Wm. S. Creighton
Department of Biology, College of the City of New York

In 1932 the writer presented, in this journal, a description of the worker of *Aphaenogaster* (*Attomyrma*) *huachucana* (1). The type specimens came from a single nest taken at an elevation of about 7000 feet in Ramsey Canyon in the Huachuca Mountains. I expected that other workers would find additional material of *huachucana* and that this would permit a better evaluation of its status, for *huachucana* is clearly related to *texana*. Since the latter species is also present in the Huachucas, much might be learned from the way in which the two insects behave in that area. In 1950 I synonymized Wheeler's variety *furvescens* with *texana* (2). The variety *furvescens,* which was based on material coming from the Huachucas, had proven to be a color phase that occurs over the entire range of *texana*. The synonymy of this variety raised disturbing possibilities in the case of *huachucana,* for there was a chance that it might also prove to be an inconsequential variation of *texana* when better known. In order to test the significance of the structural features on which *huachucana* was based, more material was urgently needed. This material has now come to hand and with it field data which provide good evidence that *huachucana* is a separate species. In order for this evidence to be appreciated it is necessary to discuss the range and ecological response of *texana* as well as those of *huachucana.*

It is impossible to give a concise account of the behavior of *texana* in the field. The species has a wide but discontinuous distribution in the southern United States. As far as can be determined all of the range of *texana* lies south of the 38th parallel and the great majority of it lies south of the 36th parallel. At this latitude, and south of it, the range extends from the Atlantic seaboard states to Arizona. This seems simple enough, but a careful examination of the stations in which *texana* has been taken will show that they have remarkably little in common. Thus, *texana* is abundant at sea-level in the neighborhood of Miami, Florida (Wheeler, Smith). It has been reported from damp woods at an elevation 1800 feet in the Great Smoky Mountains of Tennessee (Cole). It occurs in the foot-hills of the Appalachians in South Carolina (Smith) and northern Alabama (Creighton). It has been taken at an elevation of 900 feet on the plains of southern Kansas (Wheeler). It inhabits shady ravines in central Texas (Wheeler). It has been found on Bright Angel Trail below Indian Garden in the Grand Canyon (Wheeler). It is abundant at the 6000 foot level on sunny slopes in the canyons of mountains of southern Arizona (Wheeler, Creighton).[1] All these stations lie south of the 38th parallel, but I fail to see that there is any other feature which they share that could be cited as a reason why they were selected as nest sites by *texana.* Under such circumstances it appears hopeless to attempt a generalization which will cover the behavior of *texana* over its entire range. However the situation is by no means difficult if field observations are limited to a particular part of the range. For it seems that wherever this insect has been found in sufficient numbers to permit an adequate view of its behavior, this behavior has been surprisingly constant for the area involved. Thus, in the Huachuca Mountains the range of *texana* lies in the lower part of the evergreen oak belt which, on the northeastern

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[1] *A. texana* also occurs in the northern part of the Sierra Madre Oriental. The writer has recently taken it on Chipingue Mesa (2400′-4200′) and near Iturbide (2800′) Nuevo Leon, Mexico.

slopes of the mountains, extends from the canyon mouths to an elevation of about 7000 feet.

This evergreen oak area is an interesting one. Shreve calls it a "western xeric evergreen forest in which oaks are dominant" (3). The term "forest" is apt to mislead those who expect a forest to consist of sizeable trees. It is only under especially favorable conditions that this association produces a forest in the popular sense. In certain areas, however, the evergreen oaks form groves in which the trees may be thirty or forty feet high. On the northeastern slopes of the mountains the best stands of evergreen oaks occur at elevations of about 6500 feet. At higher elevations the groves become increasingly mixed with pines until, at an elevation of about 7000 feet, the pines replace the oaks. As one descends from the 6500 foot level most of the evergreen oaks decrease in size and at the 6000 foot level, and below it, they are usually stunted, bushy little trees not more than ten or twelve feet high and often much smaller. These little oaks frequently form dense thickets, but the thickets are seldom extensive and generally the evergreen oaks at the 6000 foot level are thinly scattered over the slopes which rise from the stream bottom. Along the stream bottom at this level groves are almost always present, but these consist of various deciduous trees and large junipers.

In the area just described I have observed several dozen nests of *texana*. The majority of the nests of this ant are situated between the 5500 and 6000 foot levels. The area selected is almost always a sunny, open slope, far enough away from the stream bottom to be out of the shade of the groves which occur there. As a rule the nests are placed so that they avoid even the scant shade furnished by the small evergreen oaks. Since the nests are often less than fifty yards away from areas of heavy shade, it seems clear that the nest-founding female prefers sunny places to shady ones. Above the 6000 foot level the incidence of the colonies decreases as the elevation increases. For practical purposes the upper limit of the range is reached about the 6500 foot level. I have found one nest of *texana* at an elevation of 6700 feet but the incidence of nests above the 6500 foot level is very small and I feel sure that colonies founded above this level only rarely come to maturity. This rather abrupt termination of the range in the neighborhood of 6500 feet offers a marked contrast to the abundance of *texana* at lower levels. It should be noted that at these lower levels, and on the same slopes where the nests of *texana* occur, there is an extraordinarily rich ant fauna. Conspicuous in it are representatives of genera which are typically Sonoran (*Pogonomyrmex, Myrmecocystus, Xiphomyrmex,* etc.). It is true that these Sonoran elements are not as abundant in the evergreen oak belt as they are on the plains at the base of the mountains (where *texana* appears to be absent) but they are sufficiently well represented to give the lower part of the evergreen oak association a distinctly Sonoran character. It may, therefore be stated that, in the Huachuca Mountains, *texana* is associated with the Sonoran elements of the biota and shows little tendency to nest outside the area where the Sonoran representatives occur.

The association where *huachucana* is found is a wholly different one. This is Shreve's "northern mesic evergreen forest". This association occurs in various parts of Arizona and because its constituent plants vary somewhat with latitude, it is more difficult to characterize than is the evergreen oak association. In the Huachuca Mountains the northern mesic evergreen forest is predominantly a zone of pines. As noted above the lower edge of this pine belt mingles with the upper edge of the evergreen oak belt. At the 7000 foot level on the northeastern slopes the pines are the dominant element of the flora. At the 8000 foot level the stand of pine is frequently interrupted by aspen groves. These groves continue to the tops of the peaks but do not form a belt. According to Shreve the pines may be replaced by spruce and fir at elevations above 9000 feet. If this is true in the Huachucas the spruces and firs must be limited to a small area at the top of Miller Peak and Carr Peak. The five nests of *huachucana* which were found during the summer of 1950 were all situated between the 7000 and 8000 foot levels. The area in which they occurred lay between the head of Carr Canyon and the lower slopes of Carr Peak. In this same area were taken representatives of typically northern ant groups (*Polyergus, Myrmica, Raptiformica, Camponotus* sen. str., *Stenamma,* etc.). Since the Sonoran elements of the evergreen oak belt are absent at these elevations, the ant fauna above the 7000 foot level has an entirely different character from that of the 6000 foot level. Its affinities are Transitional or Canadian and the presence of *huachucana* in this association offers a good demonstration that this insect belongs with the northern elements of the biota. It may be added that all the nests of *huachucana,* including the type nest, were situated on steep slopes. They were placed in shady aspen groves, in the lighter shade of pine groves or in full sun. Some were built in the soil under a covering stone, others in the soil which had accumulated between the stones in a rock slide. In view of the fact that *texana* is quite fussy about its nest sites, the greater tolerance of *huachucana* in this respect is surprising.

What is even more surprising is that the range of these two species should be so clearly separated by so small an amount of space. It should be plain from the discussion just presented that there is an elevational gap of some five hundred feet between the lower edge of the range of *huachucana* and the upper edge of the range of *texana.* The distance involved is such a minor one that it could not conceivably be a direct barrier to movement in either direction, particularly to winged females. We must suppose, therefore, that the gap between the ranges exists not because either species is unable to enter it but because, when they have done so, each species finds the area unsuitable as a situation for a successful nest. Both *huachucana* and *texana* (at least that part of its population which occurs in the Huachucas) have developed a degree of environmental restriction which isolates the two species as effectively as though their ranges were separated by hundreds of miles. In view of the actual proximity of the ranges one may inquire how this isolation can be maintained. There is every reason to believe that at the time of nuptial flight, many males and females of each species reach the range of the other species. If the nuptial flight of *texana* coincides with that of *huachucana*, there would be ample opportunity for cross-fertilization and, if this occurred, the two populations would soon merge. The fact that the two populations show no sign of intergradation may be taken as proof that no cross-fertilization is occurring. If it can be shown that the nuptial flights of the two species take place at different times, one need look no further for the mechanism which maintains the two populations as separate entities. The evidence on this point is scanty but it seems significant nonetheless. One nest of *huachucana*, secured on July 24th, contained a few mature males and many mature females. There were no male or female pupae in this nest and only a few callows of the sexual forms. This leads me to believe that the nuptial flight was about to take place. If so, the marriage flight of *huachucana* must occur at the end of July or the first of August. During the month of July (7th-28th) a number of nests of *texana* were examined. No winged sexual forms were found in any of them. Either the nuptial flight had taken place before July 7th or it would be some weeks before the sexual forms matured, in which case the flight would come much later in the summer. In either case the nuptial flight of *texana* would not coincide with that of *huachucana*.

The descriptions of the male and female of *huachucana* which follow deal mainly with details of sculpture, pilosity and color. The general structural features of all three castes of this insect are shown in the figures on Plate 7.

Female: length; head (exclusive of mandibles) 1.6 mm.; thorax 3 mm.; total length 8-9 mm. Mandibles with fine and rather even longitudinal striae which spread slightly as they approach the masticatory margin. Clypeus and frontal area with slightly wavy, longitudinal rugae. Longitudinal rugae on the cheeks and front notably coarser and much more wavy. Longitudinal rugae immediately behind the

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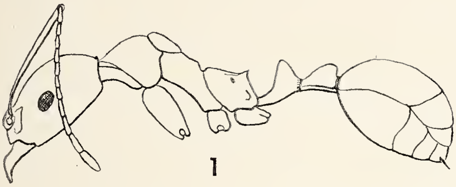
EXPLANATION OF PLATE 7

Aphaenogaster (*Attomyrma*) *huachucana* Creighton. Fig. 1. Worker. Fig. 2. Male, wings on left side removed. Fig. 3. Female, wings on left side removed. (Figs. 1-3 to the same scale.) Fig. 4. Head of worker (drawn from type). Fig. 5. Head of male. Fig. 6. Head of female.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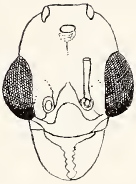
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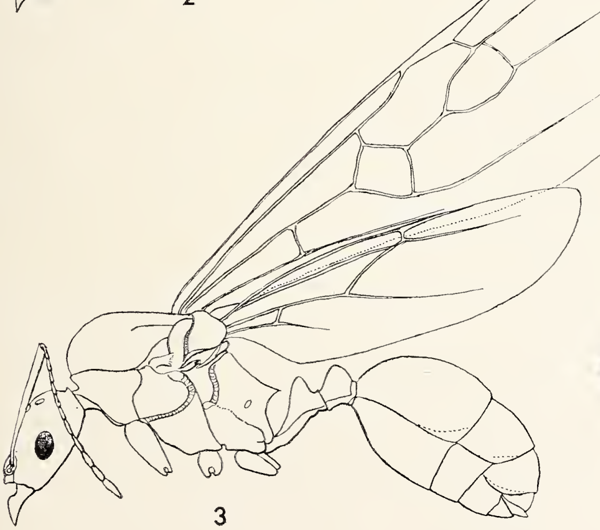
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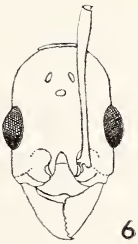
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CREIGHTON — ARIZONA ANTS

frontal lobes without transverse connectives, not reticulate. Those rugae which are immediately lateral to this central band distinctly reticulate, as are most of those on the cheeks and genae. Rugae on the occiput confined to the area adjacent to the lateral ocelli. These occipital rugae are strongly reticulate, not longitudinal. Behind them is a band which extends to the occipital flange that is not reticulate but covered with piligerous punctures only.

Pronotum with wavy rugae whose direction is roughly parallel to the suture between the pronotum and the scutum. Scutum with very feeble rugae in front which become stronger toward the rear, particularly at the middle third of the scutum. These rugae continue across the paraptera and the anterior half of the scutellum but turn inward and become transverse on the posterior half of the scutellum. Epinotum transversely rugose, the rugae on the concave area above and between the epinotal spines more feeble than elsewhere. Mesothoracic sternite and episternite with feeble rugae, their surface more shining than the other thoracic sclerites. Petiole granulo-rugose, dull; postpetiole with few rugae and with feebler granulation than the petiole, particularly at the crest where it is rather strongly shining. Coxae and gaster strongly shining, the principal sculpture consisting of scattered piligerous punctures. The surface of the gaster also has an extremely delicate reticulate sculpture which is so fine that it can be seen only at high magnifications and in oblique lights. Appendages more heavily punctured and with their surface less shining than the coxae and gaster.

Erect hairs on the head, thorax and gaster golden in color and rather short. Fairly numerous on both the upper and lower surfaces of the head. About equally numerous on the scutum and the scutellum. Sparse on the pronotum and usually absent entirely on the mesothoracic sternite and episternite. Erect hairs on the petiole largely confined to the rear face of the node. Postpetiole with the erect hairs more evenly distributed, most of those on the dorsal surface distinctly longer than those on the ventral surface. Erect hairs evenly spaced over the entire dorsum of the first gastric segment. On succeeding segments the erect hairs are largely or entirely confined to the rear edge of the segment. Erect hairs on the fore coxae longer than those anywhere else on the body. Femora with short, fine, erect hairs on their flexor surfaces, the hairs appressed on the lateral and extensor surfaces. Tibiae with the hairs appressed. Tarsi with very abundant, fine hairs which are appressed except on the flexor surface, where they are semi-erect. Antennal scapes with very fine appressed hairs. Funiculi with semi-erect hairs which become finer on the last four segments and form pubescence on the terminal segment. The entire insect without pubescence elsewhere.

Head, thorax, gaster and antennae an even, rich, reddish yellow. The legs clear yellow. Wings hyaline with iridescent reflections. The veins clear yellow, the stigma brown. Posterior edge of the wing evenly fringed with short, fine hairs.

Male: length; head (exclusive of the mandibles) 1 mm.; thorax 2.25 mm.; total length 5.5-6 mm.

Mandibles smooth, moderately shining, with numerous fine punctures. Clypeus and frontal lobes a little less shining than the mandibles, the punctures less distinct and tending to form longitudinal rows. Front and occiput feebly shining with a fine but dense reticulate sculpture over most of the surface except between the two lateral ocelli, where prominent transverse rugae are present. Entire thorax smooth and shining, largely without sculpture. Posterior half of the scutellum and the entire metanotum with a delicate, reticulate sculpture which dulls the surface to some extent. Posterior half of the epinotum rugose and coriaceous both on the basal face and on the sides. The suture separating the mesothoracic sternite from the episternite and that lying between the epinotum and the metathoracic epimeron crossed by coarse, widely separated rugae. A few of these rugae run out onto the surface of the adjacent segments. Petiole feebly shining, the upper surface evenly covered with fine punctures, the posterior face of the node and the ventral surface with three or four feeble longitudinal rugae. Postpetiole and gaster more strongly shining than the petiole, the surface covered with extremely delicate and shallow punctures which are visible only at high magnifications.

Erect hairs yellow or whitish yellow, present on the clypeus, the gula, the space between the occipital angles and the posterior border of the eye and the ocellar triangle. Hairs on the mandibles much finer than those on the rest of the head. Erect hairs very sparse or absent over most of the thorax. Those on the scutum very short. A cluster of somewhat longer hairs is present on the scutellum. Petiole without erect hairs. Postpetiole with about six long hairs on its posterior dorsal surface and a few shorter ones on the ventral surface. Erect hairs evenly spaced over the entire gaster. Hairs on the legs for the most part very fine and completely appressed. A few erect hairs on the fore coxae and fore femora. Antennal scapes and the first eight funicular segments evenly covered with fine, semi-erect hairs which grade into pubescence on the last four segments.

Mandibles clear yellow; clypeus, antennae and legs yellow, infuscated very lightly and somewhat unevenly with brown. Head, except for the appendages, blackish brown. Thorax brownish yellow except for the scutum which is clear brown. Petiole, postpetiole and gaster brownish yellow. Wings as in the female.

The additional material of *huachucana* has brought up some points which should be mentioned here. The peculiar, narrowed rear of the head which is very apparent in the worker types (Plate 7, fig. 4) is not a uniform character. A number of workers of *huachucana* show a greater degree of convexity in the part of the head which lies between the occipital flange and the rear of the eye. Such workers approach *texana* closely in head shape. There is also considerable variation in the shape of the epinotal spines, although these spines in *huachucana* are never as thin and delicate as they are in *texana*. On the other hand, all the workers of *huachucana* which the writer has seen differ from those of *texana* in their larger size, their heavier and more rugose sculpture, in the more abruptly elevated rear edge of the mesonotum and in the prominent, triangular lobe at the base of the scape. These features seem to be thoroughly reliable as separatory characters for the worker. Three of them will apply to the female as well. The female of *huachucana* is larger than that of *texana* (8-9 mm. in *huachucana*). It is also more heavily sculptured and possesses the same triangular lobe at the base of the antennal scape which marks the worker. In this connection it should be noted that the length given for the female of *texana* in Wheeler's 1915 publication (4) evidently included the wings. Wheeler gave the length of the female of *texana* as 11-11.5 mm. On the same page he gave the length of the dealated female of *furvescens* as 7.5 mm. Needless to say the second figure is the correct one for *texana* if, as is usually the case, the body length is what is being measured. The male of *huachucana* is larger than that of *texana* (4-5 mm. in *texana*, 5.5-6 mm. in *huachucana*). The scutum in the male of *huachucana* does not project so strongly above the pronotum. The basal face of the epinotum in the male of *huachucana* consists of descending anterior portion and a feebly convex posterior portion which form a distinct angle in profile (Plate 7, fig. 2). This face of the epinotum forms a single descending plane in *texana*.

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A NEW SPECIES IN THE CHILOPOD GENUS *THEATOPS*

By Ralph V. Chamberlin
University of Utah

The finding of a new species of *Theatops,* making the fourth well defined species known in the genus, is of considerable interest. The type of the new form was taken in a cave in Sonora, Texas, and may be a definitely cavernicolous species. The four species of the genus may be distinguished by means of the following key.

Key to Species of *Theatops*

1 (3) Prefemur of anal legs with no spine at mesodorsal corner 2

2 Prefemur and femur of anal legs entirely lacking spines or teeth; coxopleurae not mesally elevated, with no spine; tibiae 1 to 9 with a single ventral spine. . . . . *postica* (Say)

Prefemur and femur of anal legs each with one ventral spine; coxopleurae with inner border elevated and bearing caudally a spine or tooth; at least some of the tibiae 1 to 9 bearing a second spine. *erythrocephala* (Koch)

3 (1) Prefemur of anal legs with a distinct distal spine at mesodorsal corner 4

4 Last tergite with no median longitudinal sulcus; antennae and articles of normal length. . . . . *spinicauda* (H. C. Wood)

Last tergite with a sharply impressed median longitudinal sulcus; antennae and its articles long and slender . . . . *phanus,* n. sp.

Theatops phanus, n. sp.

Color pale yellow. Head smooth, without sulci; overlapping the first tergite. Antennae exceptionally long, reaching back to the sixth segment. First tergite with the transverse sulcus forming an obtuse angle at the middle, this sulcus crossed by a longitudinal median sulcus which furcates posteriorly. Dental plates of prosternum elongate, narrowing distad; the distal margin oblique, smooth or with an obscure nodule at outer and inner ends. Second to twentieth tergites bisulcate. The last tergite elongate as usual; with a sharply impressed median longitudinal sulcus. Sternites smooth, with no definite longitudinal sulcus but on most a median depression or shallow pit. Last sternite long and slender, narrowing caudad, the posterior corners rounded. Coxopleurae caudally truncate, with a small spinous point at inner corner which is slightly produced dorsocaudad; poriferous area ending caudally nearly on a level with the end of the sternite. Prefemur of anal legs with a well developed spine at the dorsocaudal corner as in *spinicauda*, otherwise without true spines or teeth, but with the mesodorsal and mesoventral margins compressed into a sharp edge bearing a few well separated denticles, not closely finely serrate as in *spinicauda*. Femur with two compressed ridges as in the prefemur. Terminal claw obviously more slender than in *spinicauda*.

Length: 42 mm. Length of antennae, 14 mm.

Locality: Texas: Sonora, in a cave on Stevenson's Ranch. One specimen found beneath stone on bottom of first drop in the vertical cave. Collected by G. G. Stevenson on April 16, 1926.

ON TWO NORTH AMERICAN PHILOTARSIDS (PSOCOPTERA)[1]

BY EDWARD L. MOCKFORD
Indianapolis, Indiana

Until now, but a single species of Philotarsidae has been known from North America.[2] While collecting at Port Townsend, Washington, I found a second species, in the genus *Philotarsus,* apparently new. Unfortunately, good specific characters of only one species, the European genotype, are available to me for comparison, but the figures given here should be adequate for separation of the new species. Described early from eastern United States was *Philotarsus maculosus* (Aaron). This species cannot fit in *Philotarsus* as restricted by Badonnel (1943), but remains in this family. I therefore propose a new genus for it named in honor of its describer.

Genus **Aaroniella** n. gen.

Differs from *Philotarsus* in that (1) Rs in hind wing is ciliated, though sparsely, for its entire length beyond its separation from M, (2) sense tubercles of male paraprocts round; elongate in *Philotarsus,* (3) phallic frame of approximately even thickness all around, not dilated anteriorly, and lacking a secondary sclerite posteriorly, (4) lateral gonapophyses of female triangular, (5) pigmented areas of subgenital plate wide, (6) antennal color pattern: each flagellar segment is white at its apex which contrasts sharply with the darker remainder, (7) many of the hairs on the veins of the fore wing with brown spots at their bases. Also of probable generic value is the peculiar tip of the maxillary pick (see pl. 9, fig. 5), and the well-developed

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

[2] When preparing this paper, I overlooked a paper by Dr. A. B. Gurney (Jour. Wash. Acad. Sci., 39: 56-65, 1949) in which records of *Philotarsus flaviceps* (Ste.) from Mount Desert Island, Maine, are cited.

gonopore plate, apparently absent or at least not sclerotized in *Philotarsus*.

Genotype: *Elipsocus maculosus* Aaron

Aaroniella maculosa (Aaron)

(Pl. 8, Figs. 1, 4, 5, 7; Pl. 9, Figs. 3, 4, 5, 6, 8, 9)

Elipsocus maculosus Aaron (1883, p. 40, pl. 9, fig. 8)
Philotarsus maculosus (Aaron) Chapman & Nadler (1928)

No measurements are given in the original description. The following are for a typical male and female: Fore wing: ♂ 3.36 mm., ♀ 2.85 mm. Total body length: ♂ 2.85 mm., ♀ (gravid) 3.24 mm. Antennal length: ♂ 2.49 & 2.55 mm., ♀ 2.10 mm.

The figure of the fore wing in the original description is not very detailed and has at least one inaccuracy — vein An is shown with hair, Ax hairless, whereas actually it is just the reverse. I here include figures of both wings. The male shows a very minute spur vein on the posterior edge of the pterostigma; this is lacking in the female. Male ocellar interval dark, that of female pale. Both sexes with rather numerous long hairs posteriorly on vertex and a fuscous lateral band starting just behind head, widening on the meso- and metapleura, narrowing again on the abdomen, and ending at the sclerotized terminal segments. Male genitalia (pl. 8, fig. 5; pl. 9, fig. 4): phallic frame anteriorly rounded and narrow, slightly wider on sides. A complex group of 'accessory sclerotizations' lies just above the frame and is easily visible between its sides. Aedeagal arch tuberculate. Hypandrium rather weakly sclerotized, hairy. Epiproct (pl. 8, fig. 4) emarginate posteriorly. Female genitalia (pl. 8, fig. 7; pl. 9, figs. 3, 8, 9): lateral gonapophyses triangular, hairy. Subgenital plate with wide pigmented areas separated in the middle; apical half sclerotized, and a small separate sclerite at extreme apex. Gonopore plate large and well sclerotized.

I have given (Mockford—in press) some biological observations and Indiana records of this species. Late-instar nymphs have numerous gland hairs on abdominal tergites and wing pads, but very few on head, thorax, and legs where there are numerous tapering hairs.

Other species of *Aaroniella*

Mr. J. V. Pearman has very kindly sent me drawings of two other species belonging in this group: (1) of a ♂ of an undescribed species in his collection; this agrees with the genotype in all bisexual and male characters listed in the generic diagnosis, (2) copies of drawings of *Philotarsus badonelli* Danks (1950). This is described from a female and agrees with the genotype in all female characters listed in the generic diagnosis plus (7). The antennae are not figured. In addition we suspect several other known species of belonging here.

Philotarsus Kolbe, 1880

In addition to the characters given by Badonnel (1943:70) it would appear that the females of this genus always have the pigmentation of the subgenital plate in the form of a pair of rather slender converging arms. Several figures of the genotype, *P. flaviceps* (Ste.) are given by Badonnel (op. cit.:71). These plus a drawing of the phallic frame sent to me by Mr. Pearman were used for comparison with the following species.

Philotarsus kwakiutl n. sp.

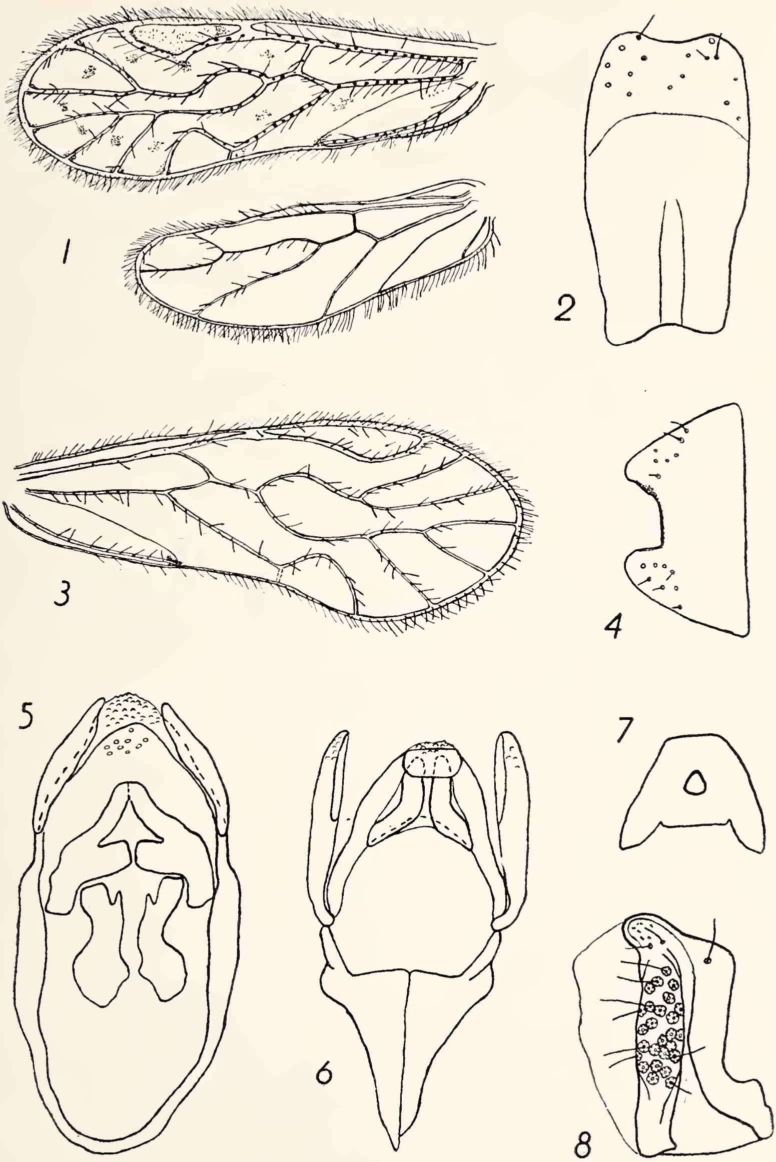
(Pl. 8, Figs. 2, 3, 6, 8; Pl. 9, Figs. 1, 2, 7)

Measurements of typical male and female: Fore wing: ♂ 3.27 mm., ♀ 3.24 mm. Total body length: ♂ 1.86 mm., ♀ 2.58 mm. Antennal length: ♂ 2.91 mm., ♀ 1.89 mm.

Near the genotype, differing in that (1) apex of fore wing in both sexes is more prolonged, (2) areola postica is slightly longer and lower, (3) pigmented area of subgenital plate (pl. 9, fig. 1) more u- than v-shaped, (4) apical sclerite of subgenital plate shorter and wider, (5) tubercle of dorsal gonapophysis proportionately larger, (6) phallic frame (pl. 8, fig. 6), especially the anterior, basal portion long and drawn out.

EXPLANATION OF PLATE 8

Fig. 1, *Aaroniella maculosa* (Aaron), ♂, fore and hind wings. Fig. 4, the same, ♂, epiproct. Fig. 5, the same, ♂, phallic frame. Fig 7, the same, ♀, gonopore plate. Fig. 2, *Philotarsus kwakiutl* n. sp., ♂, epiproct. Fig. 3, the same, ♂, fore wing. Fig. 6, the same, ♂, phallic frame. Fig. 8, the same, ♂, paraproct.



Mockford — Philotarsids

Coloration: sexes similar. Clypeus with brown lineations separated into two groups by a pale line down the middle. They converge in the lower half forming a median band. Vertex with a band of brown spots along the epicranial suture and a group of brown spots just mesad each eye. Ocellar intervals pale. Frons with a posteriorly pointing v-shaped mark in middle. Labrum, antennae, and apical two segments of maxillary palpi brown. Mesonotal lobes: anterior with a pair of brown spots in front; laterals each with a brown band, but all these marks separated by wide pale areas. Fore wing (pl. 8, fig. 3) marked much as in genotype, but markings usually very obscure or absent. Hind wings unmarked. Abdominal tergites irregularly marked with light purplish brown, heaviest on sides.

Holotype ♂: Port Townsend, Washington, June 29, 1948, ex foliage of *Thuja plicata*, in author's collection. Allotype ♀: same data as for holotype. Paratypes: Port Townsend, Washington: 8 ♂, 7 ♀, same data as for holotype. 1 ♀, July 5, 1948, ex foliage of *Thuja plicata*. 1 ♂, 2 ♀, July 6, 1948, on dead, lichen-covered laurel twigs. Of these, 2 ♂, 2 ♀ will be placed in the K. M. Sommerman collection, and 1 ♂, 1 ♀ will be placed in the Museum of Comparative Zoology, Cambridge, Mass.

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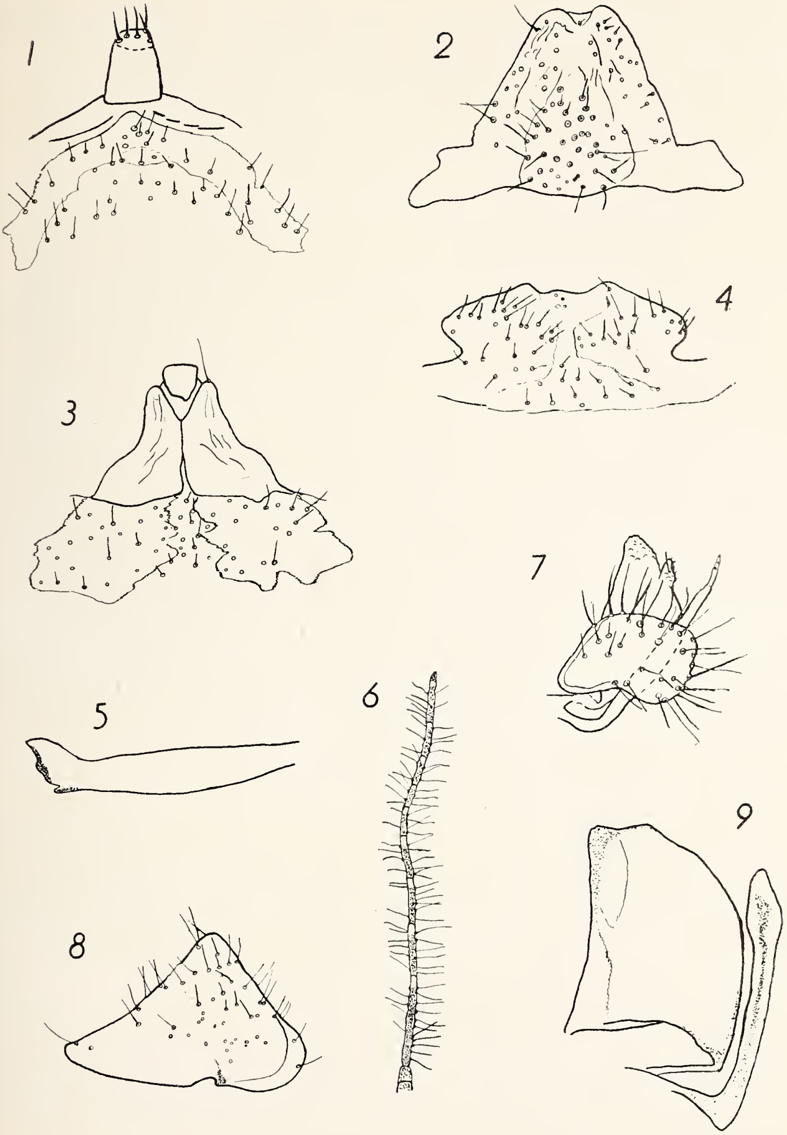
EXPLANATION OF PLATE 9

Fig. 1, *Philotarsus kwakiutl* n. sp., ♀, subgenital plate. Fig 2, the same. ♂, hypandrium. Fig. 7, the same, ♀, gonapophyses. Fig. 3, *Aaroniella maculosa* (Aaron), ♀, subgential plate. Fig. 4, the same, ♂, hypandrium. Fig. 5, the same, ♂, maxillary pick. Fig. 6, the same, ♂, antenna. Fig. 8, the same, ♀, lateral gonapophysis. Fig. 9, the same, ♀, dorsal and ventral gonapophyses.



MOCKFORD — PHILOTARSIDS

REDESCRIPTION OF *PARAPAOLIA SUPERBA* (SCUDDER) (PROTORTHOPTERA)

By F. M. Carpenter
Harvard University

In a general account of Palaeozoic insects, published in 1885, Scudder included keys to species of certain genera related to *Dictyoneura* (Palaeodictyoptera). One of the species mentioned under the genus *Paolia* was designated as new and named *superba*. The fossil was said by Scudder to have been collected at Mazon Creek, Illinois, by L. M. Umbach. Unfortunately, Scudder's description consisted of a single short sentence without the aid of a figure. What happened to the specimen after Scudder's examination of it is not clear; Handlirsch was unable to find it when he was preparing his revision of American Palaeozoic insects. At any rate, in 1918 it was in the possession of Dr. Umbach, who sold it at that time to the Field Museum of Natural History in Chicago. Through the courtesy of the authorities of the Museum I have been able to borrow the fossil and to prepare the following redescription and illustration. For reasons given below, I am placing the species in the family Palaeocixiidae of the Order Protorthoptera.

Genus *Parapaolia* Handlirsch

Parapaolia Handlirsch, 1906, Foss. Ins.: 121.

This genus was erected for *superba* without mention of generic characteristics. It differs from *Palaeocixius*, to which it seems to be related, by having the media forked at about mid-wing, instead of at the level of the origin of Rs.

Parapaolia superba (Scudder)

Figure 1

Paolia superba Scudder, 1885, Proc. Amer. Acad. Arts Sci., *20*:173. *Parapaolia superba* Handlirsch, 1906, Foss. Ins.:121.

Fore wing, length, 90 mm.; width, 23 mm. Sc terminating well beyond mid-wing. Rs arising in the proximal quarter of the wing, and having its first branch arising just beyond mid-wing. CuA apparently free from M; anal veins unknown. Sc and Rs are distinctly concave in the obverse half of the fossil, and R is equally convex. M and its branches appear slightly concave, as is the case in most Protorthoptera.

The hind wing is very incompletely known; it apparently has a more rounded apex than the fore wing, and the radial sector arises nearer the middle of the wing, but the branching of Rs and M is apparently like that of the fore wing.

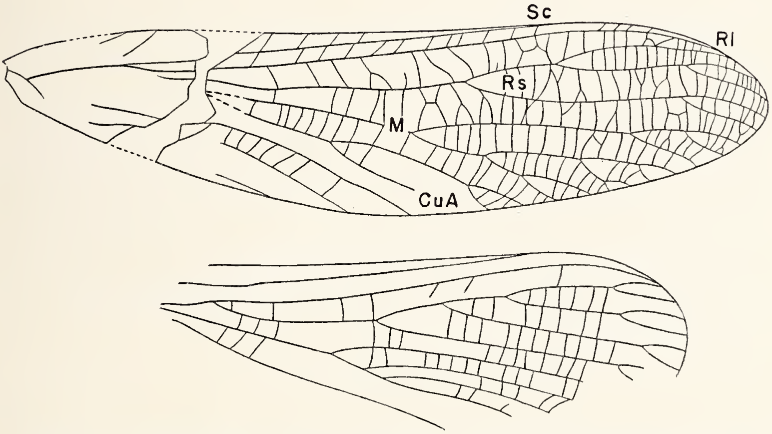


Figure 1. *Parapaolia superba* (Scudder). Fore and hind wings, drawn from holotype.

Holotype: Chicago Museum of Natural History; collected at Naperville, DuPage Co., Illinois, by Dr. L. M. Umbach. The fossil consists of two wings, with parts of the other two, superimposed and resting over the abdomen, no part of which can be distinctly seen.

Scudder placed this specimen in the Palaeodictyoptera, but since he arbitrarily assigned all Palaeozoic insects to that order, his system of classification is without phylogenetic significance. Handlirsch, who, of course, had no real knowledge of the species, placed it in *incertae sedis* under the Palaeodictyoptera. I have removed the species from that order for two reasons: 1) the superimposed wings strongly indicate that the insect was neopterous; and 2) there is no convex anterior media, the division of the media being remote from the origin of M. The insect therefore seems most probably protorthopterous, though its family affiliation is not clear because of the poor preservation of the wing. I have provisionally placed it in the family Palaeocixiidae, since it shows some resemblance to *Palaeocixius*.

ADLERZIA FROGGATTI FOREL AND SOME NEW SYNONYMY (HYMENOPTERA: FORMICIDAE) — In another paper, now in press, I have discussed the confusion attendant on Forel's description of *Adlerzia*, based on a stray worker of a single species and wrongly placed as a subgenus of *Monomorium*. It has since been determined that two subsequently described ants placed in different genera represent different castes of *A. froggatti*. The following synonymy is suggested here in order to avert proposal of a new name for *Stenothorax* McAreavey, which is preoccupied by Harris and by Agassiz:

Adlerzia froggatti Forel

Monomorium (*Adlerzia*) *froggatti* Forel, 1902, Rev. Suisse Zool., *10*: 445-447, worker [minor]; original description.

Machomyrma silvestrii Emery, 1914, Boll. Lab. Zool. Portici, *8*: 182, fig. 2, soldier; **new synonymy.**

Stenothorax katerinae McAreavey, 1949, Proc. Linn. Soc. N. S. Wales, *74*:3-4, figs. 7-16, worker major [ergatoid?]; worker minor; **new synonymy.**

Stenothorax McAreavey, *nec* Harris, *nec* Agassiz, with the genotype and sole species *katerinae* (*loc. cit.*) becomes an absolute synonym of *Adlerzia* Forel by isogenotypy; **new synonymy.** — BY WILLIAM L. BROWN, JR., Museum of Comparative Zoology.

SEASONAL DISTRIBUTION OF *NAJADICOLA INGENS* (K.) (ACARINA) IN A NEW HAMPSHIRE POND

Arthur G. Humes and Henry D. Russell
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Certain aspects of the geographical distribution and host relationships of *Najadicola ingens* (Koenike), a water-mite parasitic in fresh-water clams, have been investigated (Humes and Jamnback, 1950), but its seasonal distribution has not been reported. Wash Pond, Hampstead, New Hampshire, was selected for a study of the seasonal incidence and distribution of the mite. This pond was particularly suitable because of the high percentage of clams known to be parasitized there.[1] During the 13 months from December, 1949, to December, 1950, inclusive, a total of 2211 clams, representing three species, was examined for mites. Collections were made monthly, as nearly as possible to the 15th, but in no case earlier than the 14th or later than the 19th day. All clams were collected in 6-30 inches of water from a strip of sandy shore about 500 feet in length at the west end of the pond near an outlet brook.

The three species of clams found and the number of each examined were: *Anodonta cataracta* Say, 1147 specimens, *Elliptio complanatus* Solander, 1038, and *Lampsilis radiata* (Gmelin), 26. The size of each monthly collection and the number of each clam species contained therein (Table 1) varied, because of difficulties in collection, caused by ice, wind, and burrowing of the clams in winter. When possible at least 100 individuals of each clam species were collected. Data concerning *A. cataracta* for February and March had

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[1] Humes, A. G., and H. A. Jamnback. 1950. *Najadicola ingens* (Koenike), a water-mite parasitic in fresh-water clams. Psyche, 57(3):77-87.

less meaning than for the other months because of the small numbers of clams collected.

The temperature on the bottom of the pond at a depth of about 24 inches varied from 0.5 degrees C. in March to 26.5 degrees C. in July (Graph 1). The pond was covered with ice in January, February, and March.

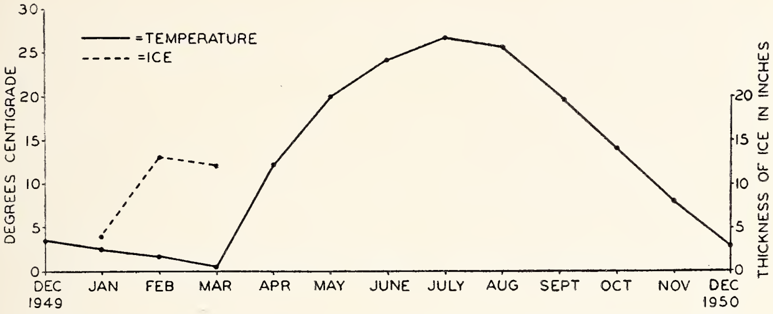
Throughout the 13 months *A. cataracta* was very frequently either parasitized by mites or had papillae in the suprabranchial chambers (which is evidence of having been parasitized) (Table 1). Mites were found in 886 or 77.2 per cent of the 1147 *A. cataracta* (a figure lower than the 87.3 per cent given by Humes and Jamnback, 1950, which was based upon a single November collection) and papillae only in 160 or 13.9 per cent. The total number of *A. cataracta* parasitized or with papillae was 1046 or 91.2 per cent, leaving 101 or 8.8 per cent unparasitized and without papillae.

E. complanatus was parasitized or had papillae much less frequently than *A. cataracta* (Table 1). *N. ingens* occurred in 19 or 1.8 per cent of the 1038 *E. complanatus.* No papillae were observed in the suprabranchial chambers of this species.

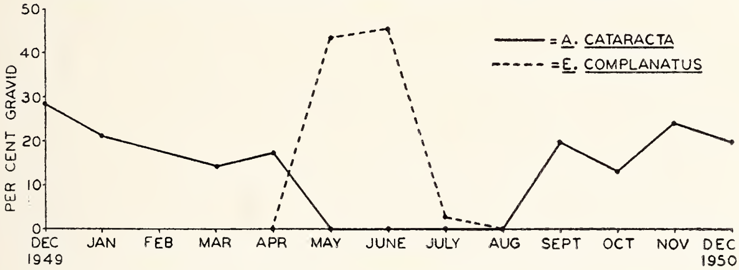
No *N. ingens* were found in *L. radiata.*

Adult male and female *N. ingens* occurred throughout the 13 months. The frequencies of clams with one male and one female adult mite, with males only, or with females only, showed no seasonal trends. Four hundred and fifty-five, or an average of 35 or 51.4 per cent per month (extremes of 5-64 or 41.6-66.6 per cent) of the parasitized *A. cataracta,* had at least one male and one female mite. Three hundred and twenty, or an average of 24.6 or 36.1 per cent (3-62 or 25.0-50.0 per cent), had male mites only. One hundred and eleven, or an average of 8.5 or 12.5 per cent (1-22 or 5.2-27.6 per cent), had female mites only.

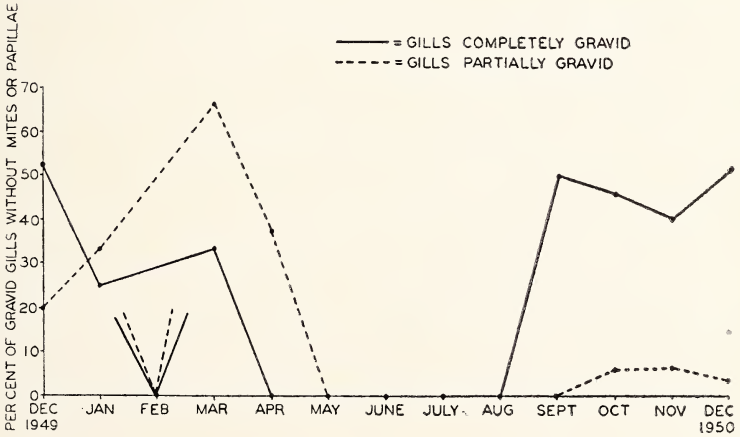
A. cataracta with glochidia in the gills was found from September to April inclusive (Graph 2). All glochidia were shed by the middle of May, when the bottom temperature had risen to 20 degrees C. The gills were not found gravid again until the middle of September, when the



GRAPH 1. BOTTOM TEMPERATURE AND THICKNESS OF ICE IN WASH POND.



GRAPH 2. MONTHLY OCCURRENCE OF GRAVID A. CATARACTA AND E. COMPLANATUS.



GRAPH 3. MONTHLY OCCURRENCE OF COMPLETELY AND PARTIALLY GRAVID GILLS IN UNPARASITIZED A. CATARACTA.

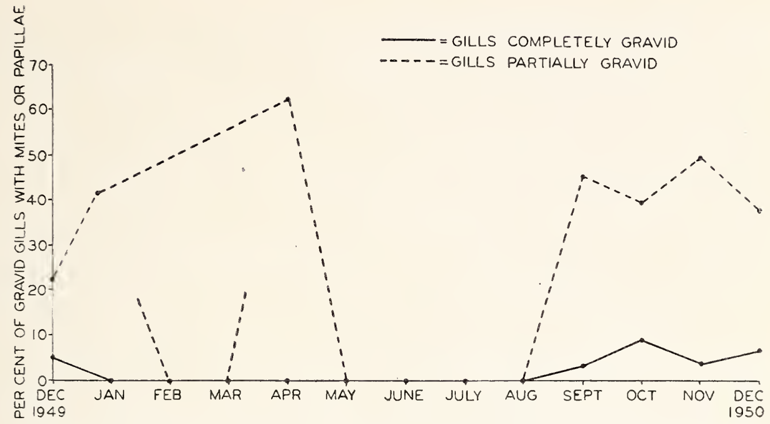
bottom temperature had dropped to 19.5 degrees C. At that time many clams were gravid (19.1 per cent of all *A. cataracta* of both sexes, both parasitized and unparasitized, collected in September).

In unparasitized *A. cataracta* without papillae gravid gills tended to be filled completely with glochidia in September and through the winter months (Graph 3). No gravid clams were found in the small February sample. The reference lines to February are not connected to the rest of the graph because of the inadequate sampling. As spring approached, the glochidia were gradually shed, and the percentage of clams with partially filled gills increased, reaching a high point in March. By May all gravid clams contained only a relatively few glochidia, usually in the central part of the gills. During this time the percentage of clams with completely filled unparasitized gills became smaller.

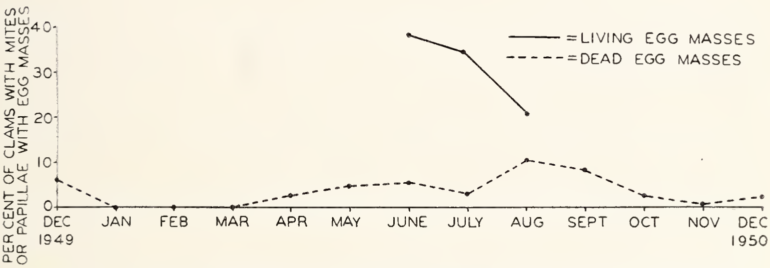
In parasitized gills or those with papillae the glochidia completely filled the gills in only a relatively few cases, and then only during September to December inclusive (Graph 4). No gravid clams were found in the small February and March collections. As in Graph 3, the reference lines to these months are not connected to the rest of the graph. Most gills with mites or papillae were incompletely filled with glochidia even early in the gravid period. For example, in September 46.3 per cent of all the gravid gills with mites or papillae were partially filled, while only 3.7 per cent were completely filled. On the other hand, in the same month all unparasitized gravid gills were completely filled.

Glochidia were found in the gills of *E. complanatus* from May to July inclusive (Graph 2). These clams were first found gravid in the middle of May, when the water temperature had risen to 20 degrees C., and were shed by the middle of August, when the temperature was 25.5 degrees C. No significant data on the seasonal distribution of the mites in this species were collected, since so few clams were parasitized (Table 1).

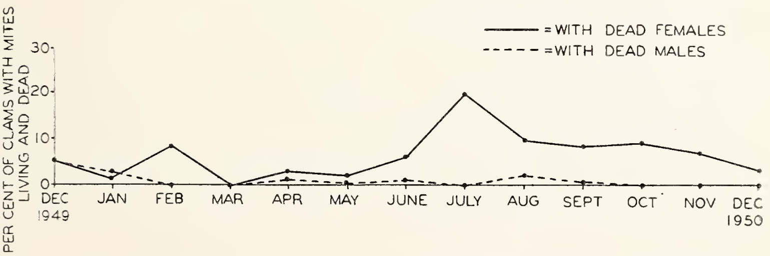
Living egg masses of *N. ingens* were present in *A. cataracta* only in June, July, and August (Graph 5), coincid-



GRAPH 4. MONTHLY OCCURRENCE OF COMPLETELY AND PARTIALLY GRAVID GILLS IN PARASITIZED A. CATARACTA



GRAPH 5. MONTHLY OCCURRENCE OF LIVING AND DEAD EGG MASSES IN A. CATARACTA WITH MITES OR PAPILLAE



GRAPH 6. MONTHLY OCCURRENCE OF DEAD MALE AND FEMALE MITES IN PARASITIZED A. CATARACTA.

ing with the time when the water temperature had reached its maximum of 26.5 degrees C. In June 38.1 per cent of the number of clams with mites or papillae for that month contained masses of living mite eggs. The eggs at this time were all white or light yellow, indicating that they had been laid recently. Observations of Humes and Jamnback (1950) have indicated that the eggs when first laid are light cream in color, but darken as development progresses to almost black at hatching, which may occur in 17 days in distilled water at summer room temperatures. In July many of the egg masses were various shades of brown, and some had already hatched. In August only 20.8 per cent of the clams with mites or papillae contained egg masses. These were generally dark in color or already hatched. A few, however, were light cream in color, indicating recent oviposition.

Dead egg masses were found in all months except January, February, and March (Graph 5). The absence of dead egg masses in these three months may be accounted for by the relatively small size of the samples of clams collected. Dead egg masses were never found in more than 10.4 per cent (in August) of the clams with mites or papillae. Apparently egg masses which were laid late in the period of oviposition and had not hatched by the middle of September died and remained in the suprabranchial chambers for several months. The dead egg masses found in April and May must have been laid during the preceding summer, since oviposition did not begin until sometime after the middle of May.

No egg masses were found in *E. complanatus* or in *L. radiata*.

Dead *N. ingens* (Graph 6) were found in parasitized *A. cataracta* in every month except March, a month when the small clam sample could account for their absence. Dead males occurred in small numbers during 6 of the 13 months, with no significant seasonal variation. Dead females occurred in every month except March, but were most abundant in July and succeeding few months. The sudden increase in incidence of dead females in July to 20.3 per cent of the parasitized *A. cataracta* occurred one month after

	A. cataracta				*E. complanatus*			*L. radiata*		
	total number	number with mites	number with papillae only no mites	% of total with mites or papillae	total number	number with mites	% with mite	total number	number with mites	% with mites
December 1949	57	38	9	82.5	5					
January 1950	38	30	8	100.0						
February	13	12		92.3	98	3	3.1			
March	14	12	1	92.9	17					
April	111	99	10	98.2	107	1	0.9	2		
May	117	92	14	90.6	111	1	0.9			
June	102	78	19	95.1	102	1	1.0	4		
July	76	59	8	88.2	108			16		
August	107	80	16	89.7	120	5	4.2	4		
September	131	103	19	93.1	131	1	0.7			
October	117	87	17	88.9	126	2	1.6			
November	170	139	21	94.1	97	5	5.1			
December	94	57	18	79.8	16					
Total	1147	886	160		1038	19		26	0	
Average %				91.2			1.8			0

Table 1. Size of monthly clam collections, number of clams parasitized or with papillae, and percentage parasitized or with papillae.

the time of maximum oviposition in June (Graphs 5 and 6). This fact suggests that at least some females die after oviposition and that their bodies may remain in the suprabranchial chambers for several months.

Nymphs of *N. ingens* occurred in small numbers in all but 4 of the 13 months (December, January, May, and September) with no significant seasonal variation.

The total number of mites recovered from the 1147 *A. cataracta* was 1400 (with monthly extremes of 17-207), comprising 893 males (11-137) and 507 females (6-74). This gave an average of mites of either sex per parasitized clam of 1.58 (1.22-1.85). During the 13 months neither the average number of mites per parasitized clam nor the percentage of males and females changed significantly. The average monthly percentage of males in the total of 1400 mites was 63.8 per cent (52.4-67.2), while that of females was 36.2 per cent (32.7-47.6). The sex ratio of males to females was 1.76:1.

The distribution of adult mites among the four suprabranchial chambers of *A. cataracta* did not vary significantly throughout the 13 months. The most frequently occupied position was the outer suprabranchial chambers (in 865 or 97.6 per cent of the 886 parasitized clams). In a few clams mites occurred in the inner suprabranchial chambers (7 or 0.8 per cent) and in both outer and inner chambers (14 or 1.6 per cent).

SUMMARY

1. Monthly collections from December, 1949, to December, 1950, inclusive, in Wash Pond, New Hampshire, showed *Najadicola ingens* to occur most commonly in *Anodonta cataracta* and occasionally in *Elliptio complanatus*. The mite did not occur in *Lampsilis radiata*. The monthly incidence of adult male and female mites showed no significant seasonal changes.

2. The gills of *A. cataracta* were gravid from September to May inclusive. In gills with mites or papillae the glochidia usually only partly filled the gills, even early in

the gravid period, when unparasitized gills without mites or papillae were completely gravid.

3. Living egg masses of *N. ingens* were found in *A. cataracta* only in June, July, and August, months which coincided with the highest water temperature. June egg masses were recently laid, July masses were older for the most part, and August masses were mostly near hatching or had already hatched. This indicated a rather sudden oviposition early in June, followed by a slackening of egg laying until September, when it ceased. Egg masses which have not hatched by September probably die and may remain in the suprabranchial chambers for several months.
4. Dead adult males were found in *A. cataracta* throughout the 13 months in about equal numbers. Dead adult females were most abundant in July, one month after the maximum oviposition, suggesting that at least some females die after oviposition and that their bodies may remain in the suprabranchial chambers for several months.
5. Nymphs were found in small numbers in *A. cataracta* in all but 4 months (December, January, May, and September) without significant seasonal variation.
6. An average number of 1.58 adult mites per parasitized clam was recovered from *A. cataracta*. This average number and the relative numbers of male and female mites showed no seasonal trends. The sex ratio of males to females was 1.76:1.
7. Throughout the 13 months the mites most often occurred in the outer suprabranchial chambers of *A. cataracta*. In only a few cases were mites found in the inner or in both outer and inner suprabranchial chambers.

REDESCRIPTION OF *CHEIRACANTHIUM MILDEI* L. KOCH, A RECENT SPIDER IMMIGRANT FROM EUROPE

By Elizabeth B. Bryant
Museum of Comparative Zoology

The fauna of New England has often been compared to that of Great Britain, which has about the same area. Dr. B. J. Kaston in his recent book, "The Spiders of Connecticut", 1948, states that 644 species of spiders have been recognized in New England, and that 72 of these are common to Europe. Some are endemic, but others have been introduced by commerce. In the summer of 1949, a spider carrying a cocoon of eggs and new to our fauna, was brought to the museum by Dr. A. M. Chickering. It proved to be *Cheiracanthium mildei* L. Koch, a species native to southern Europe.

The genus is known in Europe by 34 species and previously in North America by only one, *Cheiracanthium inclusum* (Hentz), found from New England south to Florida and the islands of the Caribbean. *Cheiracanthium mildei* was first described from Meran, Dalmatia, in 1864. It has subsequently been reported from Switzerland, Hungary, the Caucasus and Palestine. Since 1949, when the female mentioned above was recognized, additional specimens of both sexes have been found in Connecticut and New York, indicating that the species is established in our area.

I wish to express here my thanks to Dr. W. J. Gertsch, of the American Museum of Natural History, to whom we are indebted for the gift of a pair of this species taken at New Rochelle, New York, June, 1947.

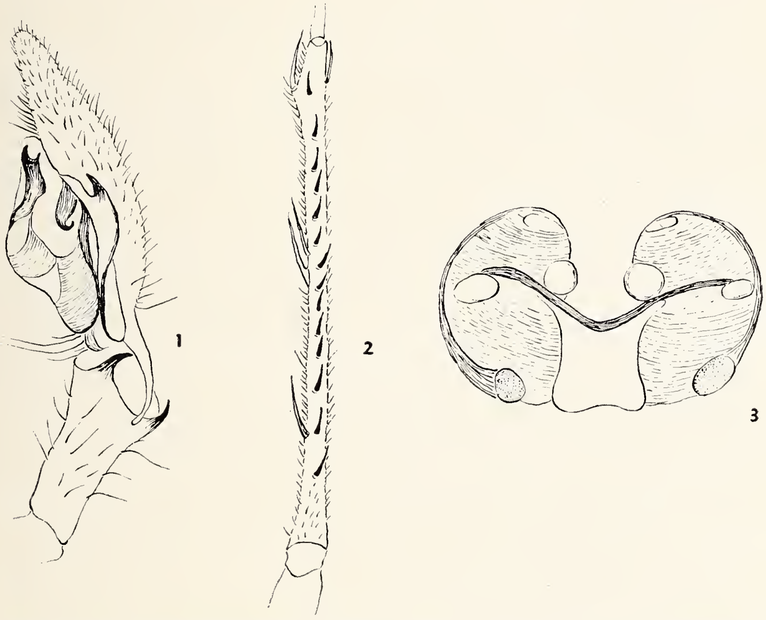
Cheiracanthium mildei L. Koch

Figures 1-3

Cheiracanthium mildei L. Koch, 1864, p. 144. "♂ ♀ in sudlichen Tirol (Meran) in Dalmatien, (Sammlung des Herrn Grafen Keyserling)".

Female: Length, 7.0 mm., ceph. 3.0 mm. long, 2.5 mm. wide, abd. 4.6 mm. long, 3.1 mm. wide.

Cephalothorax pale yellow, anterior margin truncate, about half the greatest width, moderately high, no thoracic groove but the area slightly darker and called by Simon a "false groove"; *eyes* subequal, anterior row slightly recurved, eyes equidistant, posterior row a little longer than the anterior, procurved, eyes equidistant, lateral eyes separated by a radius; *quadrangle* of median eyes narrower in front and as high as wide behind; *clypeus* below a.m.e. about equal to a radius of a.m.e.; *mandibles* vertical, large, fang groove oblique, lower margin with three contiguous teeth; *labium* wider than long; *maxillae* twice as long as the labium with the tips widened; *sternum* pale, smooth, convex, longer than wide, (5.0:4.1); *abdomen* pale, oval,



Figs. 1-3, *Cheiracanthium mildei*. Fig. 1. Left palpus, retrolateral view. Fig. 2. Fourth metatarsus, ventral view. Fig. 3. Epigynum, ventral view.

convex, with no markings; *legs,* 1-2-4-3, pale, spines weak and inconspicuous, 1 pair, tibia, ventral, 2, median, metatarsus longer than the tibia, spines, ventral, 2 at the base, II pair, tibia, ventral, 2 at the base, metatarsus, 2 at the base; *epigynum,* area wider than long, divided about the middle by a transverse dark chitinized curved ridge, the anterior half with a pair of widely separated oval depressions, the posterior half divided by parallel vertical dark lines into a broad median septum with the extreme lateral margins ending in small circular sacs below the surface, as figured.

According to the late Dr. de Lessert of Geneva, Switzerland, the epigynum is often filled with a resin that obscures the various parts, but the transverse ridge is distinct.

Male: Length, 7.0 mm., ceph. 3.1 mm. long, 2.5 mm. wide, abd. 4.5 mm. long, 2.2 mm. wide.

Cephalothorax pale, with short hairs, quite flat, anterior margin less than half the greatest width, thoracic groove faintly indicated; *eyes* as in the female; *clypeus* less than a radius of a.m.e.; *mandibles* ventral, long and narrow, teeth on the fang groove as in the female; *labium* as in the female; *maxillae* emarginate on the outer side; *sternum* as in the female; *abdomen* pale, oval; legs, 1-2-4-3, pale, spines black and conspicuous, 1 pair, femur, dorsal, median, 2, prolateral, 1, tibia, ventral, 2-2-2-2, metatarsus, 2, basal, II pair, femur, dorsal, 2-2, prolateral, 1, heavier than on I femur, tibia, 2-2-2-2, metatarsus, 2, basal, IV metatarsus, ventral, 14 short spines, (fig. 2) much shorter and heavier than the lateral spines; *palpus* (fig. 1) about as long as the cephalothorax, pale, with the terminal joint much darker, patella as long as wide, tibia about three times as long as wide, but not as long as the cymbium, with two short dark dorsal cusps at the tip, the dorsal cusp short and straight, the retrolateral cusp longer, more slender with the tip incurved, the tip of the slender process from the cymbium resting between the two, palpal organ confined to the lower two-thirds of the cymbium, bulb protruding from the cavity, embolus starts on the side about the middle, passes below the bulb as a slender tube and ends on the margin about opposite to the origin.

The eggs are flesh-color, about 0.5 mm. in diameter, in a compact mass, loosely enclosed in a thin transparent cocoon.

♀ Massachusetts; Cambridge, 26 July, 1949, (Chickering)
♂ Massachusetts; Cambridge, in museum, 18 July, 1947, (Bryant)
♂ Massachusetts; Brookline, 27 July, 1947, (Bryant)
♂ ♀ New York; New Rochelle, June, 1947, (Lacy)

The male of *Cheiracanthium mildei* is easily separated from that of *C. inclusum* by several characters. The tibia of the palpus of *mildei* has two short processes at the tip, while *inclusum* has one long process which interlocks with a similar process from the cymbium; *mildei* has on the fourth metatarsus a ventral row of short black spines that are very conspicuous; and on the second femur the prolateral spine from a raised base is much smaller than on *inclusum*. The females can be separated by the epigyna. In *mildei* the area is divided by a dark transverse bar, while in *inclusum*, the epigynum is an oval transverse pit which shows no structure.

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NEW SYNONYMY IN THE ARMY ANT GENUS AENICTUS SCHUCKARD.—*Aenictus deuqueti* Crawley (1923, Ent. Rec., *35*:177, worker) is a **new synonym** of *Aenictus turneri* Forel (1900, Ann. Soc. Ent. Belg., *44*:75, worker). I compared types of Forel's and Crawley's species in the British Museum. Crawley's distinctions are inconsequential or else, as in the case of the color, inaccurately described. — W. L. BROWN, JR., Museum of Comparative Zoology.

SYNONYMOUS ANT NAMES. — The following new synonymy has recently been established:

Kyidris nuda Brown (1949, Mushi, *20*:23-24, female) is a **new synonym** of *Kyidris mutica* Brown (1949, Mushi, *20*: 3-6, fig. 1, worker). Of nests reared by Okamoto in Shikoku, the workers are typical of *K. mutica,* while the females agree perfectly with the Formosan type of *K. nuda.* Dr. Yasumatsu has kindly made the necessary comparison. The families are relatively unusually small for dacetines, and differ in sculpture and pilosity from the workers.

Lordomyrma nobilis Yasumatsu (1950, Ins. Matsumurana, *17*:75-78, fig. 2, worker, male) is a **new synonym** of *Rogeria azumai* Santschi (1941, Mitt. schweiz. ent. Ges., *18*: 275), making a **new combination,** *Lordomyrma azumai* (Santschi). Santschi's description arrived belatedly in Japan. Types of the two forms, compared by Dr. Yasumatsu, prove to be identical. — W. L. BROWN, JR., Museum of Comparative Zoology.

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PSYCHE

Vol. 58 December, 1951 No. 4

NOTES ON ALASKAN COLLEMBOLA
II. THREE NEW SPECIES OF ARCTIC COLLEMBOLA[1]

By Kenneth A. Christiansen
American University, Beirut

This is the second in a series of papers on the Collembola fauna of northern Alaska. The material on which this paper is based was collected by Dr. Neal A. Weber while holding a contract with the Office of Naval Research and while stationed in the Alaskan Arctic under the support of the Arctic Research Laboratory.

I wish to thank Dr. Marie Hammer and Dr. Harlow B. Mills for their helpful suggestions concerning this work.

Schaefferia variabilis, n. sp.

(Pl. 10, figs. 1-11; Pl. 11 figs. 2, 6, 7)

Holotype. Eyes two on either side, pigmented and situated on a lightly pigmented eyespot. No other pigment present. Integument granulate with granulations uniform and moderate in size. Clothing of long, sturdy, straight to slightly curved, and mostly sparsely "ciliate" setae, with scattered smaller curved or straight naked setae. The longer setae on the last three abdominal segments are somewhat longer than those on the remainder of the body.

Antennal segments one through three subequal in width, fourth antennal segment slightly narrower than the third at its base and tapering gently to a blunt point. Antennal segments one through three subequal in length, with the fourth being about one and one-half times as long as the third. Fourth antennal segment with a simple distinct apical, retractile bulb, protected on the ventro-external side by an erect papilla. Dorsally there are many long, mostly straight smooth setae, and five thick blunt, curved "olfactory" setae. Ventrally there are present also a number

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

of straight smooth setae, two blunt "olfactory" setae and six small straight truncate to slightly clavate setae, (see Plate 11, fig. 2) which are less than half as long as the normal pointed setae. Third antennal segment with three transverse rows of smooth pointed setae. Third antennal segment with two short roughly boot-shaped pegs, situated in deep integumentary folds, protected on either side by a blunt seta, similar to those on the fourth antennal segment. Antennal segments one and two each with a single irregular transverse row of smooth pointed setae.

Mandibles with well-developed molar plate and four to five blunt apical teeth. Maxillae with four heavy teeth and a number of thin lamellae of varying sizes, the largest two being deeply serrate on their inner edges. Post-antennal organ (P.A.O.) located in a shallow triangular depression and consisting of three or four lobes situated around a roughly hemispherical central boss. The two anterior lobes are in transverse line and the one or two posterior lobes diagonal to this. Small accessory boss present just below and behind the P.A.O. Head clothing as in figure.

First thoracic segment somewhat reduced, possessing only a single transverse row of four setae. The outer two setae are long and ciliate; the dorsal pair are short, smooth, curved, and very thick. Second thoracic segment with three irregular transverse rows of setae. The anterior row somewhat diagonal in position. Third thoracic

---

Explanation of Plate 10

Figs. 1-11. *Schaefferia variabilis*, n. sp. 1. Head, lateral view (holotype). 2. Left fourth antennal segment, dorsal view (holotype). 3. Left anal horn and adjacent abdominal area, lateral view (paratype). 4. Left dens and mucro, from right side (paratype). 5. Left eyes and P.A.O., from above (paratype). 6. Sensory pegs of third antennal segments, showing variation in form. 7. P.A.O. and anterior eye, showing abnormal double accessory boss (paratype). 8. P.A.O. and anterior eye, seen from side of organ (paratype). 9. Single large thoracic seta. 10. Genital plate, male (one-half of setae shown) (paratype). 11. Third antennal segment, sensory organ.

Figs. 12-14. *Pseudanurophorus arctica*, n. sp. 12. Right half of fifth and sixth abdominal segments, dorsal view (holotype). 13. Left P.A.O. and antenna base, dorsal view (paratype). 14. Third antennal segment (setae omitted), showing apical sensory organ, dorsal view (paratype).

CHRISTIANSEN — ALASKAN COLLEMBOLA

segment with one transverse row of long ciliate setae, in front of which are three smooth short setae.

Abdomen sparsely clothed with setae of all types, tending to form irregular transverse bands over the median portions of abdominal segments one through four, and being more uniformly scattered and somewhat more dense on segments five and six.

Legs comparatively densely setaceous, a single longer pointed seta usually present externally just above the claw. Claw long and narrow, with a single internal tooth about midway between the base and the tip, and a smaller, more basad pair of lateral teeth; no external teeth present. Unguiculus with a broad, internal, basal lamella, and a sharp, pointed apical prolongation extending to beyond the level of the internal tooth.

Furcula with all segments distinct. Manubrium ventrally and dentes internally not as coarsely granulate as remainder of body. Manubrium naked ventrally, and sparsely clothed dorsally with short smooth setae, except for a medio-distal triangular unsetaceous area, and a single long seta at each basal lateral corner. Dens ventrally naked, dorsally with seven setae, the basal and subapical ones being about twice as long as the others. Mucro tapering, slightly expanded at the tip, with the central part of the mucro dorsally granulate. A thin lamella is present on either side of the mucro along the apical three-fourths of the structure. Internally the lamella is a flatly arcuate structure. Externally the lamella is much higher for its basal half and then abruptly narrows to the size of the inner lamella.

Tenaculum quadridentate and lacking setae.

Anal spines two, about three-fourths as long as hind unguis, slightly curved and situated on high separate papillae. Anal spines plus papillae longer than hind unguis.

VARIATION

The most striking variation in this species is in the number of lobes in the P.A.O. being quite commonly three on one side and four on the other, as in the holotype. Other specimens have an equal number (three or four) on either side, with four being the most common number. In no case were more than four lobes observed on one side. Another common variation is the presence of two accessory bosses. In other specimens the boss may be very indistinctly demarcated.

The setae of all parts vary considerably, in all ways. The antennal olfactory hairs are fairly constant, but the short truncate hairs vary from slightly truncate to distinctly clavate and from five to eighteen in number. The sensory rods of the third antennal segment are always bent, but, as shown in the figure, do not always have a marked boot shape. The head and body clothing varies considerably, but the long ciliate setae are fairly constant, although the degree of ciliation and the size vary greatly.

The mucro also exhibits a good deal of variation, with some specimens having the external lamella expanded greatly basally, producing the effect of a distinct lamellar tooth. The anal horns vary in size, but in all cases observed were at least slightly smaller than the ventral edge of the third unguis. The horns plus the papillae are usually subequal to the ventral edge of the claw, but in some specimens were as much as one and one-fourth times as long.

RELATIONSHIPS

Although, as Stach suggests, the genus *Schaefferia* is, as presently constituted, probably polyphyletic in its make-up, the present species appears to be quite closely related to the *Schaefferia emucronata* group (Absolon, 1900). The reduced number of eyes, the shape of the P.A.O. and accessory boss, the sparsely ciliate setae, the shape and size of the unguis, as well as the facies, all suggest a very close relationship. While a definite determination of the exact relationships among all the members of the *S. emucronata* complex will await a fairly complete collection of the Holarctic region, I feel justified in calling the present specimens a new species for the following reasons: a) the presence of short truncate hairs on the fourth antennal segment, not mentioned in any form of *S. emucronata* or *S. pouadensis* Delamare-Deboutteville, (1945); b) the much greater development of the furcula; c) different construction of the third antennal sense organ; d) different pattern of the genital plate of the male (see figure); and e) the unusual shape of the third antennal sensory pegs.

MEASUREMENTS

All segmental measurements and ratios taken of imbricate areas along the middorsal line, and are exclusive of intersegmental membranes. All measurements in millimeters. Holotype: total length, excluding antennae, 1.35; cephalic diagonal, .26; thoracic segment one, .07; thoracic segment two, .14; thoracic segment three, .15; abdominal segment one, .14; abdominal segment two, .15; abdominal segment three, .14; abdominal segment four, .15; abdominal segment five, .09; abdominal segment six, .08.

Segmental ratios for size range .60 - .66 mm.:

(thoracic segment 2=10)

	total antenna	cephalic diagonal	thoracic segment 2	thoracic segment 3
mean ratio	23	26	10	8.9
average deviation	1.0	1.0	X	.3

	abdominal segment 1	2	3	4	5	6	hind unguis
mean ratio	6.6	6.9	7.2	9.5	7.1	2.9	.50
average deviation	.5	.3	.4	.3	.9	.3	.04

(antennal segment 3=10)

	antennal segments 1	2	3	4
mean ratio	6	11	10	18
average deviation	.9	.7	X	1.0

(fore unguis=10)

	fore unguis	fore unguiculus	hind unguis	hind unguiculus
mean ratio	10	4.4	11	5.4
average deviation	X	.5	.4	.5

Type locality: Umiat, Colville River, Alaska, July 4, 1949, Neal A. Weber, collector. The holotype and fifty paratypes are being deposited in the United States National Museum, Washington, D. C., and thirty-five paratypes are being deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

Pseudanurophorus arctica, n. sp.

(Pl. 10, figs. 12-14; Pl. 11, figs. 1, 3-5)

Holotype. Body stout, cylindrical, rounded posteriorly, head about as wide as body. Without eyes or pigment. Clothing of scattered short, straight to weakly curved setae with a few longer straight setae, especially on the posterior regions of the body. Common setae of the head are from nine to twelve micra in length and more or less curved. There is also a single row of fifteen micra long setae along the posterior margin of the head.

First thoracic segment is naked dorsally and has a single pair of setae at each leg base, with the superior seta of each pair longer than the inferior. On each leg base of the second and third pair there is a set of four long setae. The remainder of the thorax and the abdomen is clothed mostly with short, curved to straight setae, one-half to three-fourths as long as long setae, with the smaller sizes being much more numerous. Besides these there are a few long setae, arranged as follows: second and third thoracic segment with a single seta at each lateral edge of the setaceous area; first and second abdominal segments each with a single medio-lateral pair of setae, with those on the second segment being slightly longer; third and fourth abdominal segments with four setae each, situated in lateral pairs, the anterior of each pair being slightly longer; fifth abdominal segment with a posterior row of four setae which are longer than any anterior body setae, and a single anterio-lateral shorter seta on either side; sixth abdominal segment with eight long setae.

Integument finely and uniformly granulate. Unsetaceous intersegmental membranes large between all segments except the fifth and sixth.

Fourth antennal segment fusiform, third somewhat spheroidal in appearance, and the second and first segments sub-cylindrical in shape. Fourth antennal segment with numerous obtusely pointed "olfactory" hairs, slightly thicker than, and subequal in length to, the normal clothing setae. Sense organ of third antennal segment consists of two blunt rods situated in shallow integumentary folds, the inner being somewhat above the outer.

Mandible with well-developed basal molar plate, well separated from the four or five apical teeth. Mandible externally with a darkened swelling opposite the apical end of the molar plate. Maxilla with two heavy teeth and three thin lamellate plates, serrate on their inner edges. The outer two plates are apparently double at their inner border, and the more dorsal of these plates extends well beyond the rest of the maxilla and ends in two very large serrations.

P.A.O. situated in a shallow depression on the side of the head near the base of the antenna. It is an oval, swollen lobe, about two-thirds as wide as long, and with long axis roughly perpendicular to the long axis of body.

Dorsum of first thoracic segment greatly reduced, lacking setae. Legs without tenent hairs, unguis simple, acuminate, without teeth. Unguiculus pointed, less than half as long as unguis, sides parallel for basal third of its length, then converging directly for apical two-thirds, with the inner side being the more strongly deflected.

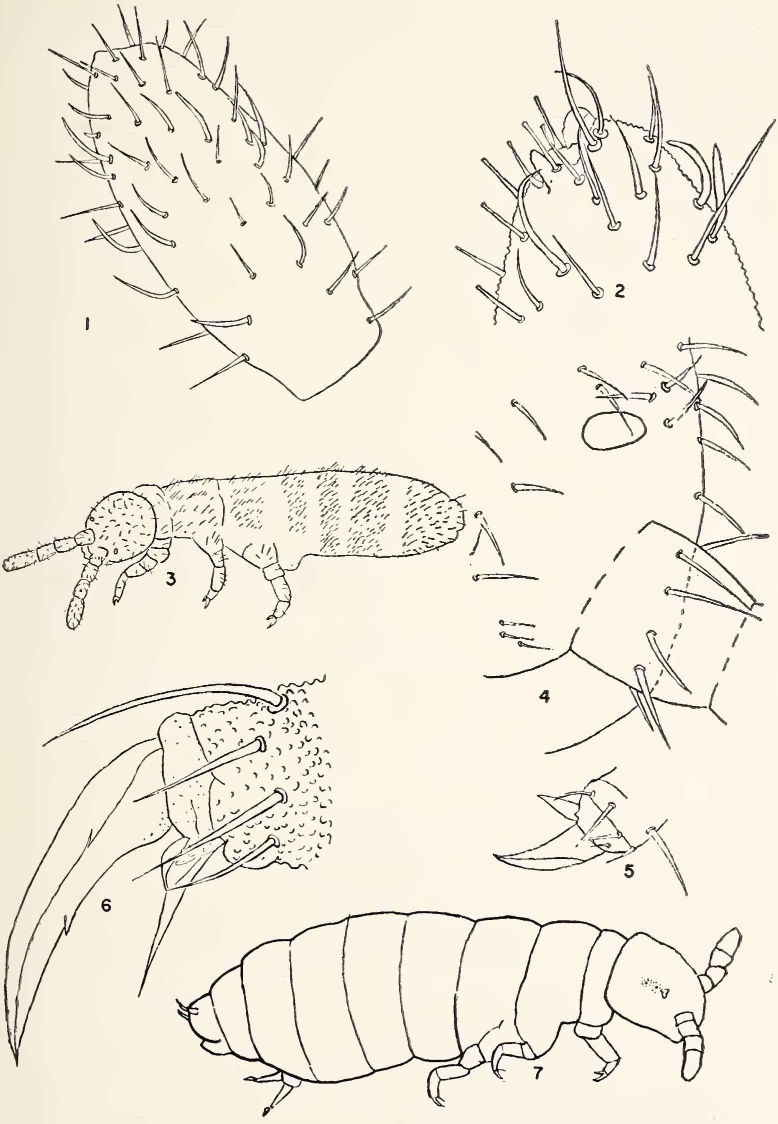
Abdominal segments five and six distinctly separated, but with a narrow intersegmental membrane. Furcula and tenaculum lacking. End of abdomen rounded, lacking anal spines or papillae. Anus ventrally directed.

VARIATION

The sensory setae of the fourth antennal segment differ only slightly from the normal clothing setae, and vary considerably in number and position. There may be as few as eight or as many as thirteen, with ten the usual number; of these a few are ventral in position (from none to three), the remainder dorsal.

EXPLANATION OF PLATE 11

Fig. 1. *Pseudanurophorus arctica,* n. sp., dorsum of right fourth antennal segment (paratype). Fig. 2. *Schaefferia variabilis,* n. sp., apex of ventral surface of fourth antennal segment (paratype). Figs. 3-5. *Pseudanurophorus arctica,* n. sp. 3. Habitus (paratype). 4. Left antennal base and P.A.O., dorsal view (paratype). 5. Right hind foot (paratype). Figs. 6-7. *Schaefferia variabilis,* n. sp. 6. Right hind foot (paratype). 7. Habitus (setae omitted) (paratype).



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The small setae covering the thorax and abdomen are not arranged in any readily visible pattern. There is a very rough arrangement into transverse rows, but this is neither constant nor very clear. The common situation is for these rows to be as follows: thoracic segment one, none; thoracic segment two, 6; thoracic segment three, 5 or 6; abdominal segment one, 4; abdominal segment two, 4; abdominal segment three, 4; abdominal segment four, 5; abdominal segment five, 5; abdominal segment six, 2. The first row of the fifth segment is usually preceded by a single discreet seta on either side. The length of the longer setae varies considerably, but those on the fifth and sixth segments are usually longer than those on the other segments.

RELATIONSHIPS

This species is the first of the genus to be described from North America. While fitting into the generic limits as already set up, it is readily distinguishable from all previously described species. Of these it would appear to be most closely related to *P. binoculatus* Kseneman (1934), and to *P. alticola* Bagnall (1949). It can be distinguished from the former by the lack of eyes and sensory hairs on the fifth abdominal segment, as well as by the swollen nature of the P.A.O. It can be separated from the latter by the shorter, broader P.A.O. and the possession of long setae on the fifth and sixth abdominal segments.

MEASUREMENTS

All segmental measurements and ratios are of the setaceous area along the middorsal line, excluding the intersegmental membranes. All measurements in millimeters. Holotype: total length, excluding antennae, .64; cephalic diagonal, .12; thoracic segment two, .05; thoracic segment three, .05; abdominal segment one, .04; abdominal segment two, .04; abdominal segment three, .04; abdominal segment four, .05; abdominal segment five, .04; abdominal segment six, .01; antennal segment one, .01; antennal segment two, .03; antennal segment three, .03; antennal segment four, .04; fore unguis, .014; fore unguiculus, .007; hind unguis, .015; hind unguiculus, .008.

Segmental ratios:

(abdominal segment 4=10)

	total antenna	cephalic diagonal	thoracic segment 1	2	3
mean ratio	13.4	18.1	4.4	8.8	10.7
average deviation	.8	1.3	.4	.6	.7

	abdominal segment 1	2	3	4	5	6	furcula	third unguis
mean ratio	9.7	9.5	8.8	10	5.9	5.3	11.6	3.5
average deviation	.4	.5	.3	X	.3	.5	.8	.3

(antennal segment 4=10)

	antennal segments 1	2	3	4
mean ratio	6.3	6.8	6.7	10
average deviation	.9	.8	.7	X

(mucro=10)

	manubrium	dens	mucro
mean ratio	32	25	10
average deviation	4	3	X

(unguis=10)

	unguis	unguiculus
mean ratio	10	4.3
average deviation	X	.2

Type locality: Point Barrow, Alaska, June 1949, Neal A. Weber, collector. The holotype and forty paratypes are being deposited in the United States National Museum, Washington, D. C. A series of twenty paratypes is being deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

Anurida hammeri, n. sp.

(Pl. 12, figs. 1-13)

Holotype. Color white, pigment completely lacking. Clothing of scattered straight stout setae of varying lengths. Body about four and one-half times as long as wide, deeply constricted intersegmentally, so as to give a lobed appearance. Abdominal segments almost cylindrical, only slightly compressed dorso-ventrally. Fourth antennal segment with a large apical, distinctly trilobed, retractile bulb, situated in a shallow pit, and nine large, blunt "olfactory" hairs. These hairs are arranged in two groups: one group of six hairs along the dorso-external side, and a second group of three along the dorso-internal area.

Third antennal segment almost completely fused with fourth. Sense organ of third segment consists of two small cylindrical pegs situated side by side in a shallow integumentary fold. Integument granulate, with the granules being large and fairly uniform in size. Antennal segments one through three decreasing in diameter, one being the widest. Segments three and four subequal in diameter. Head viewed from above somewhat heart-shaped. Buccal cone short and blunt. P.A.O. consisting of thirteen papillae packed closely into a circle. Individual papillae as seen from the side are erect triangles with rounded angles; these are packed together to form a low truncate cone. Eyes five in number on each side, pigmentless, arranged as follows: two close together, located just posterior to the P.A.O., the anterior of these somewhat larger than the posterior, and somewhat oval in shape; two others located considerably behind the forward pair and further apart; the fifth is positioned about midway between these pairs, and somewhat dorsad of both. Fourth antennal segment with numerous moderately long, slightly curved, slender setae. One single straight seta on apex on truncate papilla. Third segment with scattered similar setae, plus

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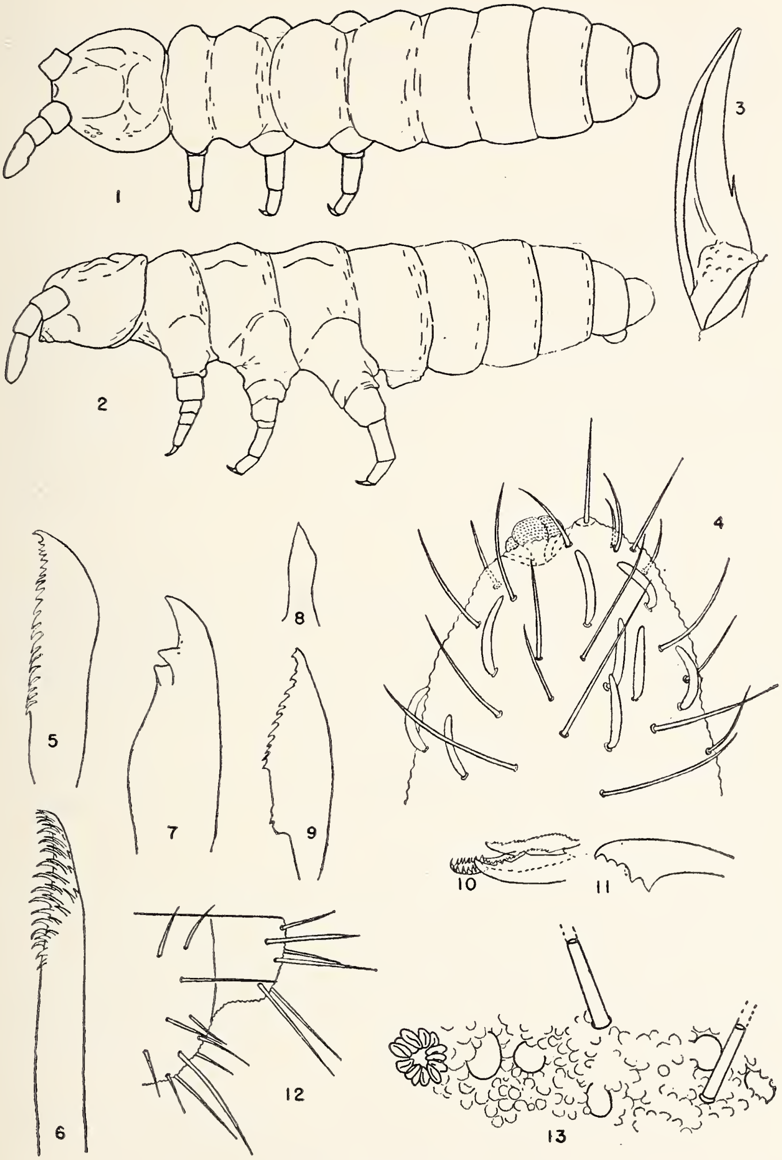
Explanation of Plate 12

Figs. 1-13. *Anurida hammeri,* n. sp. 1. Habitus, dorsal view (setae omitted). 2. Habitus, lateral view (setae omitted). 3. Left hind claw (paratype). 4. Right fourth antennal segment, dorsal view (paratype). 5. First lamella of maxilla (paratype). 6. Second lamella of maxilla (paratype). 7. Galea of maxilla (paratype). 8. Basal process of maxilla (paratype). 9. Third lamella of maxilla (paratype). 10. Maxilla, showing all parts in natural position (paratype). 11. Mandible (paratype). 12. Left half of last two abdominal segments, with setae (paratype). 13. Eyes and P.A.O. of right side (paratype).



CHRISTIANSEN — ALASKAN COLLEMBOLA

a single transverse median row of straight longer setae. First and second segments each with a single median transverse row of long straight setae, slightly thicker and larger than those on the third segment.

Clothing of head straight, sturdy setae of three sizes: the smallest size is subequal to the clothing setae of the fourth antennal segment, but much stouter and more spiniform. These are scattered sparsely and irregularly over anterio-dorsal area between antennal bases and over posterior half of the head. Slightly longer setae are scattered irregularly and sparsely over the dorsal and lateral surfaces of the head. The longest setae are approximately four times as long as the shortest and are arranged as follows: a band of seven setae on each side covering the cheek areas of the head; three other setae, two in a straight line between the middle of the antenna base and the rear of the head, and the third about midway between these two and displaced laterally.

Body with sparsely scattered setae of varying lengths which tend to form interrupted tranverse bands. Fifth abdominal segment with four setae definitely longer than any anterior body setae arranged along the posterior edge. Sixth segment with eight similar setae, with four somewhat shorter setae located between them.

Furcula, anal horns, unguiculus, and tenent hairs lacking. Claw large, with a single large protruding basal tooth.

Mandibles without molar area equipped with five large teeth, the basal two being larger. Maxillae with galea possessing three teeth and an expanded basal area. Lamella one and three pointed arcuate, with serrate single edges. Lamella two projecting beyond the rest of the maxilla and possessing a multiple pectinate edge for the projecting part.

Male genital plate circular, slightly raised, with twenty short, fairly uniform smooth setae, arranged as follows: eight forming a circlet about the genital aperture, and the remaining twelve filling a roughly lunate area anterior to this group.

VARIATION

The most striking variation is in the grouping and number of the eyes. The anterior two are often closely approximated or even fused, and in many cases only four eyes are present. The number of papillae in the P.A.O. also varies, from twelve to seventeen. The chaetotaxy of the head and abdomen varies considerably, both in number of setae and in the positions. The size of the setae increases with the size of the specimen. The number and position of the olfactory hairs of the fourth antennal segment vary somewhat (eight to ten), but only in occasional specimens. In a few cases the apical truncate conical area lacks a straight seta. The mouth parts are fairly uniform, the apical two teeth of third maxillary lamella may be elongate, and the large teeth on the mandible may be either two or three.

RELATIONSHIPS

This species, in the structure of the P.A.O. and in mouthparts, especially in the form of the second pectinate maxillary lamella, is close to the *A. granaria* (Nicolet, 1847) group. The presence of four or five eyes removes it from all known species of this group. As the eyes in the new species are all without pigment and show other signs of reduction, this species may well represent a transition between the *granaria* group and those species of *Anurida* which are fully equipped with eyes and pigment. The present species appears to be most closely related to the species *granaria* Nicolet and *pseudogranaria* Stach (1949), but can be readily separated from both by the larger number of olfactory hairs on the fourth antennal segment (nine in the present species, as compared with six in *granaria*), by the long setae on the fifth and sixth abdominal segments, and by the similar serrations on the first and third maxillary lamellae.

MEASUREMENTS

Due to the great flexibility of the integument and the lack of clearly marked imbricate or setaceous areas, attempts to derive satisfactory ratios were fruitless. Thus the only measurements given are the absolute segmental and other measurements as determined on the holotype. All measurements in millimeters. Cephalic diagonal, .46; thoracic segment one, .16; thoracic segment two, .32; thoracic segment three, .32; abdominal segment one, .24; abdominal segment two, .29; abdominal segment three, .27; abdominal segment four, .30; abdominal segment five, .19; abdominal segment six, .10; antennal segment one, .09; antennal segment two, .09; antennal segments three and four, .21; unguis of third leg along ventral edge, .08.

Type locality: Point Barrow, Alaska, June and July, 1949, Neal A. Weber, collector. The holotype and seven paratypes are being deposited in the United States National Museum, Washington, D. C. Four paratypes are being deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts.

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PSILOBETHYLUS IN THE NEW WORLD (HYMENOPTERA: BETHYLIDAE)

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The family Bethylidae is one of the most unsatisfactorily known of the larger hymenopterous assemblages. Present-day taxonomy is dependent upon the monograph of Kieffer in Das Tierreich (Lief. 41, 1914) and on such meager authentically determined material as exists in the larger collections of insects. Kieffer's work rests on a very poor basic literature, and furthermore, the monograph includes many elements like the dryinids, *Algoella*, *Embolemus*, etc. which cannot now be considered close to the bethylids. The subsequent removal of many of these tramontane groups does little to relieve the difficulty one meets in trying to use Kieffer's work for practical identification. These considerations, together with the scarcity of material for study, make taxonomic endeavor in the bethylids a frustrating experience.

Interest in a female bethylid received from Dr. F. Bonet of Mexico City led to attempts at identification by means of Kieffer's key (*op. cit.*), where we ran it down in the wingless division to couplet 26, p.233. The choice here given was: "Mesonotum und scutellum deutlich" or "Mesonotum oder scutellum fehlend." Our specimen had the mesonotum and scutellum apparently weakly separated, and we decided in favor of a doubtful identification "cf. *Psilobethylus*." From Kieffer's generic characterization (p. 274) the specimen differed in having four (*vs.* three) mandibular teeth, but otherwise, agreement was fair. Sent to Mr. C. F. W. Muesebeck, the female was identified as *Psilobethylus* and was returned promptly with nine very similar females from various parts of the United States.

Psilobethylus has hitherto been represented by three species from the Old World. Only one species, *Ps. luteus* Kieffer (genotype) from Europe, has been known from the female sex. The descriptions of *luteus* leave much to be desired, and it is only with some doubt that the New World species are considered congeneric with the genotype. In view of the confusion presently holding among the bethylid genera, there seems little excuse for separating the American forms at this time. For better characterization, the males of the New World forms need to be discovered and the Old World ones to be redescribed.

The females of the New World forms are slender, yellowish or ferrugineous wingless wasps of very small size. The head is oblong and more or less depressed. The eyes are small and placed near the anterior quarters or fifths of the sides of the head. The antennae are 13-segmented, incrassate, the scapes especially so, and are inserted in pits close together on the extreme anterior part of the head. The clypeus and adjoining structures are much reduced and modified by fusion, so that the two depressions ventral to the processes upon which the antennae are inserted have become separated by a small but sharp vertical plate. The legs are of normal bethylid type, without peg-like spines.

The fusion of the clypeus with adjoining structures, the reduction of eyes and lack of strong pigmentation, and the incrassation of the antennae are modifications for hypogaeic or other cryptobiotic existence found also in other hymenopterous groups. Among the ants, certain dorylines and cerapachyines show similar modification, and the structural similarity has been used to support contentions that these two subfamilies are close in a phylogenetic sense. It need only be pointed out that the modifications shown by other, clearly distant groups like *Discothyrea* among the ants and *Psilobethylus* among the bethylids demonstrate that the phenomenon is one of multiple convergence and that it may not be trusted in attempting to establish relationships of systematic significance.

Little is known concerning the biology of the American forms. It is assumed that our forms follow the bethylid pattern of "parasitism" on other insect larvae. The collection data and obvious structural features of our females indicate that the hosts are hypogaeic in habit, at least during the stage at which attacked. The American records for the wasps are all indicative of a habitat in the upper soil layers or at the level of the soil cover.

Among the relatively meager material at our disposal can be recognized what seem to be two distinct species, separable on the basis of size, proportion, sculpture and shape of head. The smaller and smoother of the two species, *lucidus* n. sp., is set up for specimens stemming from Illinois, West Texas, North Carolina and Tabasco in southern Mexico. In view of slight differences between individuals from these widely separated localities, it seems probable that *lucidus* contains more than one specific entity. The differences are so elusive, however, and the variation within series relatively so great that we cannot confidently assort them taxonomically without the corresponding males. It must be borne in mind that each of the locality-series probably represents the offspring of a single female. Such a situation creates constancy within series and differences between series that are often illusory in the systematic sense, since not only may the mothers show slight individual, non-taxonomic differences, but the hosts and the differing food supplies they afford may alter radically the structure of individuals from one brood to another. In fact, even the large, densely sculptured *foveolatus* may eventually prove to be nothing more than a form of *lucidus* arising through differential feeding. The differences in size, shape, and especially in sculpture are of such magnitude that we feel fairly confident in separating the two as species at the present time.

Psilobethylus foveolatus n. sp.

(Plate 13, figure 1)

Holotype female: Total (synthetic aggregate) length 2.20±.04 mm.; head length, maximum measurable, 0.53 ±.005 mm.; alitrunk length, maximum diagonal measurement in lateral view, 0.72±.01 mm.; cephalic index (maximum head width expressed as a percentage of head length) 75±1. Habitus as in figure, except that (in both figures 1 and 2) the insertions of the antennae are depicted more boldly and more strongly set off than they are in the actual specimens. Body slender, gently depressed; head evenly convex dorsally, in lateral view suboval, with subtruncate posterior end. Eyes long-oval, with 10-12 coarse facets arranged in a double row, plus a very few other less well-developed facets. Sides of head gently convex, subparallel (see figure). Mandibles largely hidden when head is viewed from dorsal side; dentition as in figure 3. Maxillary palpi not clearly visible, but apparently much as described for *lucidus*. Labial palpi not visible. Alitrunk slightly depressed dorsally, in profile the dorsal outline nearly perfectly straight. Legs gently incrassate, profemora more strongly so.

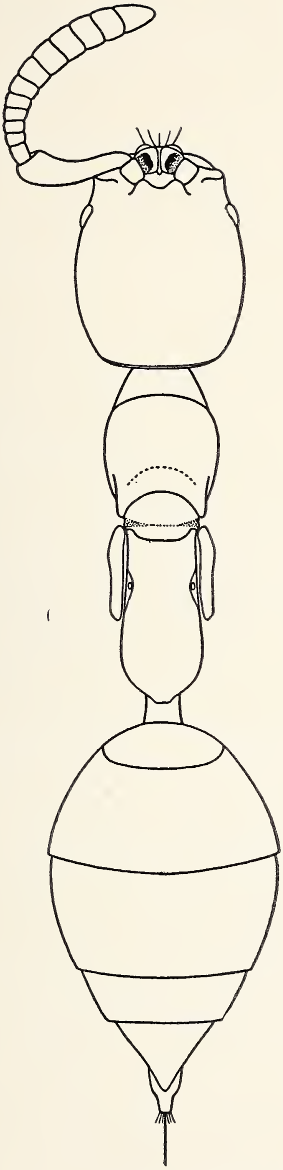
Dorsum and sides of head covered with small, densely arranged, umbilicate-piligerous foveolae, contiguous and subcontiguous on most of the sides and dorsum, but thinning out slightly in the extreme median dorsal region, where a very restricted area shows some "Scotch grain" coriaceous sculpture and is feebly shining. The greater part of the head is opaque. Alitrunk rather strongly and densely coriaceous, subopaque to opaque, with a few indistinct punctures. Mesonoto-scutellar sutural line moderately distinct. Propodeum feebly subrugulose in addition to the ground sculpture. Gaster smooth and shining. Legs, scapes and mandibles very feebly and finely punctulate-granulose, weakly to moderately shining.

Pilosity consisting of fine, tapered hairs, rather abundant and erect or suberect, but more nearly reclinate on the appendages, short to moderate in length and distributed rather evenly over the body. Color deep yellowish-ferrugineous; gaster brown, shading off to ferrugineous at both basal and apical extremities; legs and antennae clear yellow.

EXPLANATION OF PLATE 13

Fig. 1. *Psilobethylus foveolatus* new species, holotype female, Mt. Vernon, Virginia, dorsal view. Fig. 2. *Ps. lucidus* new species, paratype female, Santa Rosa, Tabasco, dorsal view of head. Fig. 3. *Ps. lucidus* new species, paratype female, Durham, North Carolina, external view of mandibular dentition.

Figures 1 and 2 are drawn to the same scale.



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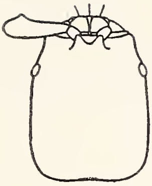

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Brown and Cheng — Psilobethylus

Holotype deposited in United States National Museum; collected at Mt. Vernon, Virginia, Dec. 16, 1944, "in *Andropogon*" (J. C. Crawford).

A single paratype female, data and deposition as for holotype, is very similar to the holotype in every way except that the gaster is slightly differently expanded. The measurements and proportions, except for the total length difference due to gastric expansion, are within the errors stated for the holotype.

Psilobethylus lucidus n. sp.

(Plate 13, figures 2, 3.)

Holotype female: Similar to *Ps. foveolatus*, but smaller in size (see measurements below) and relatively more slender. Head more nearly perfectly oblong, with parallel, nearly straight sides, also more strongly depressed (index of cephalic depression 44±2). Eyes smaller, with only 5-8 facets evident in each. Dorsal surface of head extremely feebly convex dorsally, plane ventrally. In full-face view, posterior occipital border extremely feebly concave in the middle. Dorsum and sides of head with close but superficial "Scotch grain" coriaceous sculpture and a few sparse, widely spaced small piligerous punctures; the latter most numerous on the sides of the head, but even here not approaching in number or size the foveolae of the preceding species. Alitrunk with fine coriaceous sculpture much like that of head, but here punctulae are scarce and indistinct or altogether absent. Surfaces of head and alitrunk distinctly shining. Gaster smooth and shining.

Hairs a little less abundant and shorter than those of *foveolatus*, particularly on cephalic dorsum. Color as in *foveolatus*, but lighter, the gaster not so distinctly darkened in the middle. Other characters, except for certain slight proportional differences shown in the figure, as in *foveolatus*.

Holotype (U. S. National Museum) taken from the soil of a peach orchard in El Paso County, Texas, Nov. 2, 1936 (W. F. Turner, No. T-1872).

Paratypes, all females: Two specimens with the data as for holotype were very similar to it, but were lighter and more yellowish in color, lacking the gastric infuscation. The total length in the El Paso County (type locality) series ranged for three specimens from 1.63 to 1.70 mm.[1] Head length 0.35-0.42; alitrunk length 0.45-0.56 mm.; cephalic index 66-69.

One of the two El Paso County paratypes was dissected, and the maxillary palpi proved to be composed each of one cigar-shaped segment with slender, curved base; the single segment bears a low welt on the lateral face near midlength. The labial palpi are two-segmented, the apical segment robust, ovoid, fitting snugly into the curved, trumpet-shaped basal segment. The palpal segmentation in combination with the mandibular dentition may prove of value at some future date in differentiating the American forms from those of the Old World in which the labial palpi are stated to have one segment.

One female (figure 2) from Santa Rosa, Tabasco, Mexico, in a Berlese funnel soil sample with ants and collembolans, Aug. 16, 1945 (F. Bonet). Total length 1.79 mm., head length 0.39 mm., alitrunk length 0.60 mm., cephalic index 71. This specimen is much like the holotype, but is pale yellow in color. The two basal teeth of the mandibular series are much reduced, smaller than as shown in figure 3.

Three specimens from Urbana, Illinois, Feb. 18, 1945 (J. L. C. Rapp) taken in soil. Like the holotype but head a bit more convex dorsally and ventrally and also at the sides, in this respect tending toward *foveolatus*. Size, color and particularly the very similar sculpture ally this sample with *lucidus* and not *foveolatus*. Cephalic index 75-78.

One specimen, Duke Forest, Durham, North Carolina, June 2, 1945, "oak on sand, 2 inches deep," (A. S. Pearse). Total length 1.99 mm., head length 0.43 mm., alitrunk length 0.62 mm., cephalic index 73. Head shape intermediate between those of Texan and Illinoian specimens.

[1] Conditions of measurement and range of error as in corresponding measurements for *Ps. foveolatus* n. sp.

Mandible shown in figure 3. Punctulation of head a trifle coarser than in holotype, but not closely approaching that of the *foveolatus* types; specimen rather dirty, of dullish coloration.

The paratype series has been returned to the collection of the U. S. National Museum. *Ps. lucidus* as presently conceived may be separated from the related *foveolatus* by the striking sculptural difference as well as by the probably less reliable characters of size, head shape, color, etc. Discovery of *Psilobethylus* males in association with females on this continent will probably lead to revision of the status of the forms here included in *lucidus.*

We wish to offer our thanks to Mr. Muesebeck and Dr. Bonet for their aid in sending material and in furnishing other information used in this paper.

SOME NOTES ON SYNONOMY OF THE MYCETOPHILIDAE (DIPTERA). — In 1940 (Revista Ent., 11 :803-808), the author described several new species of Mycetophilidae from Costa Rica. Among these was included *Neoempheria neivai.* This publication appeared in December. Without the knowledge of the author, Dr. F. W. Edwards of the British Museum described some species of *Neoempheria,* including a *Neoempheria neivai* (Nov. Zool., 42:107-129). This paper appeared in April, 1940, and hence Edward's specific name *neivai* has priority. At this time I would like to rename my *Neoempheria neivai* and will substitute the name *phillipsi* for *neivai.* This name is selected in honor of Dr. E. F. Phillips whose untimely death during the past summer is greatly mourned.

During the current year, 1951, the author published descriptions (Bull. Brooklyn Ent. Soc., 46:65-70) of new Mycetophilidae from western United States. In these was included a new species which I named *Exechia ligulata.* Laffoon, in correspondence, has recently indicated that the name *ligulata* was a homonym having been used by Lundstrom in 1913. Hence I will substitute the specific name *subligulata* for my *ligulata.* F. R. SHAW, University of Massachusetts.

TWO NEW SPECIES OF DICTYNIDAE (ARANEAE) FROM PANAMA

By Arthur M. Chickering
Albion College, Michigan

As previously pointed out (Chickering, '50), Petrunkevitch ('25) was the first to report a dictynid (*Mallos niveus* O. P.—Cambridge) from Panama. Gertsch ('46) reported a male of *Dictyna meditata* Gertsch from the Canal Zone Biological Area. This species is now known to be fairly common over much of that region of Panama where I have worked. *Thallumetus dulcineus* Gertsch was described in 1946 from a single male collected at El Volcan in February. In 1950 I described three species of dictynids as follows: *Dictyna alyceae, D. donaldi,* and *Thallumetus pusillus*. The first two were from Boquete, and the third was from the Canal Zone Biological Area. From my collection of 1950 I have selected two new species belonging to this family. These are described in the present paper in accord with my usual formula and under the following names: *Dictyna lecta* sp. nov., and *Thallumetus pullus* sp. nov.

It is expected that the general state of our available knowledge on the Dictynidae of Panama and other parts of Central America will be made clear when a revision of the family is published by Dr. W. J. Gertsch, American Museum of Natural History, who is now engaged in this important study.

This paper is the first of a series of publications dealing with the spider fauna of Panama depending in part or wholly upon collections made during my period of field work in various parts of this interesting country during the summer of 1950. This most recent of a series of visits to Panama was made possible through grants from the Penrose Fund of the American Philosophical Society and The Society of Sigma Xi. The descriptions were drawn up during the summer of 1951 while I enjoyed the many advantages of the Museum of Comparative Zoology at Harvard College.

Genus *Dictyna* Sundevall, 1833

Dictyna lecta sp. nov.

(Figure 1)

Male holotype.—Total length 1.41 mm. (Abdomen and cephalothorax detached; otherwise in good condition). Carapace .704 mm. long; .55 mm. wide opposite second coxae where it is widest; pars cephalica very prominent and quite convex; almost circular from opposite palps; .352 mm. tall and, therefore, about .64 as tall as wide.

Eyes.—Eight in two rows: only AME diurnal. Viewed from above, posterior row moderately recurved. Viewed from in front, anterior row moderately procurved. Central ocular quadrangle wider behind than in front in ratio of 5 : 4; wider behind than long in ratio of 5 : 4; posterior row fully as wide as pars cephalica at that level; posterior row wider than anterior row in ratio of 28 : 25. Ratio of eyes AME : ALE :: PME : PLE=3.5 : 5 :: 4.5 : 5 (long diameters). AME separated from one another by a little more than 1.5 times their diameter, from ALE by their diameter. PME separated from one another by a little more than 1.5 times their diameter, from PLE by slightly less than 1.25 times their diameter. Laterals separated from one another by .3 of their diameter. Clypeus grooved below AME and ventral half strongly protrusive, the latter part provided with several stiff convergent bristles. Height of clypeus equal to about three times the diameter of AME.

Chelicerae.—Essentially vertical and parallel if taken as wholes; considerably bowed outward just above the middle of the outer border; excavated medially so as to form a long narrow oval opening between the two; with a prominent basal boss having a keel which extends for some distance; moderately concave in front; basal segment .40 mm. long; fang appears to be weak; impossible to determine exact number and position of teeth along fang groove without serious injury to type.

Maxillae.—Convergent; extend beyond lip about three tenths of their length; palp inserted into basal third.

Lip.—About as wide as long. Sternal suture straight.

Sternum.—Cordiform; moderately convex; only slightly longer than wide; widest between second coxae but nearly as wide between first coxae; with a moderately well developed coat of long light colored bristles; posterior end a blunt point between fourth coxae which are separated by nearly 1.5 times their width. All coxae of moderate length, but first are somewhat the most robust.

Legs.—1243. Width of first patella at "knee" .0758 mm., tibial index of first leg 10. Width of fourth patella at "knee" .05956 mm., tibial index of fourth leg 11.

	Femora	Patellae	Tibiae	Metatarsi	Tarsi	Totals
		(All measurements in millimeters)				
1.	.649	.162	.574	.412	.325	2.122
2.	.541	.162	.412	.304	.271	1.690
3.	.435	.108	.282	.293	.216	1.334
4.	.520	.140	.379	.401	.216	1.656
Palp	.335	.108	.119	——	.444	1.006

Each metatarsus bears a single long dorsal trichobothrium near the distal end of the segment; each tibia bears a long dorsal trichobothrium near the middle of the segment; other less conspicuous trichobothria may be present but this is uncertain. The calamistrum is well developed on the fourth metatarsus where it extends over the proximal four fifths of the segment.

Spines.—True spines seem to be completely lacking but bristles and spiniform hairs are numerous.

Palp.—The retrolateral tibial apophysis is very long and it projects at a right angle. The tarsus is much flattened and bent sharply toward the ventral side in its distal third; there is a long narrow cleft at its base and the basal hook is quite characteristically shaped. The cymbium is narrow and it projects beyond the embolus only a short distance; the embolus nearly encircles the structure (Fig. 1).

Abdomen.—Ovoid; .946 mm. long; longer than wide in ratio of 43 : 30; widest near the middle; the cribellum is undivided and quite normal in appearance; the six spinnerets are as usual in the genus.

Color in alcohol.—Carapace gray-brown with black streaks, lighter on top of the pars cephalica. Sternum and lip much the same but somewhat darker. Chelicerae and maxillae somewhat lighter. Legs and palps yellowish white. Abdomen: with a median dorsal yellowish stripe with irregular borders extending from near the base to the tip of the anal tubercle and enclosing two small central dark spots in its posterior half; dark brown elsewhere, obscurely spotted with yellowish.

Type locality.—Male holotype from El Volcan, R. P., August, 1950. No paratypes; female unknown.

Genus *Thallumetus* Simon, 1892

Thallumetus pullus sp. nov.

(Figures 2-5)

Male holotype.—Total length 1.755 mm. Carapace .704 mm. long; .682 mm. wide opposite second coxae where it is widest; .396 mm. tall and, therefore, about .58 as tall as wide; with steep and somewhat irregular descent almost immediately behind PME to bottom of posterior declivity opposite third coxae; no longitudinal thoracic groove observed; near bottom of steep posterior declivity there is a group of four or five moderately long stiff black bristles; pars cephalica quite convex and well separated from pars thoracica; with little or no hair but bristles are numerous around eyes and especially between both pairs of median eyes and below AME.

Eyes.—Eight in two rows, only AME dark. Viewed from above, both rows of eyes recurved. Viewed from in front, anterior row moderately procurved. Central ocular quadrangle only slightly wider behind than in front, wider behind than long in ratio of about 13 : 11. Ratio of eyes AME : ALE : : PME : PLE=4.5 : 4.5 : : 4 : 3.75 (ratios are difficult to establish with accuracy). AME separated from one another by slightly more than their diameter, from

ALE by their radius. PME separated by 1.5 of their diameter, from PLE by their diameter. Laterals barely separated. Clypeus markedly concave; height equal to about five diameters of AME. As already noted, the clypeus is provided with a cluster of bristles merging with those between AME.

Chelicerae.—Vertical, essentially parallel; with very slight bowing outward near base of outer margin; moderately excavated medially near middle to form a small oval opening between the two; with a moderately well developed basal boss; basal segment .35 mm. long; moderately robust; promargin of fang groove with three moderately stout teeth, retromargin with a single smaller one near distal end of groove (taken from paratype to avoid injury to holotype).

Maxillae.—Convergent; palp inserted into basal fourth; bluntly rounded at distal end.

Lip.—Wider than long in ratio of about 5 : 4; well rounded but not strongly narrowed at distal end; sternal suture very slightly procurved; maxillae extend beyond lip about two thirds of its length.

Sternum.—Somewhat scutiform; moderately convex; only slightly longer than wide; widest between second coxae but nearly as wide between first coxae; with a moderately well developed covering of long dark bristles; posterior end a bluntly rounded point extended between fourth coxae which are separated by slightly more than their diameter. All coxae of moderate length and nearly equal in width.

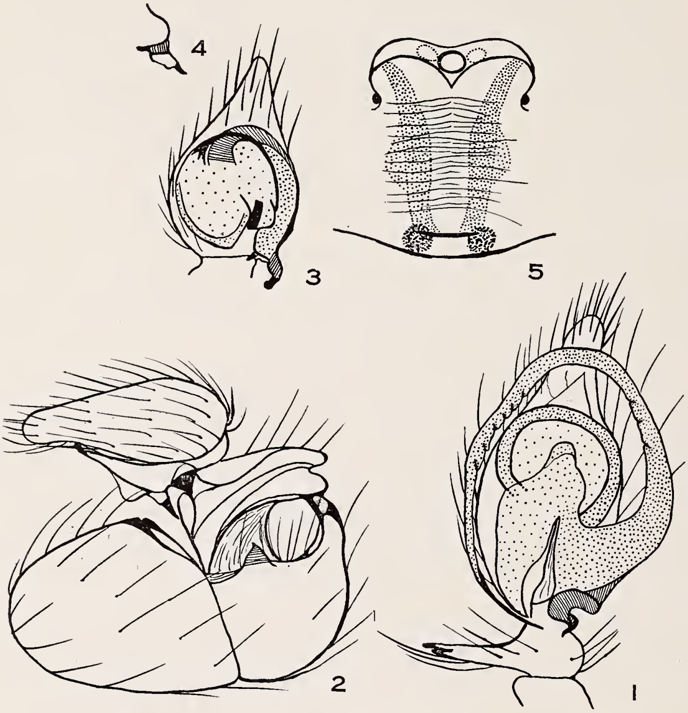
Legs.—1243. Width of first patella at "knee" .088 mm., tibial index of first leg 9. Width of fourth patella at "knee" .077 mm., tibial index of fourth leg 12.

(All measurements in millimeters)

	Femora	Patellae	Tibiae	Metatarsi	Tarsi	Totals
1.	.770	.220	.744	.528	.355	2.617
2.	.660	.220	.616	.484	.330	2.310
3.	.610	.176	.374	.440	.330	1.930
4.	.650	.176	.440	.484	.308	2.058
Palp.	.335	*.335	*.330	——	.330	1.350

* Including their processes.

The only trichobothrium so far seen with reasonable certainty is dorsal in position near the distal end of each metatarsus. The hairs of the calamistrum appear to be reduced in length but extend nearly the whole length of the fourth metatarsus.



Figures 1-5. External Anatomy of Dictynid Spiders. Fig. 1. *Dictyna lecta* sp. nov.; male palpal tibia and tarsus. Fig. 2. *Thallumetus pullus* sp. nov.; male palpal femur, patella, tibia, and tarsus; nearly retrolateral view. Fig. 3. *T. pullus;* palpal tarsus; ventral view. Fig. 4. *T. pullus;* palpal basal tarsal apophysis. Fig. 5. *T. pullus;* epigynum.

Spines.—True spines are lacking but spiniform hairs are numerous. Claws appear to be the same as described in *T. pusillus* Chickering ('50).

Palp.—Short, highly modified in all four segments from femur to tarsus, inclusive. Femur deepened so that it is only longer than deep in ratio of 34 : 25; somewhat flattened laterally but very robust; its distal ventral rim is strongly chitinized. The patella is very robust and is drawn out distally to form a large strong chitinized ramus ending in a strong tooth; near its base there is a short robust retrolateral pointed tubercle. The tibia is also strongly modified; it is curved to meet the patellar ramus and together with this segment forms a kind of forceps; the tibial ramus terminates in three points between which the tip of the patellar ramus terminates; this segment also has a robust, strongly chitinized, retrolateral pointed tubercle near its base. The meeting place of the patella and tibia leaves a relatively large rounded aperture between them thus suggesting an important specific use. The most characteristic tarsal feature appears to be the conspicuous basal apophysis of special shape (Figs. 2-4).

Abdomen.—Broad at base, widest about two fifths from base, narrows to a point at anal tubercle, overlaps carapace somewhat; with a series of three transverse dorsal grooves in posterior fifth; with four quite clear dorsal sigilla in second fourth, the first pair especially distinct; cribellum of normal size, clearly undivided, with numerous stiff bristles along its anterior surface; six spinnerets as usual in the genus.

Color in alcohol.—Carapace light reddish brown with dark streaks. Sternum and mouth parts various shades of amber. Legs: nearly uniformly dark brown, lighter below. Abdomen: generally dark brown, nearly black above, lighter below; on the dorsum just anterior to middle there is a small irregular light spot which is more conspicuous on some of the paratypes.

Female allotype.—Total length 1.716 mm. Carapace .660 mm. long; .638 mm. wide; .264 mm. tall and, therefore, about .41 as tall as wide. Pars cephalica much less prominent than in male. The characters of the female with respect to eyes, chelicerae, maxillae, lip, and sternum are so closely similar to those of the male that a detailed description of these parts is regarded as unnecessary.

Legs.—1423. Width of first patella at "knee" .08664 mm., tibial index of first leg 11. Width of fourth patella at "knee" .08123 mm., tibial index of fourth leg 11.

	Femora	Patellae	Tibiae	Metatarsi	Tarsi	Totals
		(All measurements	in millimeters)			
1.	.748	.242	.572	.484	.355	2.401
2.	.660	.231	.484	.418	.352	2.145
3.	.572	.198	.418	.396	.308	1.892
4.	.616	.220	.528	.484	.308	2.156

The calamistrum is well developed, consisting of a row of curved hairs on the proximal four fifths of the fourth metatarsus.

Abdomen.—Essentially as in male. Cribellum well developed, normal to the genus.

Epigynum.—Relatively large; convex; with a short transverse lip near the genital groove; a small spermatheca lies at each end of the lip; two diverging stripes extend forward from the lip; lateral to the anterior end of each stripe there is a small depression (probably an opening); the anterior end of the epigynal plate is formed by a strongly chitinized curved band with a central opening. Dissection reveals the presence of several tubules, nodules, etc. just internal to the surface. The convex part of the plate is finely and transversely rugulose (Fig. 5).

Color in alcohol.—Almost identical with that of male except that the light areas on the dorsum are plainer; here in the female they are two light brownish spots separated by a central dark stripe; in some paratype females the light spots are large and quite conspicuous.

Type locality.—Male holotype from Canal Zone Biological Area, C. Z., July, 1950; female allotype from the same locality, August, 1950. Several paratypes of both sexes from the same locality, July-August, 1950.

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CARNUS HEMAPTERUS NITZSCH ON A SCREECH OWL IN ARIZONA (DIPTERA). — In 1942 I recorded this ectoparasite from a flicker in New York State and from a screech owl in Florida, and reviewed what was known of its distribution and natural history (Bull. Brooklyn Ent. Soc., 37: 140-149). I was informed since that it was found in British Columbia and California, the details of these occurrences to be published later by the discoverers. Meanwhile I may record that it occurs also in Arizona. A collection of bird-flies, recently received from Professor George D. Butler, Jr., of the University of Arizona, contains 5 deälated specimens (3 males and 2 females) taken April 24, 1938, by Mr. S. L. Jacot on a nestling Arizona screech owl, *Otus asio gilmani* Swarth, 9 miles east of Tucson, at 2300 ft. altitude. No doubt the insect is widely distributed in North America, but overlooked owing to its small size (1.5 to 3 mm.). — J. BEQUAERT, Museum of Comparative Zoology, Cambridge, Mass.

THE EUROPEAN MANTIS, MANTIS RELIGIOSA (LINNE), IN CONNECTICUT. — At the time Dr. Nutting published his survey on the distribution of the European mantis in New England, (Psyche, 57:28, 1950) only one specimen was recorded from Connecticut. This single specimen was listed as possibly from Connecticut, without data.

During the summer of 1951 the author collected four males and eight females of this species at Storrs, Connecticut. The first was a full grown nymph collected in meadow grass on August 12. It transformed into an adult female a few days later. The following adults also were collected:

On Aug. 13, two males and a female; Aug. 19, one female; Aug. 29, one female; Aug. 21, one male and one female; Sept. 12, one female; Sept. 14, one male; Sept. 15, one female; Sept. 16, one female. Most of the specimens were taken in fairly tall grass in a meadow, but one female was taken on a huckleberry bush at the edge of a wooded area and one male on the campus at the University of Connecticut. Mr. Franklin B. Lewis also collected a male specimen on the campus. The males fly readily and probably their dispersal is greater locally than that of the females.

Two egg masses were found in the field on Sept. 13. They were deposited on grass six or eight inches above the ground. Several egg masses were obtained from caged mantids.

One of the captive males was eaten by the female after copulation. The preferred food of these mantids in captivity appears to be small long-horned grasshoppers (Conocephalinae), although they will feed on various species of grasshoppers. They have been observed to eat specimens as large as *Neoconocephalus* (Copiphorinae) and false katydids (Phaneropterinae). They consistently refused to accept specimens of the Pentatomidae, order Hemiptera.— R. M. DECOURSEY, University of Connecticut, Storrs, Conn.

PSYCHE

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All new genera, new species and new names are printed in LARGE AND SMALL CAPITAL TYPE.

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PSYCHE

Vol. 59 March, 1952 No. 1

SIX NEW SPECIES OF *MEGISTOPS* WITH KEYS TO THE KNOWN SPECIES (COLEOPTERA)*

By Doris H. Blake
Arlington, Virginia

The genus *Megistops,* originally based by Boheman[1] on two species supposedly from San Francisco but actually from Ecuador[2], at present contains fifteen species. Eight of these were described from the West Indies, ranging from Cuba to Trinidad, and the other seven from Venezuela (1), Brazil (3), Ecuador (2), and Paraguay (1). The group is for the most part fairly homogeneous in its size, shape and coloring, being composed of small (2-5 mm.), oval beetles with extraordinarily large eyes that in some are contiguous on the occiput. Eight of the species (three from the West Indies) have deep reddish brown or piceous elytra with four large pale spots, five have dark spots on pale yellow elytra, and four (from the West Indies) have streaks or subvittate dark markings. Only five (of which three, I believe, are merely dark color forms of other species) have the elytra of one color. It is not difficult to conceive that all of these color patterns on the elytra are degrees of coloring of the typical four-spotted elytra, varying from nearly pale, with only remnants of spots, to entirely dark.

Recently I have been able to examine many type specimens of Boheman's, Baly's, Jacoby's, Bryant's, and Duvi-

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

[1] Boheman, Eugenia Resa, Coleoptera, 1859, p.187.

[2] Blake, Bull. Brooklyn Ent. Soc., vol. 26, 1931, p.8.

vier's species. Since I have six more to add to the genus and since they comprise two from the West Indies, three from South America and the first one to be described from the mainland of North America (Costa Rica), it seems worth while to give keys to both the West Indian and South American species.

Key to West Indian Species

1. Pale yellow except for the dark antennae and dark streaks on legs. Cuba .... *adulta* Suff.
   Elytra with spots or vittae or entirely dark 2
2. Elytra entirely dark 3
   Elytra not entirely dark 5
3. Elytra deep blue, eyes not very close together, Puerto Rico .... *dissita* Blake
   Elytra piceous or reddish brown 4
4. Elytra piceous black. Cuba ...... *rubropustulata* Suff.
   Elytra deep reddish brown. Puerto Rico *tabebuiae* Blake
5. Elytra dark with 4 pale spots 6
   Elytra not with 4 pale spots 8
6. Elytral pale spots elliptical. Trinidad *trinitatis* Bryant
   Elytral pale spots more or less irregular in shape 7
7. Basal pale spot not running parallel to suture but curving away from it towards margin. Harbor Island, Bahamas .... *bahamensis* n. sp.
   Basal pale spot running parallel to suture, sometimes coalescing with apical spot. Puerto Rico *tabebuiae* Blake
8. Elytra pale with 2 dark triangular spots on each in the middle and a dark lateral stripe. Grenada *granulata* Jacoby
   Elytra black, yellow brown or reddish brown with streaks or lines 9

9. Elytra black with 6 red streaks ("litura"). Cuba
rubropustulata Suff.
Elytra reddish brown or yellowish brown with streaks 10

10. Elytra reddish brown with pale base and pale streaks down towards the middle and vestiges of other streaks in apical half. Puerto Rico . . . . *fictor* Weise
Elytra yellow brown with dark brown narrow vittae 11

11. Elytra with heavy black margin joining at middle with a median dark vitta, a sutural vitta and a subsutural vitta often uniting, neither of these median vittae entire. Puerto Rico . . . . *bryanti* n. sp.
Elytra with a narrow sutural and 3 short median vittae and also dark markings on the humeri and along the margin and near apex. Santo Domingo.
liturata Olivier

Key to South American Species

1. Elytra dark, without spots. Ecuador
lugubrina Boheman[3]
Elytra spotted 2

2. Elytra dark with pale spots 3
Elytra pale with darker spots 8

3. Elytra 10-spotted. Paraguay . . . . *10-maculata* Bryant
Elytra 4-spotted 4

4. Large (nearly 5 mm.), oblong, thorax with a median dark vitta, spur at apex of hind tibiae very short and broad. Brazil . . . . *fenestrata* Illiger
Smaller (2-4 mm.), thorax without a median vitta, spurs on the hind tibiae of the usual length 5

5. The pale basal spot on each elytron curved about from base near scutellum towards margin. Ecuador
4-notata Boheman

---

[3] Probably dark form of *4-notata* Boheman.

The pale basal spot on each elytron not noticeably curved towards margin 6

6. Beetle elongate oval with elongate basal spot. Venezuela .... *pretiosa* Baly

Beetles more oval, less elongate 7

7. About 2.5 mm. in length, elytral basal spot oblong. Amazon, Brazil .... *ornata* Baly

About 3.5 mm. in length, elytral basal spot elliptical and extending obliquely towards margin. Trinidad .... *trinitatis* Bryant

8. Elytra pale orange yellow, 4 dark spots, the suture and apex dark, lateral margin pale. Brazil *vandepolli* Duvivier

Elytra pale with 4 dark spots or vittae, lateral margin more or less darkened 9

9. Each elytron with an angular spot in the middle, sometimes one at middle of the base, the suture pale. Grenada .... *granulata* Jacoby

Suture dark in part or entirely dark 10

10. A large median dark spot common to both elytra, otherwise suture pale. South America .... *taurops* n. sp.

Suture dark from base to apex 11

11. Body beneath, femora and tibiae in part dark. Bolivia .... *melanoloma* n. sp.

Body beneath, femora and legs pale yellow brown. Argentina .... *argentinensis* n. sp.

Megistops bryanti n. sp.

(Plate 1, figure 8)

About 3.5 mm. in length, smooth, oval, faintly shining, pale yellow brown, the elytra with dark brown sutural and lateral margins, covering humeri and wider at apex, and a long but not entire subsutural vitta often connecting with the sutural vitta, and a shorter median vitta connecting with the lateral marginal one below middle; breast and often middle of prosternum deeper brown.

Head pale yellow brown with dark mouthparts, eyes almost meeting on occiput. Antennae brownish, the three basal joints paler beneath. Prothorax not quite twice so broad as long, narrowed anteriorly and with thickened apical angles; pale yellow, in some specimens, with faint traces of five spots, faintly and shallowly punctate. Elytra rather flat, feebly shining and finely alutaceous with obsolete fine punctures; pale yellow brown with deeper brown markings in the shape of a sutural vitta often uniting with a shorter subsutural one, and also with the wide irregular lateral-marginal one before the apex, another even shorter median vitta uniting a little below the middle with the lateral marginal darkening. Body beneath often deeper brown except the pale abdomen and legs; in dark specimens apical half of hind femora deep brown. Length 3—3.7 mm.; width 1.5—1.8 mm.

Type data.—Holotype male and 28 paratypes (U.S.N.M. Cat. No. 60,930), 2 paratypes in M.C.Z. (No. 28,691), all collected by R. G. Oakley on *Tabebuia* sp. June 25, 1934, at Guanica, Puerto Rico.

Other material.—In U.S.N.M. collected by R. G. Oakley on *Tabebuia* sp. Oct. 4, 1933, and on *Scirpus validus* Sept. 29, 1933, both at Ponce, and on *Clusia rosea* by Martorell April 2, 1940, near Rio Piedras; in M.C.Z. one specimen collected by C. M. Matos at Guanica in the Stuart T. Danforth collection.

Remarks.—At first the beetles would seem to be a more heavily marked race of *M. liturata* Oliv., a species occurring in Hispaniola, but dissection reveals an entirely differently shaped aedeagus. *M. liturata* also appears to be a little broader with more granular surface. *M. tabebuiae* from Puerto Rico also feeds on *Tabebuia* but the two beetles are not at all alike either in their external appearance or in their aedeagi, *M. tabebuiae* usually being dark reddish brown to piceous, sometimes with four pale elytral spots or, in pale specimens, with the spots coalescing. The species is dedicated to G. E. Bryant of the British Museum, who has done much work on the genus.

Megistops bahamensis n. sp.

(Plate 1, figure 6)

About 3.5 mm. in length, oval, feebly shining, alutaceous and finely punctate, deep reddish brown with pale yellow prothorax and the elytra with four large pale yellow spots somewhat irregular in shape, the two basal ones being longer than the apical ones.

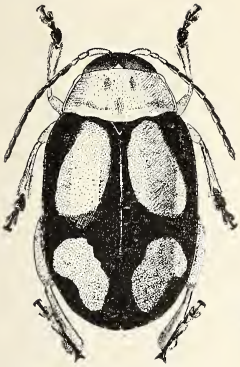
Head yellow brown with darker mouthparts, eyes only slightly separated on the occiput. Antennae reddish brown, the basal joints yellowish below. Prothorax twice as wide as long, narrowed anteriorly with thickened apical angles; surface alutaceous and thickly and finely punctate, in some specimens traces of five indistinct spots. Elytra deep chocolate brown to piceous with four pale yellow spots, the basal one on each elytron being larger and curving irregularly towards the lateral margin, the apical one smaller and usually more rounded. Body beneath usually with the middle of the prosternum and breast and apical half of hind femora deeper brown. Length 3.4-3.7 mm.; width 1.9 mm.

Type data.—Holotype male (U.S.N.M. Cat. No. 60,931) and 6 paratypes, 3 paratypes in M.C.Z. (Type No. 28,690), all collected on Harbor Island, Bahamas, July 8 by H. F. Wickham.

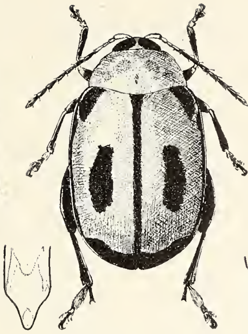
Remarks.—The only West Indian species likely to be confused with this is one of the color forms of *M. tabebuiae* Blake, in which one specimen with deep brown elytra has very faint traces of four small spots and another specimen has the spots so large as to coalesce leaving only the suture and margin dark. These two species have rather similarly shaped but clearly different aedeagi, that of the Bahaman species having a wider, more rounded tip.

EXPLANATION OF PLATE 1

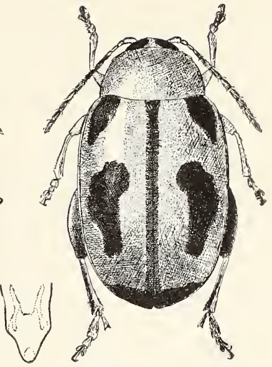
Fig. 1. *Megistops costaricensis* n. sp. Fig. 2. *Megistops melanoloma* n. sp. Fig. 3. *Megistops vandepolli* Duv. Fig. 4. *Megistops argentinensis* n. sp. Fig. 5. *Megistops taurops* n. sp. Fig. 6. *Megistops bahamensis* n. sp. Fig. 7. *Megistops liturata* (Oliv.) Fig. 8. *Megistops bryanti* n. sp.



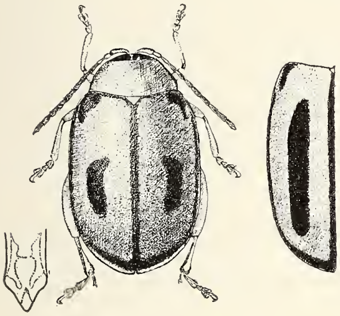
1. Megistops costaricensis



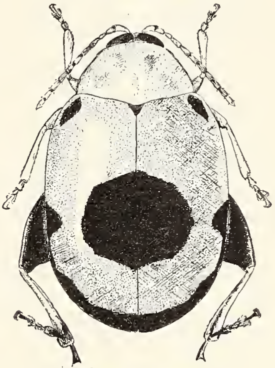
2. Megistops melanoloma



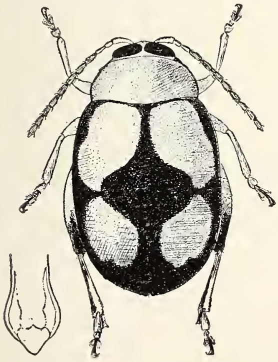
3. Megistops vandepolli Duv.



4. Megistops argentinensis vittate form

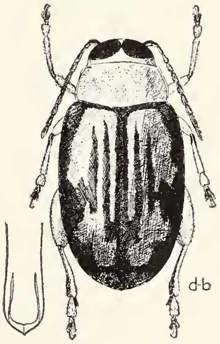


5. Megistops taurops



6. Megistops bahamensis

7. Megistops liturata (Oliv.)



8. Megistops bryanti

BLAKE — MEGISTOPS

Megistops melanoloma n. sp.

(Plate 1, figure 2)

Between 3 and 3.5 mm. in length, oval, feebly shining, head, undersurface, femora and part of tibiae dark, prothorax pale orange yellow, elytra also pale with a black sutural and lateral marginal vitta, a black spot on humerus and a large median spot common to both elytra.

Head with the eyes very little separated on the occiput, deep brown, very finely and densely punctate. Antennae dark brown with the three basal joints pale yellow. Prothorax at base twice as wide as long, very finely and densely punctate, pale orange, in one specimen with five faint spots. Elytra pale orange, finely and faintly punctate, with black markings on humeri, black sutural vitta, and black lateral marginal vitta widening at apex and joined with sutural dark vitta; in the middle of each elytron an elongate black spot in the form of a short vitta. Body beneath and femora black with deep brown coxae and tibiae streaked with black, tarsal joints deep brown. Length 3.2-3.4 mm.; width 2 mm.

Type data.—Holotype male (U.S.N.M. Cat. No. 60,933), collected in May by G. L. Harrington, at Encuentro, Dept. La Paz, Bolivia.

Other material.—One other specimen also collected by G. L. Harrington, at Calisaya, Rio Bopi, Bolivia.

Remarks.—This species is closely related to *M. vandepolli* Duv. described from Santarem, on the Amazon River, and may be only a race of that species. But because of the wide difference in locality coupled with the slight differences in structure, such as the more closely placed eyes and the more narrowed tip to the aedeagus, as well as the darker coloring of the legs and elytra, I believe this is distinct.

Megistops argentinensis n. sp.

(Plate 1, figure 4)

From 2.5-3.5 mm. in length, oval, feebly shining, yellow brown with deeper brown markings on the elytra, a sutural vitta uniting broadly near the apex with a narrow lateral marginal vitta, a humeral dark spot and an elongate spot in the middle of each elytron sometimes becoming a vitta that does not extend to the base.

Head pale with deeper brown mouthparts, finely punctate, eyes nearly meeting on the occiput. Antennae pale brownish with the three basal joints yellowish. Prothorax twice as broad as long at base with thickened apical angles, finely and densely punctate, sometimes very faintly 5-spotted. Elytra a little more shining, distinctly and rather densely punctate, pale with deeper brown markings in the form of a sutural vitta uniting broadly at apex with a lateral marginal vitta, also a spot on humerus and a median elongate spot, sometimes becoming a short median vitta. Body beneath yellowish or reddish brown with paler tibiae and tarsi. Length 2.6-3.5 mm.; width 1.7-2 mm.

Type data.—Holotype male (U.S.N.M. Cat. No. 60,932), and four paratypes from Tucuman, Argentina, collected Oct. 11, 1925 by G. F. Moznette.

Other material.—In the U.S.N.M.: Argentina: 4 specimens from Santiago del Estero, collected April 13, 1940 by H. L. Parker, 6 specimens from Betania de Salta collected in a citrus grove May 13, 1927 by M. Kisliuk. In M.C.Z. in Bowditch collection: 1 specimen from Tucuman Prov. collected by C. Bruch, 1 from Jujuy, 2 from Catamarca Prov., C. Bruch, all these from Argentina. One specimen in collection F. Monros collected at Tarija on Rio Bermejo, Bolivia, Oct. 20, 1948 by A. Marlinez.

Remarks.—This is another species closely related to *M. vandepolli* Duv., but distinguished by the dark lateral vitta and the slightly differently shaped aedeagus. It is a paler species also, being yellow brown and not orange brown, and has brownish dark markings instead of black. As in the case of *M. melanoloma,* the median elytral spot is more elongate and less triangular, and in some specimens in a series from the same locality the median spot is lengthened to a vitta, which, however, does not extend to the base. So far specimens have been seen only from the northwestern part of Argentina and from Bolivia.

Megistops taurops n. sp.

(Plate 1, figure 5)

About 4 mm. in length, broadly oval, faintly shining, pale orange yellow above with deep brown to piceous head, undersurface and hind legs; anterior legs with basal half of femora dark; scutellum dark, elytra with a large dark median spot common to both elytra, a spot on the humerus and dark apex with the margin from apex to middle dark.

Head dark, eyes (in female) well separated on the occiput. Antennae with the first four joints pale, rest piceous, second joint fully as long as third, fourth twice as long. Prothorax approximately twice as wide as long at base, narrowed anteriorly and with thickened apical angles; surface not very shiny, granular, pale orange yellow with traces of five spots. Scutellum dark. Elytra granular with the surface sculpture a little smoother than the prothorax and very finely and substriately punctate; pale orange yellow with a piceous spot on the humerus and a large spot common to both elytra slightly below the middle, the apex broadly dark with the margin from the apex to the middle dark and widened into a lobe at the middle. Body beneath with the middle of the prothorax, breast and abdomen dark brown to piceous, hind legs also dark, anterior pairs of legs with the basal half of femora dark but rest paler, tarsi brown. Length 4 mm.; width 2.5 mm.

Type data.—Holotype female M.C.Z. Type No. 28,689. No locality label on the specimen but probably from South America.

Remarks.—Although no locality label is on the single female specimen, it is safe to say that this was collected in South America and probably in Brazil or southward. The specimen, which is included in Jacoby's second collection, now in the Bowditch collection, bears a label "Burchell collection". Burchell is known to have collected in South America. The markings on the humerus and apex resemble those of *M. vandepolli* Duv., but the large size and striking large spot on the middle of the elytra make it quite different in appearance. Possibly it is a color form of a four-spotted species. It is larger than any four-spotted species except *M. fenestrata* Illiger, which, unlike it, has a median vitta on the prothorax.

Megistops costaricensis n. sp.

(Plate 1, figure 1)

About 3.5 mm. in length, oval, moderately shiny, finely and densely punctate, pale yellow brown with deeper reddish brown mouthparts, dark outer joints to the antennae, pale brown undersurface and legs, and the elytra deep brown with four pale spots, the basal ones being more elongate and larger.

Head with eyes contiguous, a slightly produced carina extending from lower front with a few scattered punctures on it; mouthparts deeper in color. Antennae with the three basal joints paler than the distal ones, joints 2 and 3 about equal. Prothorax approximately twice as wide as long at base, narrowed apically, pale yellow with five indistinct spots, finely and densely punctate (granular), smoothly rounded but not very convex, and without depressions, basal margin sinuate. Scutellum small, deep brown. Elytra deep brown, almost piceous, each with an elongate pale basal spot curving outwards towards margin and larger than the apical spot, which curves irregularly from the margin to the suture; surface moderately shiny, granular. Body beneath deeper reddish brown, shining. Length 3.7 mm.; width 2 mm.

Type data.—Holotype, female and one paratype, female, U.S.N.M. Cat. No. 61,195. Taken on *Lippia berlandieri* Schauer, at San Pedro de Montes de Ora, Costa Rica, July 12, 1935, by Sofia Ballou.

Remarks.—This is the first species of *Megistops* to be taken on the North American continent, the species hitherto being known only from the West Indies and South America. The markings are similar to many other species, notably *M. pretiosus* Baly, from Venezuela, and *M. trinitatis* Bryant from Trinidad. *M. pretiosus* is described as having the thorax three times as broad as long, and Bryant describes *M. trinitatis* as being broader than *M. pretiosus*, so *M. costaricensis* is a more slender beetle than either of them.

INTERESTING NORTHERN RECORDS FOR EASTERN HYMENOPTERA (FORMICIDAE AND EMBOLEMIDAE). — On May 3, 1952, a mild, sunny day, Dr. W. L. Nutting, Dr. F. G. Werner and myself spent an afternoon collecting on Horn Pond Hill, near Winchester and Woburn, Massachusetts. This glaciated hill, low and largely denuded of its forest cover, bears many stones loosely set in the soil and providing excellent ant collecting. Under a large stone covering a nest of *Formica fusca* L., Werner discovered foraging workers of *Smithistruma* (*Wessonistruma*) *pergandei* (Emery); the nest of this ant was found under an adjoining rock. We secured most (perhaps 90%) of the population, which seemed unusually large for a dacetine nest, and a count yielded a total of 648 workers and 3 females (deälate queens). This is the largest population recorded for the nest of any dacetine species, and is more than twice the usual maximums recorded previously for this and other species. Previous northern records for *S. pergandei* are from nearby Boston and Cambridge, only a few miles farther south.

Beneath the rock covering the *S. pergandei* nest, but to one side, were found three workers of *Proceratium silaceum* Roger, of which the northeastern limit has been considered to rest in southern New York.

Under another rock overturned by Werner was found a female of the curious embolemid wasp, *Embolemus nearcticus* (Brues), previously known from Massachusetts (Stony Brook Reservation) and New York. This specimen is very similar to the types in the Museum of Comparative Zoology, but is darker and more brownish in color. It was found crawling on the under side of the rock. It is interesting to note that all the records for this insect are dated in May. The host is unknown. — W. L. BROWN, JR., Museum of Comparative Zoology, Harvard University.

THE FEMALE OF *FORMICA OPACIVENTRIS* EMERY (FORMICIDAE)

By Robert E. Gregg
Department of Biology, University of Colorado

The forms of *Formica exsecta* constitute a small, well defined group of ants easily recognized by the excavated, or broadly emarginate, occipital border of the head. Only three of the North American variants are now considered valid (Creighton, 1950, for synonymy). All the castes of *Formica exsectoides* and *F. ulkei* have been described previously, but the worker and male alone were the castes hitherto known for *F. opaciventris*, the female having escaped collection. I am now able, however, to fill this gap by presentation of the description of the *opaciventris* queen.

Dr. Creighton cites the mountains of Colorado and Wyoming as the range of this species, and states that it appears to be confined to high intermountain valleys, and does not occur on the eastern slope of the Rockies. The nests he observed were built in hard, stony soil, and consequently differed much from the nests of the eastern *exsectoides* and *ulkei* which are usually in moist, spongy earth.

Near the village of Valmont, Colorado, five miles east of Boulder, is an assemblage of mound nests of *Formica* readily visible from the road. The nests are in a low, moist meadow at approximately 5160 feet, and partly arranged with reference to the water table in that most of them are present on slightly higher ground and fewer are in the swales where alkali accumulates from the evaporation of water.

These mounds are occupied largely by *Formica altipetens*, but some are constructed by *opaciventris*. With Dr. Creighton, I visited the area on November 29, 1950, and by careful excavation of one of the nests, we discovered the single deälated female of *Formica opaciventris*. This was much better luck than we had any right to expect, especially in view of the fact that it was the first nest completely dug into, and also that no other queens were taken from the colony. Though we tried other nests, no further specimens of females of this species were obtained, and no winged forms, male or female, were found either. The queen was brought to the laboratory and kept in an observation nest for four months (until April 2, 1951), after which she was preserved. During the period, a few eggs were laid but only three workers were reared to maturity, and these were all much smaller than the workers from the original colony which were brought with the queen and kept with her in the artificial nest. No positive information was gleaned regarding the species of ant which serves as host for the incipient colonies of *opaciventris,* but it seems probable that *altipetens* may function in this capacity, owing to the fact that so many nests of the latter were present in the pasture where the *opaciventris* colonies were found. We did not turn up any incipient nests of the parasitic species, nor did we find any mixed colonies of the two ants, though we searched for them. It has never been established that *opaciventris* is truly a temporary social parasite, and its host is still unknown; however, it has been shown that *exsectoides* and *ulkei* both utilize *F. fusca,* so it will be no surprise if *opaciventris* is found eventually to use *fusca* or some related species. The well developed trichomes, or brushes of short hairs, on the mesonotum of the queen are strong evidence in favor of such a prediction.

Formica opaciventris Emery

Female: — Length 10.5 mm.; head index 0.96.

Head subquadrate, almost as wide as long; sides straight but distinctly converging anteriorly; greatest width occurs just behind the eyes; occipital border broadly and definitely excised. Clypeus entire, with only a slight point at the middle of the anterior margin, and an indistinct carina. Frontal area well defined and triangular. Antennal scapes slender though gradually increasing in thickness toward the tips, and surpassing the occipital angles by a distance equal to about ⅓ of their lengths. Eyes of the usual shape (oval), rather flat, and situated posterior to the middle of the head. Mandibles triangular, with 5 to 6 more or less distinct teeth, and no denticles along the basal border. Frontal carinae short (about twice as long as the diameter of the antennal fossae), straight, and strongly divergent. Ocelli distinct.

Thorax somewhat narrower than the head, dorsum almost flat in profile. Scutum broadly egg-shaped with prominent parapsidal furrows; scutellar sclerites well developed laterally, obsolete medially; postscutellum trapezoidal, moderately elevated above the metanotum. Epinotum rounded dorsally and laterally; basal face short and the declivity long and sloping, with the angle between them indistinct, indicated only by the greatest convexity of the epinotal profile. Petiolar scale extremely broad with straight sides, giving it a decidedly quadrate appearance, especially when viewed from the front; slightly convex anteriorly and flat posteriorly; superior border sharp, faintly emarginate in the middle, and expanded into small spatulate lobes at the upper corners of the scale. Spiracular openings on the petiole form prominent denticles on the sides near the base of the scale. Wings are absent on the specimen, but ragged fragments of the bases of both anterior wings and the left posterior wing present. Abdomen oval and of the usual formicine shape.

Head opaque, except the frontal area and corners of the clypeus which are somewhat smooth and shining. Mandibles striated but otherwise shining. Thorax subopaque, rather faintly shining on the mesonotum and near the sutures. Petiole and gaster subopaque, the surfaces less heavily shagreened so that their shiny appearance is not completely obscured.

Erect hairs present on the frons, clypeus, vertex, mandibles, top of pro-, meso-, and metanotum, posterior face and peduncle of the petiole, anterior margin of gaster, venter, dorsum of last three gastric segments, coxae, and a very few on the femora. Tibiae with graduated bristles on the flexor surfaces. The scutellum has on each side a trichome of short, curved, golden hairs distinct from the other more scattered hairs on the thorax. Hairs absent on the gula, occiput, antennal scapes, thoracic pleurae, and most of the dorsum of the first two gastric segments. All hairs are golden yellow, coarse, irregular in length, and blunt but not spatulate. A few, short scattered hairs occur on the eyes. Pubescence dilute.

Color of head, most of thorax, petiole, base of gaster, and the legs ferruginous red, mandibles darker red. Ocellar triangle, postscutellum, and metanotum deeply infuscated. Gaster infuscated except at base, becoming dark brown to black toward the tip. Wings, as far as can be seen from the broken basal pieces, straw-colored.

Gynetype: one deälated female (Queen of a mature colony). Collection of R. E. Gregg.

Direct comparison with eleven females of *F. ulkei* in the collection of the author (three of which retain wings), showed that this species may be distinguished from the queen of *opaciventris* by a slightly more quadrate head (head index of 1.0), the postscutellum faintly more concave in profile, the scale of the petiole more convex along its superior border and tapering to a narrower base where it attaches to the peduncle, hairs very much longer, more abundant and curly on the thorax and petiole, and sculpture weak, leaving the head, thorax, and abdomen very shining. In color, *ulkei* shows the posterior one-half to two-thirds of the head very dark brown to black, with the anterior portion yellowish red, the promesonotal suture darkened, longitudinal stripes of infuscation on the scutum, mesopleurae and a spot on the propleurae dark brown, infuscation of the postscutellum confined to the posterior margin, and the gaster concolorous without a basal patch of red.

Two winged females of *exsectoides* also available for study made possible the following comparisons. The female of *opaciventris* differs from that of *exsectoides* in having distinctly more dilute gastric pubescence, long hairs on the anterior margin of the first segment of the gaster and on the petiolar scale, shorter but much more numerous hairs on the thorax, and hairs on the lower angle of the pronotum and on all coxae. The distinct scutellar trichomes of *opaciventris* are lacking on my specimens of *exsectoides*, but this cannot be assumed to be the result of rubbing and old age, for the youth of these females is attested by their retention of wings. Wheeler (1913) alludes to small tufts of flexuous hairs on the mesonotum in his description of the queen of *exsectoides* but does not definitely state that they are trichomes. He also states that the color is like that of the worker, being deep red, with the gaster black and the mandibles, legs, vertex, funiculi, and dorsal portions of the thorax sometimes brownish or dark red. One of my specimens of *exsectoides* has no infuscation of the head or thorax except on the vertex, while the other female is heavily infuscated on all parts. Any minor color differences, therefore, which exist between *exsectoides* and *opaciventris* probably should be regarded as inconsequential. Finally, the scale on the petiole of *opaciventris* has spatulate corners, but there is no such trait in *exsectoides* typicus.

A worker and a female of the ant *exsectoides* var. *davisi* Wheeler (1913), labeled "cotype", have also been examined, and I am in agreement with Creighton that this form is a synonym of the eastern *exsectoides*. The only detectable differences between these insects are that the *davisi* female has somewhat shorter hairs and is practically devoid of gastric pubescence.

Wheeler further described the variation *hesperia* from diminutive workers, and Creighton has recently invalidated it too. A cotype worker of this ant (in the Creighton collection), checked against specimens of *exsectoides* which I have from Illinois and New York, showed the ant to be almost identical with the small workers of the typical species, particularly with respect to color, hair pattern, and shape and size of the petiolar scale. The scale is not like that of *F. dakotensis*, as contended by Wheeler, but has rather a sharp, elevated, and evenly curved superior border. Dr. Creighton (1950, p. 514), seems to be quite justified in submerging *hesperia* as a synonym of *exsectoides*. The sole difference I could find between the two is an insignificantly broader head with slightly shallower occipital emargination, but this is the sort of variation one would expect to find even in a nest series of *exsectoides*. It must be remembered that the types of the supposed *hesperia* came from Colorado Springs.

To return to the species of greatest concern in this paper, Creighton believes that *opaciventris* should stand as a well defined form and not as a subspecies of *exsectoides* where it was placed by Wheeler in 1913. Emery had originally described it as a variety of the same in 1893. Creighton's treatment may be the wiser, but from the descriptions of differences among the females as noted above, and the workers which also differ only in the greater pilosity of *opaciventris*, it may be necessary to return to Wheeler's proposal. The differences enumerated, at best, seem to be rather slight, hence it would appear possible to consider the two ants as very closely related with *opaciventris* a subspecies of *exsectoides*. Moreover, the ranges of these insects, though heretofore regarded as far apart, actually overlap, but the degree of overlap is at present very uncertain. Creighton gives Nova Scotia to Georgia and west to Wisconsin and Iowa as the territory of *exsectoides*, while *opaciventris* is a Rocky Mountain form. Specimens of both of these species are present in my collections from the vicinity of Boulder, Colorado, the former from foothills at about 7500 feet, and the latter from the plains at slightly over 5000 feet. Thus we have to revise westward our conception of the range of *exsectoides*, and the range of *opaciventris* is now known to extend to lower altitudes and perhaps eastward on the plains. It may be found, when more material is gathered, that the two forms intergrade, and if so they will have to be classed as subspecies.

Formica ulkei should stand alone as a distinct species. The ranges of *ulkei* and *exsectoides* are known to overlap in northern Illinois and Indiana, southern Wisconsin, and Iowa, but the ants remain morphologically distinct even though the nests of each are practically identical in appearance. I have specimens of *ulkei* and *exsectoides* collected within a few hundred feet of each other at Palos Park, Illinois, and there is not the faintest indication of intergradation. In the case of these two species, then, we have nothing to show that one could be a subspecies of the other. *F. ulkei* is a boreal form whose main range is in the northern tier of states and southern Canada.

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CORRECTION TO THE SYNONYMY OF THE ANT CAMPONOTUS FORMOSENSIS WHEELER.—In a joint paper (Yasumatsu and Brown, 1951, Jour. Fac. Agr., Univ. Kyushu, 10, cf. p. 42), the synonymy of *Camponotus formosensis* is cited incorrectly. Due to an unfortunate clerical error, the name *Camponotus maculatus taylori* var. *formosae* Wheeler and the variant nomenclatorial equivalents *C. barbatus albosparsa* var. *formosae*, Emery and *C. barbatus taylori* var. *formosae*, Teranishi were wrongly included in this formal list of synonyms and must now be removed. The variety *formosae*, whatever may be its relationship to *maculatus* or *barbatus*, is of course not at all closely related to *C. formosensis* or any other member of the *C. herculeanus* group.—W. L. BROWN, JR., Museum of Comparative Zoology, Harvard University.

A NEW GENUS AND SPECIES OF ISOTOMIDAE (COLLEMBOLA)[1]

By Peter F. Bellinger
Osborn Zoological Laboratory, Yale University

In the course of an investigation of the soil fauna of some localities in Connecticut[2], a number of species of Collembola were found which do not appear to have been described. One of these is the subject of the present paper. Others will be dealt with in future contributions, as sufficient material becomes available.

Micrisotoma, gen. nov.

Vestiture generally of short simple setae; a few curved, strongly serrate setae on all body segments, and some long simple setae on the last tergite. Fourth antennal segment with blunt, cylindrical sensory hairs dorsally. Postantennal organ broadly oval, with a thick border divided into equal arcs by four fine partitions. Eyes absent. Unguis and empodial appendage untoothed. Tibiotarsus with a distal subsegment defined by an indistinct suture. Tenent hairs absent. Fifth and sixth abdominal segments ankylosed. Manubrium with two pairs of setae ventrally. Dentes dorsally crenulate. Mucro bidentate. Pigment absent.

Generotype: *M. achromata,* sp. nov.

Micrisotoma achromata, sp. nov.

(Plate 2)

Numerous short, simple, curved setae on the head, tergites, and appendages. Outstanding, curved, serrate setae

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

[2] Carried out with financial assistance from the Connecticut Agricultural Experiment Station.

are distributed as follows: one on each side of each thoracic tergite; one on the base of the prothoracic leg; two to five on the bases of the mesothoracic and metathoracic legs; two or more pairs on each abdominal tergite, becoming more numerous posteriorly. These setae (fig. 6) bear a small number of strong, well spaced teeth.

The characteristic vestiture of the fused fifth and sixth abdominal segments is as follows (fig. 8) : mixed simple and serrate setae in a line at the anterior border of the tergite, and at the sides posteriorly; dorsally, behind this line, a straight transverse row of eight long, straight, simple, blunt-tipped setae (fig. 7) ; behind this row five similar setae in a W-shaped line, two anterior and three posterior; along the posterior margin a straight row of five long, straight, simple, sharp-pointed setae. Among the first two rows are scattered a number of very fine hairs; two additional fine hairs, of which the anterior is minute, are just inside and in front of each of the two lateral blunt setae of the third row. On each side of the tergite, in the first row, is a short, broad sensory hair.

Antenna slightly longer than head; relative length of segments (expanded) 2:3:3:6. Fourth segment (fig. 1) enlarged, oval, ending in a blunt cone; dorsally with a number of blunt, cylindrical sensory hairs. Sense organ of third antennal segment with two short, curved rods directed anteromediad, and two adjacent guard hairs, the ventral one straight, the dorsal curved and somewhat posterior to the rods.

Postantennal organ (figs. 2, 3) longer than the greatest width of the second antennal segment (about 5:4), broadly oval with a border about ⅓ of its greatest diameter in width; this border is interrupted at each end, and midway on each side, by fine partitions. Eyes absent.

Unguis (fig. 4) moderate in length, curved, untoothed. Empodial appendage three-winged, more or less triangular with acuminate apex; about ½ length of unguis. Tenent hairs absent. Tibiotarsus with an incomplete distal subsegment; the suture is evident only ventrally.

Ventral tube with about eight ventral setae. Rami of tenaculum quadridentate; corpus with one seta.

Manubrium ventrally with two pairs of strong setae near the distal margin. Dens twice length of manubrium; dorsally crenulate in the middle third only, with about 16 folds; bearing a few fine setae dorsally and many ventrally. Mucro (fig. 5) bidentate, the apical tooth much the larger and strongly curved; a medial lamella runs to the tip of the proximal tooth.

Fifth and sixth abdominal segments wholly ankylosed. Female genital opening a transverse slit, with anterior and posterior lips each bearing a pair of setae. Male genital opening not seen.

Pigment wholly absent, except for the amber-colored mouth parts.

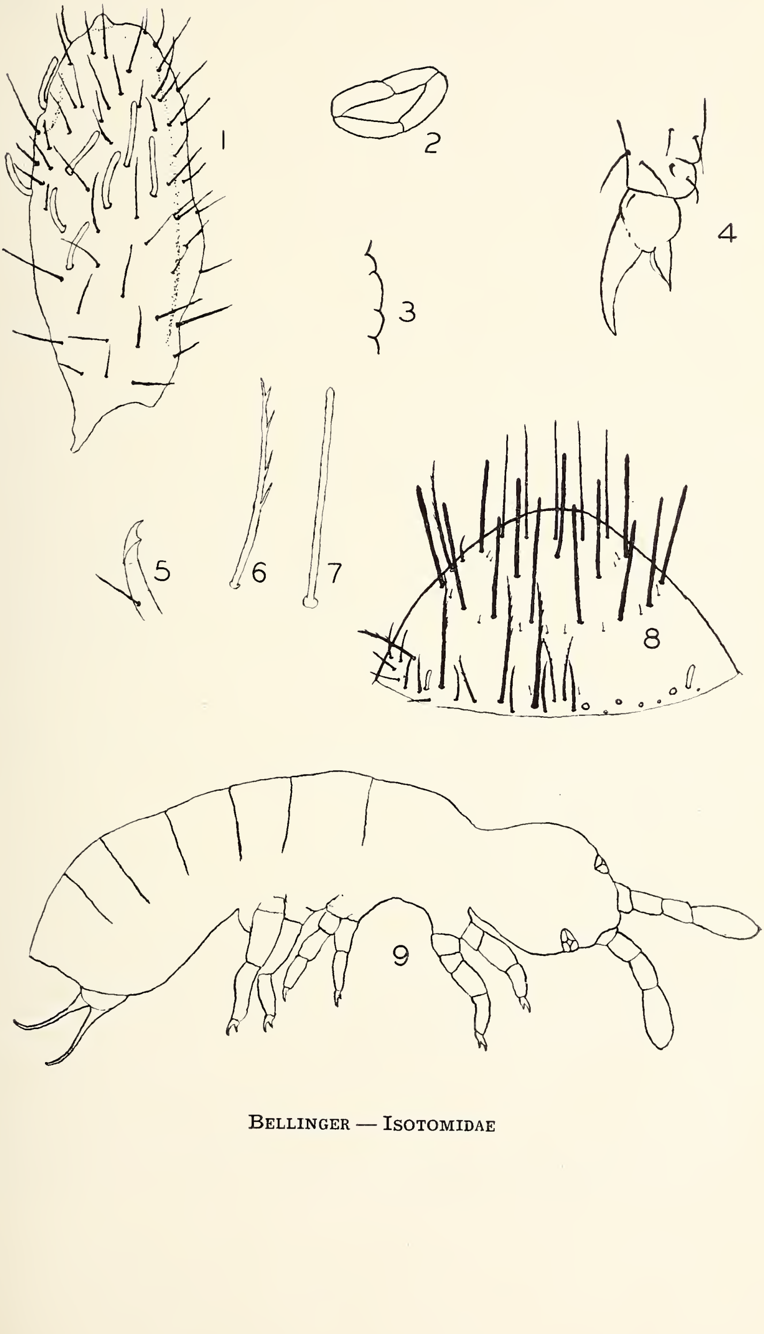
Length of holotype 0.65 mm. Range (12 specimens) 0.4 to 0.75 mm. The relative proportions of the segments may be judged from fig. 9; unfortunately specimens tend to be somewhat distorted in mounting, and the normal proportions cannot be determined.

The number of sensory hairs on the fourth antennal segment varies from eight to eleven. The number of serrate setae varies somewhat also, but these are easily detached and part of the variation may be apparent only. In one specimen one ramus of the tenaculum is quinquedentate.

Holotype: "Cathedral Pines", Cornwall, Litchfield Co.,

EXPLANATION OF PLATE 2

Micrisotoma achromata. Magnifications approximate. Fig. 1. Dorsal view of left fourth antennal segment, holotype (700 X). Fig. 2. Right postantennal organ, partype (700 X). Fig. 3. Right postantennal organ. paratype, transverse optical section (700 X). Fig. 4. Left hind claw and distal part of tibiotarsus, holotype (700 X). Fig. 5. Left mucro and end of dens, paratype (700 X). Fig. 6. Serrate seta from second abdominal segment, holotype (700 X). Fig. 7. Blunt seta from sixth abdominal segment, holotype (700 X). Fig. 8. Fused fifth and sixth abdominal segments showing arrangement of setae; somewhat diagrammatic (350 X). Fig. 9. Holotype; outline, setae omitted. (120 X).



BELLINGER — ISOTOMIDAE

Connecticut; taken in humus in a mature white pine-hemlock stand, 19 December 1950.

Paratypes: same locality, October and December 1950; February, May, and August 1951. Eleven specimens.

Also taken once in humus under cedars in the outer zone of an acid bog, Bethany, New Haven Co., Connecticut.

The holotype will be deposited in the Museum of Comparative Zoology, Harvard University. One paratype will be sent to the California Academy of Sciences, San Francisco, Calif., and one to the United States National Museum, Washington, D. C. The remaining paratypes are in the author's collection.

Micrisotoma cannot be distinguished from other genera of Isotomidae by any single character. The form of the postantennal organ will distinguish it from other isotomids in the holarctic region, but *Isotomina interrupta* Schott, from Camercons, is said to have a similar organ (Stach 1947; the original description is not available to me), and some species of *Proisotoma* approach it in this respect (Folsom 1937, figs. 245, 246, and 273). The subsegmented tibiotarsus allies it to *Proisotoma* Börner, and the fused abdominal segments and absence of eyes to *Proisotomina* Salmon; from both genera it is distinguished by the presence of serrate setae. In vestiture and general appearance it resembles *Isotomiella* Bagnall, which, however, lacks a postantennal organ.

Micrisotoma achromata appears to be relatively uncommon in the two situations in which it has been found so far. It is possible that it is a marginal species in these areas, and that its environmental optimum is somewhat different. The species has not been seen alive; specimens in alcohol are indistinguishable from *Isotomiella minor* Schaffer, which is common in the same samples.

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MYSTRIUM IN AUSTRALIA (HYMENOPTERA: FORMICIDAE). On July 8, 1951, in the company of Mr. William Bateman, Forest Officer for the Northern Territory of Australia, I collected three workers of *Mystrium camillae* Emery at the Howard River, north of Howard Springs, Northern Territory. This locality, southeast of Darwin, bears vegetation of the type known as "tall open monsoon forest," made up of the co-dominant trees *Eucalyptus miniata* and *E. tetradonta,* with cycads and various tall grasses conspicuous in the understories. The ants were found beneath a dry log very close to a termite colony. They lay feigning death for at least thirty seconds before being put into alcohol.

The particular log from which the collection was made lay near, but not within, gallery forest of the type common along watercourses in the Darwin area. In such forest are found many species of Indomalayan trees growing close to the permanent moisture; these belong to such widespread genera as *Terminalia, Pandanus,* etc., and are intermingled with large specimens of the paperbark, *Melaleuca leucodendron.* (I am grateful to Mr. Bateman for the botanical information here greatly condensed.) This is the first time the genus *Mystrium* has been taken in the Australian region. *M. camillae* has been taken at several points in southeastern Asia, from Burma through the East Indies and the Philippines, and is the sole species found in this area. Several closely related species of the *M. mysticum* group occur on Madagascar.—WILLIAM L. BROWN, JR., Museum of Comparative Zoology, Harvard University.

NOTES ON SOME OF OSBORN'S MALLOPHAGA TYPES AND THE DESCRIPTION OF A NEW GENUS, *ROTUNDICEPS* (PHILOPTERIDAE)[1]

By Robert L. Edwards
Biological Laboratories, Brandeis University

There is a small series of Herbert Osborn's Mallophaga types, comprising nine species, in the Museum of Comparative Zoology. These were described as new in his 1896 paper, *Insects Affecting Domestic Animals.*[2] I should like to express my indebtedness to the late Mr. James E. Peters, Curator of Birds, Museum of Comparative Zoology, who permitted me on numerous occasions to examine bird skins for lice to help determine the validity of host designations, and to Dr. Joseph Bequaert, Curator of Insects, for the loan of the type material. Mr. Louis Lipovsky, Department of Entomology, University of Kansas, supplied me with additional material. Dr. K. C. Emerson has given me many valuable suggestions concerning the material. A grant-in-aid from the Society of the Sigma Xi made it possible for me to complete this study.

The Osborn types are mounted on roughly cut thick glass slides, and many of them have cover glasses of the same material. The insects are in relatively good condition, although only partially cleared, and are undoubtedly those referred to in the descriptions. The type catalog numbers are contained in parentheses with the initials (MCZ).

Penenirmus tyrannus (Osborn)

Nirmus tyrannus Osborn, 1896, p. 228.

One slide with two females in fairly good condition (MCZ 27341).

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

[2] 1896. U.S.D.A. Bull., No. 5 (N.S.).

Type host: *Tyrannus tyrannus* (Linn.), the Eastern Kingbird.

Philopterus fusco-ventralis (Osborn)

Docophorus fusco-ventralis Osborn, 1896, pp. 221-222.

Two slides containing seven adults and three immatures in good condition (MCZ 27342).

Type host: *Contopus virens* (Linn.), the Eastern Wood Pewee.

Philopterus osborni, nom. nov.

Docophorus corvi Osborn, 1896, pp. 220-221.

Three slides containing five adults and three immatures in good condition although uncleared. Since Clay and Hopkins[3] have designated *Philopterus corvi* as the correct name for *Pediculus corvi* Linn. from *Corvus c. corax* Linn., Osborn's name must fall as a homonym (MCZ 27344).

Type host: *Corvus brachyrhynchus* Brehm, the Crow.

Quadraceps boephilus (Kellogg)

Nirmus boephilus Kellogg, 1896, New Mallophaga I, pp. 107-109.

Nirmus parallelus Osborn, 1896, pp. 229-230.

Three females on one slide, in good condition (MCZ 27336).

Type host: *Charadrius vociferus* Linn., the Killdeer.

Picicola marginatulus (Harrison)

Nirmus marginatus Osborn, 1896, p. 228.

Degeeriella marginatulus Harrison 1916, Parasitology 9, p. 117. Nomen novum.

One slide with three adult females in good condition (MCZ 27339).

Type host: *Dryocopus pileatus* (Linn.), the Pileated Woodpecker.

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[3] 1950. The Early Literature on Mallophaga. Bull. Brit. Mus. (Nat. Hist.), Ent. Ser., 1(3): 231-233, figs. 6-9.

Picicola orpheus (Osborn)

Nirmus orpheus Osborn 1896, pp. 227-228.

One slide containing two males, both of which are apparently terminating their last instar or are very recently adult. Dr. K. C. Emerson believes that they are possibly members of the genus *Lagopoecus,* while I believe they are more closely related to *Picicola* (as does Miss T. Clay, personal communication). This species is particularly difficult to determine since Osborn's host reference, *Galeoscoptes carolinensis,* presently *Dumatella carolinensis* (Linn.) is apparently incorrect. The genitalia certainly show affinities with *Picicola.* This species must remain an enigma until additional material is obtained. (MCZ 27340).

Type host: Yet to be determined, probably a woodpecker.

Bruelia abruptus (Osborn)

Nirmus abruptus Osborn, 1896, p. 229.

One adult female and an immature in good condition (MCZ 27338).

Type host: Unknown. The reference to *Colinus virginianus* (Linn.) is almost certainly incorrect. The louse has, in all probability, a passeriform host.

Rotundiceps gen. nov.

(Plate 3)

The genus is described for Osborn's *Nirmus cordatus.* It is closely related to *Lunaceps,* and is another example of ecological adaptation, *Lunaceps* frequenting the wings and back of the host while *Rotundiceps* is usually found about the head.

Description: Head broadly rounded, slightly broader than long, only slightly buttressed marginally. Relatively strongly buttressed around the bases of the antennae and mandibular articulations. Signature only barely repre-

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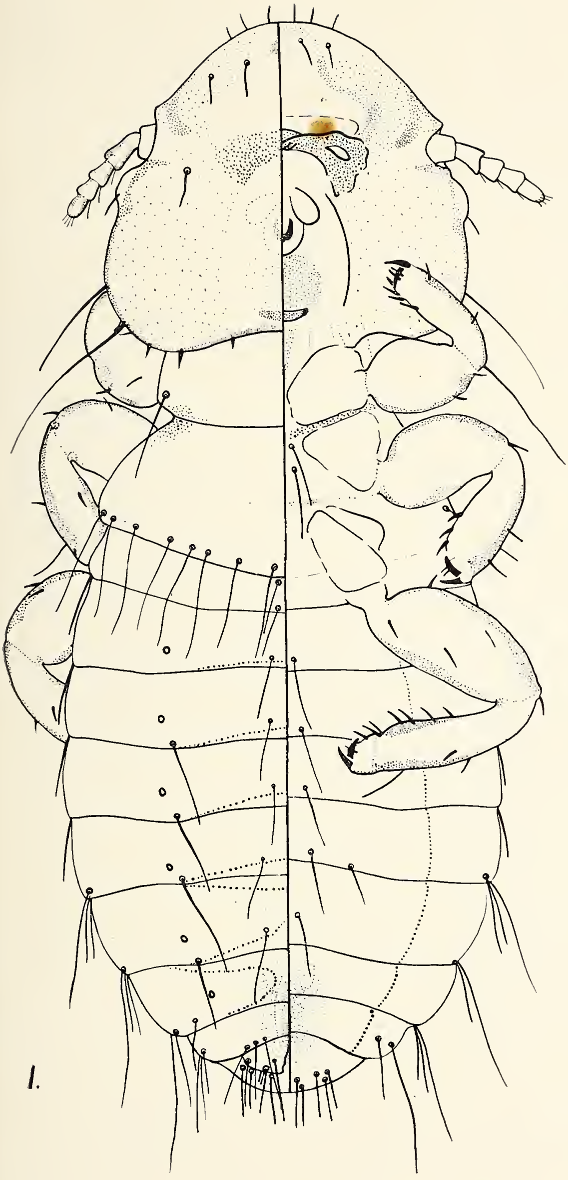
EXPLANATION OF PLATE 3

Fig. 1. Dorso-ventral view of male *Rotundiceps cordatus* Osborn. Fig. 2. Male genitalia.



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EDWARDS — MALLOPHAGA

sented by small irregular sclerotized area. Posterior margin of head armed with short, stout setae. Rounded, lightly sclerotized gular area. Posterior margin of pterothorax with complete although irregular row of long setae. Abdomen slightly longer than broad, lightly sclerotized without obvious delineation of tergites and sternites. Spiracles six, on morphological segments 3-8. Mid-dorsal and mid-ventral double rows of setae on proximal seven segments. All spiracles except first and last with long seta posterior to each on border of tergite. In male, the first six tergites narrowed medially, with seventh separated into two parts, the eighth complete. Male genital opening dorso-terminal.

Genotype: *Nirmus cordatus* Osborn.

Type host: *Limosa fedoa* (Linn.), the Marbled Godwit. Although Osborn lists *L. haemastica* as the host in his text, I have failed to find any specimens in many collections from this bird. Collections from *L. fedoa* however contain abundant specimens of this louse. The type slide (MCZ 27337) label lists the host as *Limosa hudsonica.*

Rhynonirmus infuscatus (Osborn)

Lipeurus infuscatus Osborn, 1896, pp. 234-235.

The type material consists of three slides as follows: No. 340 with an adult female *Lunaceps;* No. 314 with an adult female *Rhynonirmus;* and No. 334 with two adult males, *Rhynonirmus,* from *Bartramia longicauda* (Bechstein). The male specimen centrally located in slide No. 334 is hereby designated as the lectotype (MCZ 27343).

Type host: *Bartramia longicauda,* the Upland Plover. The louse has been taken commonly from his host. Contrarywise, I failed to locate it in several collections from *Philohela minor* (Gmelin).

LECTOTYPES OF HAGEN SPECIES BELONGING TO CERTAIN FAMILIES OF TRICHOPTERA[1]

By Herbert H. Ross
Illinois Natural History Survey, Urbana

During the course of study of the Hagen material belonging to the primitive families of Trichoptera it appeared desirable to designate lectotypes of those species represented by a type series. This material is in the collection of the Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts. Lectotype specimens have been so labelled. In addition to these, a few unique types have been recorded here for convenience.

The species treated belong primarily to the families Philopotamidae, Psychomyiidae, Hydropsychidae and Rhyacophilidae, plus one or two in other families. The species are listed alphabetically, first by the genus in which they were originally described, then by the species names given by Hagen. In certain genera such as *Macronema,* Hagen included species of great taxonomic diversity; for clarity all species described by Hagen in such genera are treated here.

In addition to the labels indicated the specimens noted bear also the Hagen Collection label. The English translation of the label is given.

Agapetus rudis Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:211.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11086.

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[1] This study was aided by a research grant from the John Simon Guggenheim Memorial Foundation and published with a grant from the Museum of Comparative Zoology at Harvard College.

Aphelocheira meridionalis Hagen

1864. Ann. Soc. Ent. France, ser. 4, 4:44. ♂.
Data in original description: Corsica (inferred from title).
Lectotype male: Corsica, B. Ch., M.C.Z. Type No. 11056.

Chimarrha auriceps Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:486.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11094.

Chimarrha circularis Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:210.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11095.

Chimarrha funesta Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:486.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11097.

This species belongs in the family Psychomyiidae and perhaps in the genus *Pseudoneureclipsis* Ulmer.

Chimarrha pulchra Hagen

1861. Synopsis Neur. N. Amer. :298.
Data in original description: Cuba (Poey, Osten Sacken).
Lectotype female: Cuba, March 1858, O. Sacken, M.C.Z. Type No. 11100.

Chimarrha sepulcralis Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:486.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11096.

Hydropsyche (?) *bivittata* Hagen

1861. Synopsis Neur. N. Amer. :291.
Data in original description: Panama.
Lectotype female: Panama, M.C.Z. Type No. 11019.

A member of the genus *Smicridea,* closely allied to *fasciatella* McL.

Hydropsyche maderensis Hagen

1865. Stettiner Ent. Ztg., 26:219.
Data in original description: Madeira.
Lectotype male: Madeira, 1852, M.C.Z. Type No. 22182.

Hydropsyche maligna Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:211.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11023.

Hydropsyche mitis Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:487.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11024.

This species belongs to the genus *Tinodes* (see under *Polycentropus* ? *rufus* below).

Hydropsyche papilionacea Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:211.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11022.

Hydropsyche taprobanes Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:487.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11021.

Hydroptila cursitans Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:209.
Data in original description: Rambodde, Ceylon, Nietner coll.; common.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11106. Made the genotype of *Plethus* Hagen.

Macronema aeneum Hagen

1861. Synopsis Neur. N. Amer.: 285.
Data in original description: Mexico (Sallé).
Type female: Sallé, V.C., M.C.Z. Type No. 10992. Probably a member of the genus *Notiomyia.*

Macronema annulicorne Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:485.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 10990. Placed in *Anisocentropus* by Ulmer.

Macronema ceylanicum Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:485.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11031. The type of the genus *Pseudoleptonema* Mosely.

Macronema chalybeum Hagen

1861. Synopsis Neur. N. Amer. :285.
Data in original description: Cuba (Poey).
Lectotype male: Cuba, 1864, Poey, M.C.Z. Type No. 10991. Now considered a member of the genus *Phylloicus* Müller.

Macronema nebulosum Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:485.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11030.

Macronema obliquum Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:485.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11033.

Macronema sepultum Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:209.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11032.

Macronema splendidum Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:484.
Data in original description: Rambodde, Ceylon, Nietner coll.
Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11029.

Macronema vitrinum Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:209.
Data in original description: a single male, Rambodde, Ceylon, Nietner coll.
Type male: Ceylon, Nietner, M.C.Z. Type No. 11025.

Notibodia lutea Hagen

1861. Synopsis Neur. N. Amer. :271.
Data in original description: St. Domingo.
Lectotype female: St. Domingo, Winthem, M.C.Z. Type No. 10940.

A member of the genus *Helicopsyche*.

Philopotamus flavidus Hagen

1864. Ann. Soc. Ent. France, ser. 4, 4:44.
Data in original description: Corsica.
Lectotype male: Corsica, B. Ch., M.C.Z. Type No. 11061.

Philopotamus siculus Hagen

1860. Stettiner Ent. Ztg., 21:278.

Data in original description: 2 females from Messina, end of March.

Lectotype female: Messina, May 30, 1844, M.C.Z. Type No. 11059.

Polycentropus nubigenus Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:211.

Data in original description: Rambodde, Ceylon, Nietner coll.

Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11034.

Polycentropus ? *rufus* Hagen

1859. Verh. K.K. zool.-bot. Ges. Wien, 9:211.

Data in original description: Rambodde, Ceylon, Nietner coll.

Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11035. This species is a synonym of *Tinodes mitis* (Hagen).

Rhyacophila castanea Hagen

1858. Verh. K.K. zool.-bot. Ges. Wien, 8:487.

Data in original description: Rambodde, Ceylon, Nietner coll.

Lectotype male: Ceylon, Nietner, M.C.Z. Type No. 11079.

Rhyacophila fasciata Hagen

1859. Stettiner Ent. Ztg., 20:153.

Data in original description: A single male from Elberfeld.

Type male: M.C.Z. Type No. 11067. Bears a label which says "57", but no other data.

Rhyacophila paupera Hagen

1859. Stettiner Ent. Ztg., 20:153.

Data in original description: Prussia, Schlesien, on the Rhein (?), Archangel.

Lectotype female: M.C.Z. Type 11066, and a label bearing a word which might be "Schlesien".

OBSERVATIONS ON THE DISTRIBUTION OF TABANIDAE IN THE CARIBBEAN AREA, WITH NEW RECORDS OF SPECIES FROM TRINIDAD, B.W.I. (DIPTERA)

By E. McC. Callan
Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa[1]

Since the appearance of Dr. J. C. Bequaert's papers on the Tabanidae of Trinidad (1940, Bull. ent. Res., 30: 447-453 and 1944, Psyche, 51: 12-21), three further species have been found in that island. This brings the total to 34 species now known from Trinidad, B.W.I.

Dr. Alan Stone and Dr. G. B. Fairchild have kindly examined material of these three species. I am much indebted to Dr. Stone for the determination of *Tabanus* (*Chlorotabanus*) *inanis* Fabricius. To Dr. Fairchild I am very grateful for the determination of *Stibasoma sulfurotaeniata* Kröber var. and *Fidena* sp. near *niveibarba* Kröber and his remarks in regard to them.

An important discussion of the tabanid fauna of the Caribbean islands has been published by Bequaert (1940, Revista Ent., 11: 253-369), and Fairchild (1942, Ann. ent. Soc. Amer., 35: 441-474) has presented a very interesting résumé of the Tabanidae of Panama. The table below gives the number of species of Tabanidae known from various West Indian islands and adjacent parts of the Caribbean region with their approximate area in square miles.

It is evident that Trinidad, for its size, has an exceptionally rich Tabanid fauna. Indeed, Trinidad has more species of Tabanidae than any other comparable area in the Caribbean region. Further, no really intensive collecting of Tabanidae has ever been done in the island, most species

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[1] Observations were made while the writer was on the staff of the Imperial College of Tropical Agriculture, Trinidad, B.W.I.

collected by the late Dr. R. C. Shannon, myself and others having been taken casually in the course of other work. It seems certain that additional tabanids will be discovered in Trinidad. As Dr. Fairchild (*in litt.*, 1951) aptly points out ". . . . a number of species are strict halophiles and should be searched for in mangrove swamps, salt marshes and along sea beaches . . . others have restricted habitats in mountain forest, some being quite strictly arboreal."

Country	Approximate Area in Square Miles	No. of Species of Tabanidae Recorded
Panama	33,800	106
Venezuela	346,480	88
Honduras	46,000	22
Cuba	44,000	12
Hispaniola	28,250	17
Puerto Rico	3,500	8
Jamaica	4,200	10
Trinidad	1,750	34
Antigua	108	1
Dominica	304	1
St. Vincent	130	1
Barbados	166	1
Martinique	380	0
Guadeloupe	619	0
St. Lucia	233	0
Grenada	120	0

In Venezuela a comparatively small amount of collecting has been done, and the 88 tabanids known from that country probably bear little relation to the number actually occurring there. In Panama, with an area approximately one tenth that of Venezuela, Fairchild (1942, Ann. ent. Soc. Amer., 35: 441-474; 1951, ibid., 44:441-462) has recorded 106 species from intensive collections largely confined to the central part of the Isthmus.

The Lesser Antilles are a group of small oceanic islands disposed in an arc between the north-eastern corner of Venezuela and the eastern extremity of Puerto Rico. Guadeloupe and Martinique, the largest islands of the archipelago, are some 619 and 380 square miles in area respectively, while some such as the Grenadines are mere islets and even rocks. Here a very interesting situation obtains in regard to the tabanid fauna. In Antigua, Dominica, St. Vincent and Barbados only a single species is known with certainty from each island (see Bequaert, 1940, Revista Ent., 11:253-369). In Martinique, Guadeloupe, St. Lucia and Grenada apparently no Tabanidae have ever been recorded.

Indubitably the Lesser Antilles have a markedly depauperate fauna, and Bequaert (*loc. cit.*) has suggested that the paucity of large mammals may well be the cause of the scarcity of Tabanidae. Nevertheless, it is a remarkable fact that the family appears to be completely unrepresented in several of the larger islands of the group. I have searched personally in both Grenada and St. Lucia without finding any Tabanidae. As most tabanids are haematophagous, I have also made inquiries in these islands in regard to large blood-feeding flies attacking man or livestock, but no descriptions of such flies could conceivably refer to Tabanidae.

The fauna of Trinidad and that of Grenada have quite different affinities, the former lying with the South American continent and the latter with the Antilles. This is strikingly borne out by the Tabanidae. Although Grenada is visible from the Northern Range of Trinidad on a clear day, the two islands being separated by a channel only some 90 miles wide, Trinidad has a comparatively rich Tabanid fauna comprising 34 species, all of which are also known from South America, while in Grenada the family is completely absent.

Additional Records of Tabanidae from Trinidad, B.W.I.

Tabanus (*Chlorotabanus*) *inanis* Fabricius

St. Augustine, male, 8 Jan. 1948 (D. S. Blake).

Fairchild (1940, Revista Ent., 11: 713-722) mentions that he has seen specimens from Paraguay to British Honduras and that it has also been recorded from Mexico. Dr.

Fairchild (*in litt.*, 1951) informs me that ". . . . this species is very widespread in the neotropical region, is quite crepuscular or even nocturnal, being not rarely taken at light, and is often quite a pest of livestock."

Stibasoma sulfurotaeniata Kröber var.

St. Augustine, female, 12 Dec. 1948 (D. G. Austin).

The typical form was described from Para, Brazil and, as Dr. Fairchild (*in litt.*, 1951) points out, the Trinidad variety lacks complete yellow bands on the third and fourth tergites, although these are present at the sides.

Fidena sp. near *niveibarba* Kröber

Caura Valley, 2 females, biting man, 24 June 1945 (T. S. Jones) ; Maracas Valley, 3 females, biting man, 10 August 1945 (E. McC. Callan) ; Caura Valley, 4 females, biting man, 9 July 1949 (E. McC. Callan).

F. niveibarba was described from Minas Geraes, Brazil, and the Trinidad specimens are apparently closely allied to it. In Trinidad this species is very persistent in its attack. I have been bitten by it on numerous occasions while bathing in pools in the Maracas and Caura Rivers, and it has so far been found only in these two valleys of the Northern Range. It is rather strange that this species has not been previously recorded from Trinidad.

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PSYCHE

Vol. 59 June, 1952 No. 2

INHERITANCE OF SOME VARIETAL CHARACTERS IN *CHRYSOPA OCULATA* SAY (NEUROPTERA: CHRYSOPIDAE)*

By William E. Bickley
College Park, Maryland

Varieties of *Chrysopa oculata* Say are distinguished by the degree of darkness of wing veins and by color patterns, chiefly markings on the genae, vertex, and pronotum. Most of the varieties are species synonyms. *C. albicornis* Fitch, which has dark cross veins, and *C. chlorophana* Burm., which has green cross veins, were placed under *C. oculata* Say by Smith (1922). One of several reasons for doing so was the fact that the forms readily cross.

Smith (1932 and 1934) recognized five varieties which have different color patterns on the vertex. In *carei* Smith, spots on the vertex are absent. In *xanthocephala* Fitch there are two black or brown spots in the antennal band or closely connected with it; but if the two spots are not connected with the antennal band the form is called *bipuncata* Fitch. Variety *oculata* Say has four dark spots on the vertex (pl. 5, A). In *illepida* Fitch there are two elongate bands; in other words the spots on each side are fused (pl. 5, B).

When large numbers of *Chrysopa oculata* are examined it is found that some specimens cannot be placed in the recognized categories. A good example is a form in which the vertex has two spots on one side and an elongate band on the other (pl. 5, C). In an attempt to clarify the status of some of the varieties, an investigation was made of the inheritance of some characters upon which varieties are based.

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* Scientific Art. No. A357, Contribution No. 2338 of the Maryland Agricultural Experiment Station, Department of Entomology. Dr. Sumner O. Burhoe, Professor of Zoology, University of Maryland aided in interpreting the possible genetic status of the varieties.

Field-collected gravid females were put in separate fruit jars with cheese-cloth coverings, and eggs obtained from them were isolated in one-ounce bottles with absorbent cotton plugs. Larvae were given about a dozen field-collected aphids every day or every other day. Sometimes larvae were fed termite workers. They spun cocoons, pupated, and emerged in the small bottles. Adults lived and reproduced satisfactorily in fruit jars. They were given a few aphids and a little water daily. The average duration of the egg stage was approximately three days and the larval stage, 14 days. Adults usually emerged 14 days after the cocoon was spun.

Two varieties were reared, inbred and inter-bred, namely the common *oculata,* which has four spots on the vertex, and *illepida,* which has two elongate bands on the vertex. Seven *oculata* females of unknown ancestry, some from different localities in Maryland, produced 103 offspring. Of these, 101 or 98% were *oculata.* There were one *illepida* and one *xanthocephala* (a form with only two spots). The progeny of two wild *illepida* females consisted of 83 individuals, 58 of which were *oculata* and 25 of which were *illepida*—respectively 70% and 30%.

Twelve pairs of first generation individuals were mated so that offspring of nearly all possible combinations could be studied. To determine whether or not there was any sex linkage, duplicate crosses were made in which the sexes with given characters were reversed.

Results of second generation pairings are given in Table 1. It is obvious that the genes responsible for *oculata* are more prevalent. This appears to be true not only in the populations reared but also throughout the range of the species. It is unlikely, however, that *oculata* is a dominant character in the Mendelian sense, because of its occurrence in offspring from *illepida* parents. Pairing F as given in the table shows that one pair of *illepida* from an *illepida* female produced 50% *oculata* offspring, indicating that they carried the *oculata* gene. This high percentage fur-

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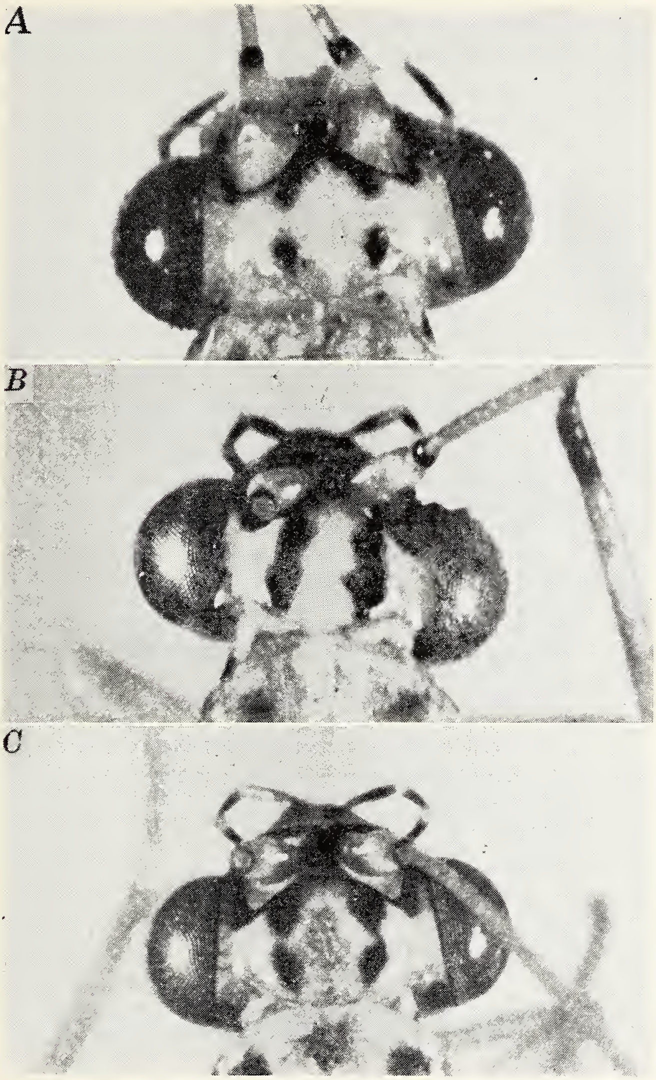
Explanation of Plate 4

Markings on the vertex of *Chrysopa oculata.* A. Variety *oculata.* B. Variety *illepida.*. C. "Borderline" individual.



BICKLEY—INHERITANCE IN CHRYSOPA

nishes proof that *oculata* is not a simple dominant. Furthermore, in B, C, and E *oculata*, presumably heterozygous if *illepida* is recessive (because they were the offspring of *illepida* females) produced low percentages of *illepida.* If *oculata* were dominant the expected proportions of *illepida* would be 25% in B and C, and 50% in E.

The high percentage of *oculata* offspring in all the crosses occurs in a manner showing close approximation to the results expected from segregating recessives with a rare production of *illepida,* which could be explained by the presence of two or more pairs of recessive genes either of which in the homozygous recessive state could produce *oculata.* Thus, if there are two genes any one of which in the recessive state would produce *oculata,* a cross like those in D (Table 1) could theoretically produce 25% *illepida,* provided that the *illepida* parent is heterozygous for both pairs of genes. The actual number obtained was 19%. If it is assumed that any one of three genes in the recessive state might produce *oculata,* the actual ratios of the five crosses will conform more closely with the theoretical.

Whatever the genetic mechanism may be, it can be concluded that *illepida* is not a simple recessive. If such were the case, inbreeding could not possibly produce anything except *illepida,* but actually the result is 50% *oculata.* (Table 1, F.) Conversely, the fact that inbreeding of five pairs of *oculata* from an *oculata* female gives only *oculata* suggests that this character may be a recessive. There are of course the other patterns on the vertex to be considered, but no attempt is being made to explain their occurrence.

Even though the manner in which the variations are produced cannot be explained easily and regardless of the percentages of the two varieties obtained from the different crosses, the important point is that the characters which have caused the naming of *oculata* and *illepida* are inherited. Moreover this appears to be true for the other varieties previously mentioned, including those with differences in darkness of wing venation.

An eighth variety recognized by Smith (1932) is *separata* Banks which "is distinguished by the absence of a connection between the black loop under the antennae and the black genal band." If the connection is very faint the form is still called *separata.* There are various degrees in reduction of width of this connecting band, and in this case it appears that the character is so subtle that it is not reliable.

Because of inconsistencies and intergradations in color patterns and because the genetic status of some of the varietal characters is at least partially understood, it seems reasonable to conclude that the varietal names are no longer of any value. The avoidance of the term variety where it lacks real meaning is one of the principles set forth by Ferris (1928). If this principle is applied the work of the taxonomist will be simplified. He no longer has a problem when he is confronted with borderline cases such as individuals with spots on one side of the vertex and a band on the other, and specimens with the face as in *separata,* the vertex as in *illepida,* and the wings as in *albicornis.*

	Pairing	No. of Pairs	Total Off-Spring	*oculata*		*illepida*		Borderline	
				No.	%	No.	%	No.	%
A	oc(oc) x oc(oc)	5	84	84	100				
B	oc(oc) x oc(ill)	2	83	78	94	4	5	1	1
C	oc(ill) x oc(ill)	1	11	10	91	1	9		
D	oc(oc) x ill(ill)	2	59	48	81	11	19		
E	oc(ill) x ill(ill)	1	60	39	65	21	35		
F	ill(ill) x ill(ill)	1	18	9	50	8	44	1	6

Table 1. Inbreeding and crossing of two varieties of *Chrysopa oculata* (Say); oc(oc) indicates *oculata* from an *oculata* female; oc(ill) indicates *oculata* from an *illepida* female; ill(ill) indicates *illepida* from an *illepida* female.

SUMMARY

Two varieties of *Chrysopa oculata* Say were reared, inbred, and interbred, namely, the common *oculata,* which has four spots on the vertex, and *illepida,* which has two elongate bands on the vertex. Twelve second generation pairings were made and 315 offspring obtained. All of these pairings resulted in high percentages of *oculata.* It is, therefore, concluded that the genes responsible for this character are more prevalent. However, *oculata* is not a simple dominant, and there is evidence which suggests that there are two or more genes, any one of which in the recessive state produces *oculata*. Because of inconsistencies and intergradations in color patterns and because the genetic status of some of the varietal characters is partially understood, it may be concluded that the varietal names are no longer of any value.

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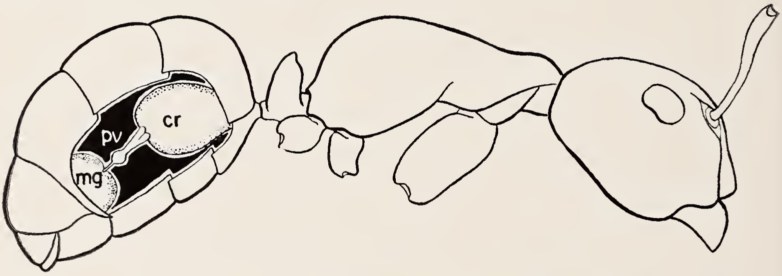
THE MORPHOLOGY OF THE PROVENTRICULUS OF A FORMICINE ANT

By T. Eisner and E. O. Wilson
Biological Laboratories, Harvard University

The ant proventriculus is a structure of considerable entomological interest. It is most elaborately developed in those groups of ants which have the highest form of social behavior and has been generally thought to be associated in some way with food storage and trophallaxis. It has been used extensively as a taxonomic character in the classification of higher categories in the Dolichoderinae and Formicinae and in phylogenetic speculation concerning these groups. Yet, despite several involved descriptions of the anatomy of this organ that have appeared in the past, its function and activity have never been properly understood. The following paper contains the results of a concentrated study of the morphology of the proventriculus of one typical species of formicine. An emphasis has been laid on those details that appear to be relevant to its function, and there is offered a new explanation of its mechanics.

The first accurate anatomical study of the dolichoderine-formicine proventriculus was that of Forel (1879). Emery (1888) followed up Forel's work in a classic comparative monograph which is still the basic reference on this organ. He reviewed most of the dolichoderine and formicine tribes, as well as the aberrant myrmicine tribe Cephalotini. Additional brief descriptions of the proventriculus of the Dolichoderinae and Formicinae were given in 1912 and 1925, respectively, in the fascicles of Wytsman's *Genera Insectorum* dealing with those groups. The most recent research on the formicine proventriculus is that of Forbes (1938), whose account is mostly a review of earlier work and adds little information of significance.

The ant chosen for the present study was *Camponotus americanus* Mayr. This species proved especially amenable to this type of anatomical work, since it is large and possesses a translucent integument. The crop, when filled with stained fluid, can be observed through the gastric tergites, so that those individuals that have their crops distended most suitably for dissection can easily be picked from the artificial nests. China ink was found to be the most suitable of several stains considered for use in studying the course of food in the living gut. This was ground up in honey to make an intensely black liquid, which could be traced even when passing through the fine canal system of the proventriculus. Dissections were accomplished simply by clipping the ant's legs, removing the sternites with a fine pair of scissors, picking out the fat body, and washing the cavity of the gaster with insect Ringer's solution. For histological studies the gut was serially sectioned at seven microns and stained with Ehrlich's haemotoxylin and eosin.



Text-figure 1. Soldier of *Camponotus americanus* Mayr, with a window cut in the gaster to show size and placement of the proventriculus. Cr, crop; pv, proventriculus; mg, midgut.

The proventriculus, or gizzard, lies in the anterior half of the gastric cavity when not displaced posteriorly by the distended crop (text--fig. 1.). It is the last segment of the foregut and connects the usually voluminous crop with the midgut. In the "euformicine" ants (section

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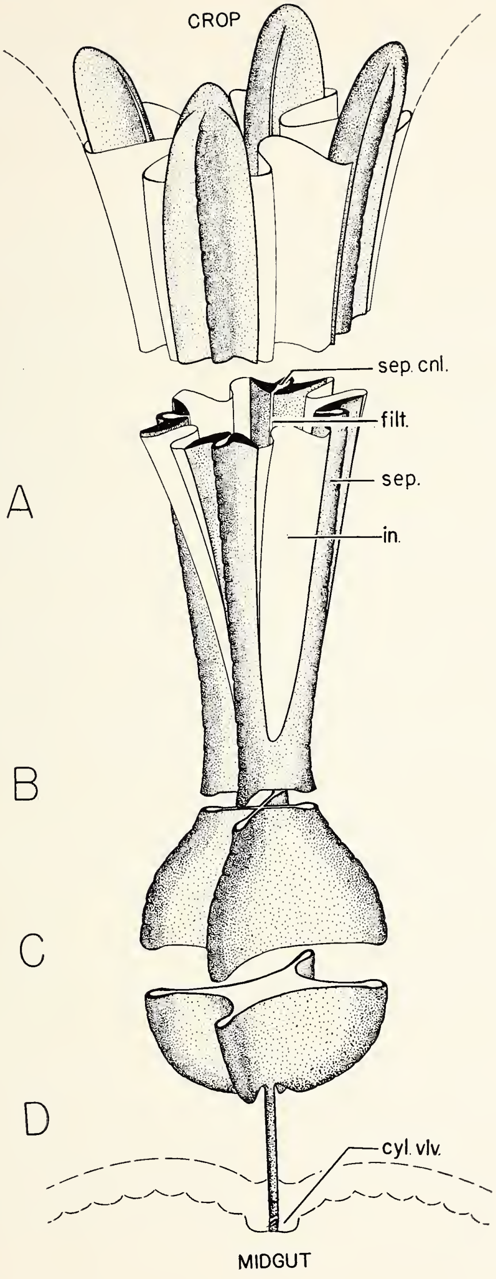
EXPLANATION OF PLATE 5

Exploded semidiagrammatic drawing of the chitinous framework of the proventriculus. Epithelium and muscularis not shown. A, calyx; B, occlusory tract; C, bulb; D, cylinder. Sep. cnl., sepal canal; filt., filtering slit of sepal; sep., sepal; in., intersepalary intima; cyl. vlv., cylinder valve. (180X)

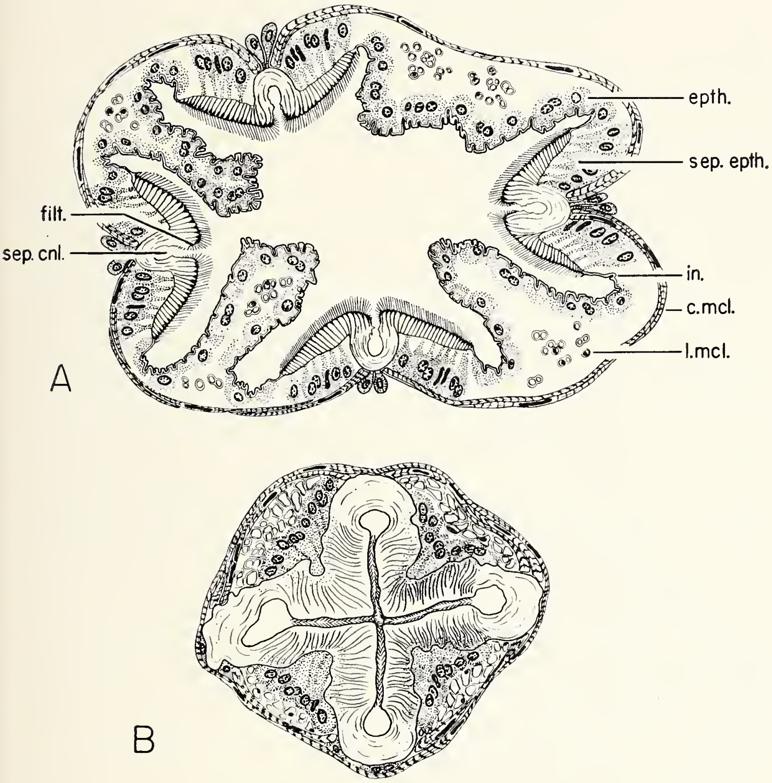

CROP
sep. cnl.
filt.
sep.
in.
A
B
C
D
cyl. vlv.
MIDGUT

Euformicinae), under which Emery grouped seven of the twelve formicine tribes recognized by him, and including *Camponotus*, the proventriculus is divided into four distinct parts: the *calyx*, the *occlusory tract* ("valve" of Emery), the *bulb*, and the *cylinder* (pl. 5; A, B, C, D). The calyx is composed of four strap-like, chitinous rods, or *sepals*, which extend anteriorly from the body of the proventriculus to capture part of the posterior wall of the crop. It acts like a collapsible funnel which can be closed by the combined action of its intrinsic muscles and the posterior ring muscles of the crop. Seen in cross-section, each sepal is morphologically differentiated into two zones (plate 6, fig. A), which represent two successive phases of secretion by the underlying epithelial cells. The inner area is composed of closely approximated chitinous hairs, which lend it a finely and evenly striated appearance. The outer zone also appears striate, but coarsely and unevenly so, and it is not composed of independent hairs. This area incloses medially the *sepal canal*, which is to be distinguished from the lateral solid *wings* of the sepal. The canal opens through a narrow slit to the calyx cavity; this slit is a cross section of the longitudinal cleft which extends the full length of the sepal. It is guarded by fine, loosely interdigitating chitinous hairs (collectively designated as the *filter*), which are actually structural hairs of the inner area of the sepal that have been separated from one another. The canal narrows gradually in the anterior end of the sepal and finally ends blindly; it does not extend into the cavity of the crop. The bulk of the calyx wall is made up of epithelium, designated according to position as *sepalary* or *intersepalary*. Externally the wall is limited by a layer of striated muscle, one to two fibers thick, which attaches to the sepals themselves. Between the points of

---

Explanation of Plate 6

Fig. A, cross section of the calyx at approximately the level of transection shown in plate 6. Fig. B, cross section of the occlusory tract at slightly above the level of transection shown in plate 6. Filt., sepal filter; sep. cnl, sepal canal; epth., intersepalary epithelium; sep. epth., sepalary epithelium; c. mcl., circular muscle fibers; 1. mcl., longitudinal muscle fibers. (360X)



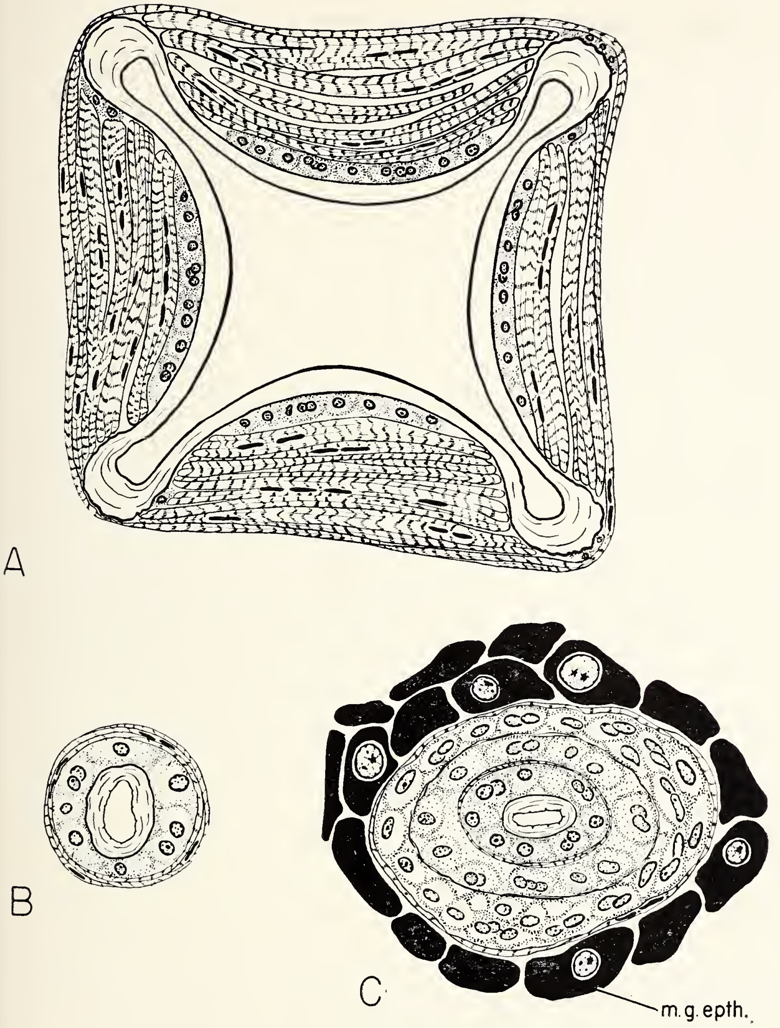
Eisner and Wilson—Formicine Proventriculus attachment on each sepal is a pair of external epithelioid cells of unknown function. Internally the calyx wall is lined with a chitinous intima, which is continuous with the intima of the crop wall proper. Scattered in the intersepalary folds are slender longitudinal muscle cells; these are few in number and have no obvious function. They are inserted on the anterior face of the bulb and are continuous with the muscularis of the crop.

The occlusory tract, or valve of the previous literature, is formed posteriorly by a coalescence of the sepals in the following manner. As the calyx narrows, the sepals are brought closer together. Their wings shorten, the inner chitinous zone grows progressively thinner, and the outer zone expands toward the center, extending with it the filter area. Finally the inner zone disappears altogether; the sepals curve together and fuse medially. The filter area, seen in cross section of the sepal as a narrow zone separating the canal from the calyx cavity, has now elongated to form one of the filter slits of the occlusory tract (pl. 6, fig. B). The tract is thus a solid chitinous structure having in the center a single united cruciform slit, the arms of which are expanded at their tips into four canals, which are in turn continuous with the sepal canals in front and the bulb canals behind. It is of interest to note here that the arms of the cross are densely covered with chitinous hairs, whereas the canals are bare. The wall of the tract, external to the chitinous cross, is similar to that of the calyx. The longitudinal muscles are more concentrated due to convergence, and the external pairs of epithelioid cells are no longer evident.

The occlusory tract merges into the bulb by a thinning of the intercanal chitin and an expansion of the cruciform slit into the bulb cavity. The outstanding feature of the bulb is the powerful development of its circular muscles, which are five or more fibers thick in cross section.

EXPLANATION OF PLATE 7

Fig. A, cross section of the bulb at approximately the level of transection shown in plate 6. Fig. B, cross section of the cylinder. Fig. C, cross section of the cylinder at the level of the cylinder valve. M. g. epth., midgut epithelium. (360X)



Eisner and Wilson—Formicine Proventriculus

Longitudinal muscle fibers are absent. Four *bulb canals,* continuous with those of the tract and calyx, extend the length of the bulb and end blindly at the posterior extremity. In the anterior half of the bulb they do not communicate with the bulb cavity, but are closed off by the approximating chitin walls internally adjacent to them. Posteriorly, the walls diverge so that the canals communicate widely with the lumen when the transverse muscles are relaxed (pl. 7, fig. A), but are closed off from the lumen when the muscles contract. As in the calyx and tract, the outer surfaces of the walls form the points of attachment of the transverse muscles.

The bulb merges into the cylinder by a posterior constriction and a termination of the bulb canals. The circular muscles are again reduced to a thickness of one to two fibers, and there is still no evidence of longitudinal muscle fibers (pl. 7, fig. B). Internally the cylinder consists of a simple chitinous tube surrounded by a single-cell layer of epithelium. At its posterior end, as it enters the midgut, the cylinder is seen in our preparations to fold upon itself in such a way as to become a compound tube (pl. 7, fig. C). This is made possible by an extreme thinning of the intima in that area. At the end of the cylinder the intima is folded inside out and back upon the cylinder for a short distance; it is then turned inward again and envelops the cylinder as a third fold before it terminates at the midgut junction. The median intima shown in our figure is therefore actually the true intima folded upon itself. The significance of this rather complicated situation is that the tip of the cylinder is highly flexible, allowing the cylinder to be intruded far into the midgut as the *cylinder valve* ("knob" of previous literature) or to be pulled out of the cavity altogether as a straight, simple tube. Thus the relative lengths of the cylinder and cylinder valve, or those parts outside and inside the midgut cavity respectively, can vary considerably, and the cylinder valve can disappear entirely under some conditions. This phenomenon was first observed by Forel in *Conomyrma pyramica* (1929); we have seen it in several formicine genera, including *Camponotus, Lasius,* and *Prenolepis.*

The midgut is of sufficient histological interest to deserve a note in passing. The wall consists of a loose aggregation of epithelial cells with variably polyploid nuclei. Our method of fixation (Schaudinn's, five minutes) shows a dense concentration of basophilic granules in the cytoplasm. The cells themselves are so loosely connected that they can be dissected out individually with a fine pin, and it seems unlikely that they are able to withstand much pressure from the contents of the lumen.

It has been generally understood that the proventriculus functions in some way to allow storage of liquid in the crop and to regulate the amount which passes into the midgut. This increase in efficiency at storing food in turn facilitates a greater rate of trophallaxis, which is a fundamental bond of social life in higher ants. As to the specific mode of action of this organ, Emery proposed a scheme in his original paper (1888) which to the present time has been varied upon only slightly. This scheme can be summarized as follows. The occlusory tract acts as a valve which is controlled by the muscles surrounding it and which is able to seal off completely the bulb from the crop. In the euformicines the calyx acts as an accessory valve, collapsing its walls together to prevent the flow of liquid through it. The bulb acts as a unidirectional pump with a valve on each end. As the transverse muscles contract, the adjacent walls of the bulb collapse on one another, first at the periphery and then toward the center, forcing the contents of the cavity down through the cylinder and into the midgut. At the same time the occlusory tract closes off independently and prevents flow of the bulb's contents forward into the crop. As the bulb muscles relax, the elasticity of the chitinous wall opens the cavity and creates suction, while the occlusory tract opens and allows liquid from the crop to fill the bulb. The "knob", the end of the cylinder which enters the midgut cavity, acts as a valve to prevent flow of liquid back from the midgut, since its cavity is collapsed by slight external pressure. Regurgitation is initiated by a closure of the occlusory tract (and calyx also in the euformicines) and an expansion of the pharyngeal cavity; the latter process sucks liquid forward out of the crop. This original scheme was based entirely on prepared, sectioned material.

Our studies indicate that while the function attributed to the proventriculus by Emery and others is correct, the accepted explanation of its mechanics as given above is basically erroneous. The reason for this lies in several fundamental misconceptions established by Emery in his 1888 paper and maintained in the literature ever since. First, Emery believed that the filter hairs of the euformicine sepal canals actually seal off the canals from the calyx cavity: "Die Rinne wird gegen das Lumen des Kelches durch das Ineinandergreifen der die Flügel besetzenden Härchen verschlossen". Because of this he was inclined to treat the canals as relatively unimportant structures. Subsequent workers, including Forbes, have observed that the canals really open into the lumen, but none have considered the obvious possibility that they might serve to conduct liquid past the occlusory tract. That this conduction may occur has been ascertained by our observations on the proventriculi of *Camponotus* fed with stained honey. Following spontaneous contractions of the calyx and ejection of the contents into the crop, the canals could often be seen to remain full of the honey, usually back to the level of the occlusory tract, but in one instance through most of the length of the bulb as well. In these cases there were no evidences of the honey in the bulb cavity itself.

A second misconception which Emery established is that the occlusory tract acts as a valve. Actually, even if the occlusory tract could be closed entirely, which is possible, the presence of strongly reinforced canals passing through the tract prevents it from stopping flow altogether. At the same time, the cruciform slit cannot be opened to an extent much greater than that shown in plate 6. In all, the entire structure of the tract appears to be too rigid to be able to exert much control over the rate of flow by the action of its intrinsic muscles.

A third misconception is that the canals of the bulb are collapsed as the transverse muscles contract. We have already seen that these canals are sealed off in the anterior portion of the bulb even when the muscles are relaxed. It is probable that they become sealed off but not collapsed in the posterior portion as contraction is initiated. Why this happens can be seen in an examination of the cross section of the bulb (pl. 7). The walls of the canals are constructed along their outer edges of exceptionally thick chitin, which cannot easily be folded in. The action of the transverse muscles is obviously to decrease the volume of the bulb. The first thing that must occur as this constriction begins is that the opposing chitinous walls immediately adjacent to the canals meet, although the canals themselves remain open. The point of contact of the walls now proceeds toward the center of the bulb, until, at the completion of contraction, the bulb cavity is mostly obliterated.

A fourth misconception, not entirely referable to Emery, but partly stemming from other authors such as Janet, is that the crop is a passive organ which functions only as a storage center. Examination of entire and dissected *Camponotus,* the crops of which were distended with stained honey, showed that the crop wall is capable of strong and almost total contraction, which at the very least would suffice for regurgitation by itself. In dissected material the movements were most marked in the posterior ring muscles, but they often proceeded anteriorly to include the entire crop. In fully intact but excited and active individuals the crop, when only slightly distended, could be seen through the body wall to undergo very swift pulsations, forcing almost its entire contents into the forward part of the gut.

Our interpretation of the action of the proventriculus in *Camponotus americanus* is as follows. The calyx and occlusory tract are devices for checking the posterior flow of liquid as fluid pressure builds up in the crop. They are able to do this without muscle contraction, simply because more pressure is required to force liquid through the filtering slits than is present even when the crop is considerably distended. Muscle action can have little effect on the width of these filtering slits and therefore cannot exert a valve-like control *per se.* In the euformicines the muscularis can act as a secondary damming device by closing the calyx and preventing liquid from reaching the filtering slits. But in dissected individuals with distended crops the closure of the calyx was not a necessary device, and liquid from the crop failed to reach the bulb even when the calyx was open and its cavity filled. The pressure required for passing liquid through the calyx and tract is provided by the bulb. As the bulb starts its contraction, its four canals are sealed off, perhaps imperfectly in the posterior portion, but at least completely enough to act as a valve to prevent most of its contents from flowing back into the calyx lumen. As the bulb cavity collapses under muscle contraction, the contents are forced back through the cylinder and into the midgut. As the muscles relax and the cavity expands due to the elasticity of its chitinous framework, the canals of the posterior portion communicate again with the lumen and allow liquid from the anterior canal system to pour in. Probably some of the liquid is sucked in through the filtering slits of the occlusory tract also, but the body of the tract is so extensive and its walls so densely covered with hairs that traffic through it must be relatively insignificant. A forward flow of liquid from the midgut is prevented by the cylinder valve, the thin walls of which can collapse under external pressure.

As we presently understand it, the significance of the characteristic elaboration of the dolichoderine-formicine proventriculus is that it allows the crop to store large amounts of liquid. As previous authors have suggested, it regulates the amount of this liquid which passes into the midgut and in this way separates the individual supply of food from the communal supply. In the concept presented here, it is considered that the primary feature of the advanced proventriculus is the filter area, while the other structures are developed supplementarily. This area acts as a plug guarding the midgut, and liquid can be forced past it only under pressure from the bulb. As its name implies, it also acts as a very thorough filter, and perhaps correlated with this is the fact that the midgut wall is so constructed as to be able to handle only small amounts of pure liquid.

The calyx of the euformicines represents an extension of the occlusory tract which allows a greater filtering area and possibly provides a secondary valvular control by its ability to collapse and occlude liquid from its lumen. In non-euformicine types the calyx is either absent or does not function in this capacity, and the occlusory tract is more massive. In the section Alloformicinae of Emery (Melophorini, Plagiolepidini, and Myrmelachistini), the occlusory tract is a prominent dome which surmounts the bulb. It is traversed by the same cruciform slit found in the euformicines. Anteriorly the slit is covered by dense chitinous hairs; this area is exactly comparable, if not homologous, to the filtered slits of the euformicine calyx and tract. Posteriorly the slit is devoid of hairs, and the tips of its arms broaden into canals which open into the bulb canals, again very much as in the euformicines. The proventriculus characterising Emery's section Heteroformicinae (Myrmecorhynchini and Myrmoteratini) appear from Emery's figures to be essentially similar to the alloformicine type, and there seems to be little justification for considering them other than aberrant alloformicines. The advanced dolichoderine type of proventriculus (Tapinomini) is the most complicated and difficult to understand, but in essential details it is still similar to the alloformicine type. There is an anterior filter area and posterior canals. Sepals, or sepal-like structures, are present and reflexed back over the bulb, with which they fuse. The chitinous septa produced by the fusion of the bulb and inverted sepals serve as the points of attachment of the bulb muscularis. The proventriculus of the myrmicine tribe Cephalotini has unquestionably evolved independently of that of the Dolichoderinae and Formicinae. Yet here again an occlusory tract abuts the crop and is the principal feature. The filtering slits are irregularly branched; they open into a rather simplified muscular portion which is little different from the primitive proventriculus of other myrmicines.

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THE BIOLOGY OF NEARCTIC LEPIDOPTERA
I. FOODPLANTS AND LIFE-HISTORIES OF COLORADO PAPILIONOIDEA

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In recent years the impact of evolutionary studies on taxonomy has greatly enhanced the interest in pairs or groups of species the members of which are almost indistinguishable according to the usual taxonomic criteria but which show no tendency to interbreed in nature and which differ in at least one important environmental specialization. For these Mayr (1940) has coined the convenient term "sibling species". In the Lepidoptera many instances have been discovered in which the siblings differ most strikingly in having special foodplant requirements, the food of each being unacceptable to the other (*e.g.*, Thorpe, 1928; Berger & Fontaine, 1947-48; Rawson & Ziegler, 1950). Some of these situations have been known for many years, and the siblings were formerly characterized as "foodplant races" of a single species.

The exposure of these unrecognized sympatric species in the Lepidoptera is very much hampered by the lack of precise knowledge of the species of foodplants on which each species can develop successfully. By such "success" we ultimately refer to the plant species on which the larvae of the insect will feed readily without fatalities from nutritional failure or from poisoning and on which they can develop to adulthood with normal fertility and inclination to mate. Several instances are now well understood in which: a) females occasionally oviposit on plants on which the larvae cannot thrive; b) larvae appear to prosper on a given plant, but very high losses occur through failure to pupate successfully; c) larvae seemingly develop normally on a given plant, producing adults as usual, but the adults of one or both sexes show no inclination to mate and are apparently sterile. But for most species this precise information is lacking, and even more limiting are the cases in which the food plants are completely unknown.

With the aim of providing some definite information on the foodplants of Lepidoptera I have begun collecting and preserving specimens of the plants, to be submitted to authoritative plant taxonomists for precise determinations. I propose to publish annotated lists of these foodplants from time to time. In the present contribution I have been substantially aided in obtaining plant identifications by my colleague, Dr. John R. Reeder, Curator of the Herbaria at Yale University, and I owe thanks to him and to the determiners: Dr. Reed C. Rollins, Director of the Gray Herbarium at Harvard University; Dr. S. F. Blake, Senior Botanist of the U. S. Division of Plant Exploration and Introductions; and Mr. Carleton R. Ball, of Washington, D. C. Specimens of most of the plants are being preserved for future reference in the Herbarium of Yale University. The initials of the determiner follow each species in brackets. The present paper is devoted to foodplants of Lepidoptera occurring in the state of Colorado. Unfortunately, in the following list little can yet be said about the suitability of the plants as permanent food. Notes on field observations are included. Records of the parasites obtained will be held for future publication.

PAPILIONIDAE

1. *Papilio eurymedon* Lucas. On 15 July 1949, J. D. Eff saw a female oviposit on a leaf of *Crataegus rivularis* Nutt. [R.C.R.] on the western slope of Rabbit Ears Pass, in Routt Co., Colo. The larva eclosed on 29 July and was preserved. In California Comstock recorded the foodplant as *Rhamnus californica*. My correspondent there, W. H. Evans, wrote (*in litt.*) : "A *Papilio eurymedon* laid four eggs on cultivated jasmine. Each year this species oviposits occasionally on this plant but I have never seen larvae on this vine. This year I gave them tender leaves on which they nibbled for several days, eating just barely enough to keep alive; then I gave them some of the native food plant, *Rhamnus crocea ilicifolia*. But all died without even tasting these leaves."

2. *Parnassius smintheus* Dbldy. & Hew. A single ovum was found 6 July 1949 attached to a leaf of *Oxytropis*

lambertii Pursh. [R.C.R.] near Nederland, Boulder Co., Colo. The ovum was fertile. This appears to be another case of a mistake by an ovipositing female, but there was no opportunity to test the nutritional suitability of *Oxytropis.* The usual foods of *Parnassius* are Crassulaceae, Saxifragaceae, and Papaveraceae. One must question Wright's records of *Viola* and *Vaccinium.* Females of *P. smintheus* from Nederland laid numerous ova on a native *Sedum* in confinement, 11 July 1949. The larvae emerged in the laboratory 12-14 September 1949, although they would normally have overwintered in the egg stage.

PIERIDIDAE

3. *Euchloe ausonides* Bdv. During the summer of 1949 larvae and ova were found almost everywhere they were sought in Boulder County at all elevations between 5600′ and 9000′. At Nederland on 6 July several ova and a half-grown larva were taken on *Arabis drummondi* Gray and *Arabis fendleri* (Wats.) Greene var. *spatifolia* (Rydb.) Rollins and one small larva on *Erysimum capitatum* (Dougl.) Greene [all R.C.R.]. The next day, in Spring Gulch, several ova and young larvae and one half-grown larva were taken on *Arabis glabra* (L.) Bernh. [R.C.R.]. This *Arabis* has erect pods, and it was noted that *Euchloe* were absent entirely from a co-occurring and similarly common *Arabis* with decumbent pods (*spatifolia?*—not collected) and from *Erysimum.* At Mt. Flagstaff and 6500′ elevation in Boulder Canyon, on 8 July several large larvae were taken on huge plants of *Sisymbrium altissimum* L. [R.C.R.]. The next day a female *E. ausonides* was observed at Nederland ovipositing on small plants of *S. altissimum* [R.C.R.], and on 22 July several large larvae were found there on the same species of plant. Also on the 22nd, a female was seen laying two ova on *A. fendleri spatifolia.* These two ova were laid in a remarkable manner, being fastened by their sides to flower buds, rather than attached by the base and standing out at right angles to the substratum as is uniformly true of the thousands of other ova I have seen laid by females of a score or more species of Pierididae. It is clear that species of *Arabis* and *Sisym-*

brium are primary foodplants of *E. ausonides* and that the eggs are laid and the larvae feed largely on the flower buds and seed pods. The suitability of other plants as food remains uncertain. The literature on North American Euchloini too often refers simply to "Cruciferae". In Connecticut we have found that the larvae of *Anthocaris midea* (Hbn.) regularly die on some members of the family, even though wild females occasionally oviposit on them.

4. *Pieris rapae* (L.). On 9 July 1949, at Nederland, females were seen ovipositing on *Thlaspi arvense* L. [R.C.R.], and on the 11th a female oviposited on a large *Sisymbrium altissimum* L. [R.C.R.]. The ova were notably white when laid (see *P. protodice,* below). In general, *P. rapae* is still uncommon in the mountains, perhaps in part because it may not thrive on native Cruciferae, and the weedy forms are not very abundant there. In spite of the presence of *P. rapae, P. napi* is by far the commonest *Pieris* above 7000′; it is believed to have been largely extirpated from New England by *P. rapae* (Scudder, 1889, p. 1198). The much greater success of *P. napi* in the Rocky Mountains, where both species oviposit on *Thlaspi* (see *P. napi,* below), suggests that *Thlaspi* may be nutritionally inadequate or poisonous for *P. rapae.*

5. *Pieris protodice* Bdv. & Lec. There is no unanimity in the name for the Colorado population of low and middle altitudes. However, I am satisfied that it cannot be a species distinct from eastern *protodice.* Near and above timberline there is a very striking form (*calyce* Edw.?), which may be a separate species. *P. protodice* females were seen at Nederland on 9 July 1949, ovipositing on *Sisymbrium altissimum* L. [R.C.R.] and *Thlaspi arvense* L. [R.C.R.]. The new ova were distinctly yellowish, contrasting with some of *P. rapae* taken at the same time (see above).

6. *Pieris napi* (L.). On 5 July 1949, at Eldora in Boulder County, Colo., a female was seen laying several ova on tiny seedlings of *Thlaspi arvense* L. [R.C.R.]. The new eggs were white. At Eldora, on 28 July, many *Thlaspi* plants beside a dirt road were examined. Fifty-six ova and a few young larvae of *P. napi* were found. Fifty-one ova

were on the underside of leaves; five were on the lower surface of large seed-silicles. Thirty of these ova were present singly on leaves or silicles; there were two ova on each of twelve leaves and one silicle (once one ovum was laid on top of the other); one leaf bore three ova. It was not possible to determine how often two or three ova were laid at a single visit of a female, but on 5 July I actually saw the female lay two ova side by side on certain leaves. At Rabbit Ears Pass, Routt Co., Colo., on 15 July, Jeanne E. Remington saw a *napi* female lay several ova on *Arabis drummondi* Gray [R.C.R.]. In Europe *P. napi* has been reared on plants of at least seven genera of Cruciferae (including *Sisymbrium*), but in Coos Co., New Hampshire, the basic, if not exclusive, food is *Dentaria,* according to information received from Donald J. Lennox.

7. *Colias eurytheme* Bdv. This name is used here for all orange members of the *eurytheme-philodice* complex of North America. The pure yellow individuals (*philodice*) are not common in the mountains in Boulder County, but observations suggest that they are permanent residents and survive the winter up to high altitudes. As the season progresses, huge orange individuals (*eurytheme*) begin to appear and increase in numbers for some weeks. There is clearly some hybridizing with *philodice,* as in all other regions where the two species are sympatric; I have a small series from Boulder County taken in 1949 above 8,000′, which includes two males and one female of *philodice,* three males and eight females of "pure" *eurytheme,* two females which look like my laboratory backcrosses to *eurytheme,* one female like my experimental F_1 hybrids, and three white females not certainly placeable. The determination of foodplants of these two species of *Colias* in any locality is of great interest, so it is regrettable that the following records are so scanty. On 6 July 1949 a "pure" *eurytheme* female was seen ovipositing on *Thermopsis montana* Nutt. [R.C.R.]. Six days later at Nederland a female *eurytheme* laid several ova on the upperside of leaves of an *Astragalus* which Dr. Rollins tentatively identified as "*racemosus* Pursh.?" (fruit was not collected).

SATYRIDAE

8. *Oeneis brucei* (Edw.). A female taken by J. D. Eff at Berthoud Pass (elev. between 11,000′ and 12,000′), Gilpin Co., Colo., was confined 16 July 1949 over a sedge. It oviposited freely at Eldora, at an altitude about 3,000 feet lower than the normal occurrence at Berthoud. The larvae emerged and fed readily, but all died en route to Connecticut or soon after arrival there.

9. *Oeneis lucilla* B. & McD. A female taken at about 13,000′ on Mt. Evans, Clear Creek Co., Colo., was confined over sedge. At Eldora, over 4,000′ lower than the point of capture, this female laid several ova on 29 July 1949. My records do not show whether the ova were fertile; in the collection are four preserved ova but no larvae.

10. *Erebia epipsodea* Butler. On 11 July 1949 females from Eldora were confined, each over a grass and a sedge. In two days 19 ova were laid, nearly all on the grass, but a few on the sedge; the grass was distinctly preferred for oviposition. The ova were fertile.

NYMPHALIDIDAE

11. *Boloria eunomia alticola* (B. & McD.). On 30 July 1949 females were found in fair numbers in a large alpine bog at Caribou (elev. 10,000′), Boulder Co., Colo. Many were followed closely, but they did not seem strongly-inclined to oviposit and, further, the strong wind made it difficult to keep track of a given individual. However, one female was observed ovipositing and the two ova were recovered. The behavior of this female was unlike that of all others (of both sexes) watched. This one alighted on the lowest plants on small hummocks rising a few inches above the standing water of the bog; the others always came to rest on shrubs and the flowers of tall herbs. The ovipositing female crawled for several seconds into the rather thick low plants (largely Graminales and a tiny *Thalictrum*) and stopped twice to oviposit on leaves of *Thalictrum alpinum* L. var. *hebetum* Boiv. [R.C.R.]. The ova were later lost, and captive females did not oviposit,

so the suitability of *Thalictrum* as a foodplant was not tested.

Our knowledge of foodplants for this genus is in a very confused state. A wide spectrum of plants has been recorded (*e.g.*, see Scudder, 1889, p. 587) as foodplants. However, information is lacking as to the plants **on which larvae were successfully reared.** From our experiences with *B. toddi* (Holland) and *B. selene myrina* (Cramer) in Connecticut, we believe that *Viola* spp. are the only suitable foodplants, but a large series of field observations shows that the females of both species characteristically avoid *Viola* for actual oviposition, although in many instances violets were found a few inches away. Most of the ova were fastened to dead twigs and grass! I suspect that most, if not all, of the recorded "foodplants" of *Boloria,* other than *Viola,* actually represent oviposition observations rather than feeding records. It is doubted that *Thalictrum* is the food of *B. eunomia alticola.*

12. *Boloria selene tollandensis* (B. & Benj.). At the type locality, in the great bogs at Tolland, Gilpin Co., Colo., on 22 July 1949 a female under observation laid an ovum on a dead *Salix* twig several inches above the ground and several feet from the nearest living *Salix.* The ovum was preserved before eclosion. I believe that the actual foodplants at Tolland are *Viola* spp. and that this female exhibited the same habit described above for *B. selene myrina* in Connecticut.

13. *Nymphalis milberti* (Godt.). Several clusters of large larvae were found on 9 and 11 July 1949, on extensively defoliated clumps of *Urtica gracilis* Ait. [R.C.R.] growing in a trash dump near Nederland (elev. 8000′), Boulder Co., Colo. On the same plants were single, concealed larvae of *Vanessa atalanta.* On 25 July many larvae of *N. milberti* of all sizes were found on stream-side clumps of *Urtica* at an elevation of 7200′ in Boulder Canyon. In the same clumps were several full-grown larvae of *V. atalanta* and four solitary larvae of *Polygonia satyrus.* Many larvae and pupae of the Nederland *N. milberti* were preserved; the remainder completed development on *U.*

gracilis and emerged during several days beginning on 26 July.

14. *Vanessa atalanta* (L.). Two sites of collection of larvae were mentioned above (see *N. milberti*). In addition a single larva was taken on *Urtica* at Rabbit Ears Pass, Routt Co., Colo., on 15 July 1949. In the Boulder Canyon clumps a pupa of *V. atalanta* was found in one of the webbed-leaf nests characteristic of *V. atalanta*. The larvae of the three *Urtica*-feeding Nymphalididae were easily distinguishable by their habits: *V. atalanta* was always in snug nests and always solitary; *N. milberti* was always gregarious, although the social groups were much subdivided and dispersed toward the end of development; *P. satyrus* constructed at best very simple nests and was not notably gregarious, and in addition the pair of branched head-horns and the broad, creamy dorsal stripe were distinctive. The *V. atalanta* larvae were very heavily parasitized by Larvaevoridae, and four minute Chalcidoidea emerged (as hyperparasites?) from a pupa.

15. *Vanessa cardui* (L.). Many larvae of all sizes were found on *Cirsium undulatum* (Nutt.) Spreng. [R.C.R.] near Spring Gulch, 9 mi. n.w. of Boulder, Colo., on 7 July 1949; two larval webs each contained a dead larva and a cocoon of one of the Ichneumonidae. Females of *V. cardui* were seen on 9 July ovipositing repeatedly on *Artemisia ludovicianus* Nutt. var. *gnaphalodes* (Nutt.) T. & G. [R.C.R.] in clearings in the pine woods near Nederland, Colo. This being an atypical foodplant, special care was taken to be sure that the butterflies were all *V. cardui*, that ova were actually laid, and that the *Artemisia* was always the plant selected. It is not known whether the larvae fed and matured on *A. gnaphalodes*. No thistles were found in these clearings. In 1949 *V. cardui* was unusually numerous in Boulder County as well as elsewhere in North America (see Eff, 1950), and these ovipositing females were probably second generation descendants of immigrants. *V. cardui* appears to oviposit commonly on plants of doubtful adequacy during these great emigrations and then to use only *Cirsium* and other thistles during the

intervening years of much less abundance. In the vicinity of St. Louis, Missouri, I never found larvae of *V. cardui* on anything but thistles except in the years of great influx, but then garden hollyhocks (*Althea rosea* Cav.) were always heavily infested. There is a very long list of recorded foodplants for *V. cardui* in North America and Eurasia, but *Artemisia* seems to be previously unlisted. Careful tests of the whole range of recorded plants for their suitability to *V. cardui* for development would be valuable.

16. *Vanessa virginiensis* (Drury). Several solitary larvae were found on 9 July 1949 in their familiar nests on *Antennaria aprica* Greene [S.F.B.] near Nederland, Colo. This is an uncommon butterfly in the mountains, and its larvae were found more easily than the adults.

17. *Polygonia satyrus* (Edw.). On 25 July 1949 one full-grown and three half-grown larvae were found on streamside *Urtica* (*U. gracilis?*) clumps at an elevation of 7200′ in Boulder Canyon, Colo. These were interspersed with larvae of *Vanessa atalanta* and *Nymphalis milberti* (see above). One larva was allowed to complete development, and the imago emerged on 8 August 1949. From the fact that they are allopatric and from the appearance and foodplant of the larvae I suspect that *P. comma* and *P. satyrus* are actually conspecific; the pattern and color differences of the adults are slight enough.

18. *Limenitis weidemeyerii* Edw. A female was seen laying several ova on the tips of leaves of *Salix* along a stream, at Eldora, Boulder Co., Colo., on 18 July 1949. One ovum laid on *Salix drummondiana* Barratt var. *subcaerulea* (Piper) Ball [C.R.B.] was recovered; the larva emerged on 30 July and was preserved.

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HETEROPONERA MAYR REINSTATED (HYMENOPTERA: FORMICIDAE). — *Heteroponera* Mayr (1887, Verh. zool.-bot. Ges. Wien, *37*: 533) has remained suppressed as a synonym of *Acanthoponera* Mayr for many years. Wheeler (1923, *loc. cit.*) has shown, however that *Acanthoponera* can be split into two groups; one group (*Acanthoponera* s. str.) having the tarsal claws with an extra, strong tooth and a basal lobe (or tooth), while the second group (*Anacanthoponera* Wheeler) has the tarsal claws at most with a single, weak median tooth. In this second group, Wheeler included *Heteroponera carinifrons* Mayr, and since *Heteroponera*, with the genotype *H. carinifrons*, has precedence, it must be **reinstated as a good genus**. *Anacanthoponera* Wheeler (1923, Psyche, *30*: 176, as a subgenus of *Acanthoponera*) is a **new synonym** of *Heteroponera,* since the genotype, *Ponera dolo* Roger, is congeneric with *H. carinifrons*.

Acanthoponera is neotropical, and has well developed propodeal teeth and the petiolar apex produced as a long tooth or spine; Kusnezov (*in litt.*) finds *A. mucronata* to have 6, 4 palpal segmentation. *Heteroponera* is neotropical and Australasian, and the propodeal teeth and dentiform petiolar apex are absent or feebly developed; *H. imbellis* Emery has 3, 3 palpal segmentation (my dissection). Until more species can be critically examined, *Acanthoponera* and *Heteroponera* should be considered as distinct genera. *Acanthoponera* appears to be the most generalized living member of the Ectatommini, and is probably close to the stem from which the proceratiines, the myrmicines and *Paraponera* arose. — W. L. Brown, Jr., Museum of Comparative Zoology, Harvard University.

STUDIES ON ARIZONA ANTS (3)
THE HABITS OF *POGONOMYRMEX HUACHUCANUS* WHEELER AND A DESCRIPTION OF THE SEXUAL CASTES

By Wm. S. Creighton
Department of Biology, College of the City of New York

It has been more than a third of a century since Wheeler described *Pogonomyrmex huachucanus* from a few workers taken in the Huachuca Mountains of Arizona (1). During this period only five additional records have been published for this interesting little species. Three of these were carried in Olsen's 1934 monograph on *Pogonomyrmex* (2). The other two records were published by Cole in 1934 (3) and 1937 (4). While these records have increased the known range of *huachucanus,* they have added little to our knowledge of the habits of this insect. There is good indication that *P. huachucanus* has special significance in the phylogeny of the genus *Pogonomyrmex,* hence it is gratifying to be able to amplify our rather meager data on this ant. During the summers of 1950 and 1951 the writer found numerous colonies of *huachucanus* and was able to study some of them in considerable detail. This paper presents the results of these studies, a review of previously published observations on *huachucanus* and a description of each of the three castes.

The nests of *huachucanus* examined by the writer were very uniform in one respect. In every case they were built in extremely harsh, stony soil. The most striking example of this was a nest taken at the summit of Montezuma Pass in the Huachuca Mountains. This nest was constructed in the hard-packed gravel of the highway. Road work had compressed the gravel to such an extent that "soil" around the nest was almost as hard as concrete. Most of the nests were situated on rather steep slopes and they were generally fully exposed to the sun. The direction of the slope seemed to be of little importance. Three of the nests were constructed beneath stones, the others had no covering object present. In the latter case the nest was provided with a single, rather irregular entrance about one-half an inch in diameter. From this entrance excavated soil was scattered in an obscure fan down the slope. In one instance there was a low crater of excavated soil about six inches in diameter spread around the entrance. But the construction of a crater seems to be exceptional for this species. The population of a nest of *huachucanus* is comparatively small. As a rule there are less than two hundred workers in a colony. The colonies frequently have two or more queens present but this seems to have little effect on their size. One nest, which was secured entire, had only one hundred and seventy workers present although it contained two females. Occasionally one encounters an especially large nest in which four or five hundred workers may be present, but there would seem to be little doubt that such a number is exceptional.

P. huachucanus is not a conspicuously aggressive ant, but it will defend its nest vigorously if disturbed. It has no hesitation about using its sting, but the effect of the sting is remarkably slight, at least to the writer. I have often been stung by half a dozen workers at once, with no results other than a slight twinge as the stings entered. The persistent and distressing after-effects which often accompany the stings of many species of *Pogonomyrmex* seem entirely absent in the case of *huachucanus.*

The marriage flight of *P. huachucanus* takes place in the latter part of July or the first weeks of August. Although the writer has never seen the marriage flight of this species in progress, there is evidence which makes the above statement valid. Mature males were taken from a nest near Socorro, N. M., on July 31st and others from two nests in Carr Canyon, Huachuca Mountains, Arizona, on August 5th. A large nest found near Springerville, Arizona, on July 30th contained not only many males but an equally large number of deälate females. There were far too many of the latter to suppose that they all represented functional females belonging to the nest. As it had rained heavily an hour or two before the nest was discovered, it seems likely that the storm had interrupted a marriage flight and that the deälated females had taken temporary shelter in the nest. It is safe to conclude, therefore, that the marriage flight of *huachucanus,* like that of many other species which occur in southern Arizona, takes place during the rainy season of July and August.

We may now consider the distribution of *huachucanus.* Presented below are the previously published locality records for this species and those which the writer secured during 1950 and 1951. The elevation of each of the first thirteen localities has been checked with U.S. Geological Survey topographic sheets. In addition, many of them have been rechecked with an altimeter as well. The last four localities have been checked against data in Stieler's Handatlas.

Huachuca Mountains, Arizona: Miller Canyon 5600′ (Type locality) W. M. Wheeler; Garden Canyon 5800′, W. S. Creighton; Carr Canyon, 5400′, W. S. Creighton; Pyeatt Cave, 5500′, W. S. Creighton; one mile east of Panama Mine, 5300′, W. S. Creighton; Montezuma Pass, 6700′, W. S. Creighton.

Santa Rita Mountains, Arizona: Mouth of Madera Canyon, 4800′, W. S. Creighton; Sweetwater, 5800′, W. S. Creighton.

Santa Catalina Mountains, Arizona:[1] Sabino Basin, 3700′, W. M. Wheeler.

Dragoon Mountains, Arizona: Texas Pass, 4700′, W. M. Wheeler.

Whetstone Mountains, Arizona: Dry Canyon 5000′, W. S. Creighton.

Baboquivari Mountains, Arizona: Brown Canyon 4200-6000′, W. S. Creighton.

Oracle, Arizona, 4500′, W. M. Wheeler.

Seligman, Arizona, 5500′, A. C. Cole.

Springerville, Arizona, 5600′, W. S. Creighton.

Sixteen miles west of Socorro, N. M., 5300′, W. S. Creighton.

Needles, California, 460′, A. C. Cole.

From these records it can be stated that *huachucanus* usually occurs between the 4000 and 6500 foot levels and, since this is the case, it is clear that Dr. Cole's record from Needles is badly out of line in the matter of elevation.

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[1] This record is cited as "South Catalina Mountains" in Olsen's monograph.

For it is more than thirty-two hundred feet below the next lowest record for *huachucanus.* The situation and character of the Needles nest were both unusual for a colony of *huachucanus.* Dr. Cole described it as " a rather minute crater mound in sand." It has been shown above that *huachucanus* nests in gravelly soil and only rarely constructs a crater. Since everything about the Needles record is wrong for *huachucanus,* I wrote Dr. Cole for permission to examine the specimens on which it is based. Unfortunately, they have been lost. There is, therefore, no possibility of a further check on this highly unusual record. In my opinion it is best disregarded. It is very unlikely that the ant was actually *huachucanus* and the inclusion of the Needles record obscures the beautifully clear distributional picture which is shown by every other record for *huachucanus.*

For all the other records for this species indicate that *huachucanus* is a member of the Upper Sonoran ant fauna. Many of the records are from mountainous areas and, when the insect occurs in such regions it prefers foothill canyons as nesting sites. It is equally at home, however, on the grassy, elevated plains at the base of the mountains. But it does not occur in nearby areas of less elevation where Lower Sonoran species are encountered. It is interesting to note that, at the eastern end of its range, *huachucanus* occurs in stations where *P. occidentalis* and the typical *P. barbatus* are also present. The main range of the typical *barbatus* lies in Mexico. That of *occidentalis* lies entirely to the north of it as far as is known at present. Hence there is only a limited area in parts of Arizona and New Mexico where these two species occur in close proximity. For the most part the range of *huachucanus* follows this area of overlap with remarkable exactness. The most obvious explanation for the distribution of *huachucanus* would, therefore, assume an unusually narrow tolerance for temperature on the part of this species. Such a limitation would exclude *huachucanus* from northern regions occupied by *occidentalis* and at the same time debar it from southern areas utilized by the typical *barbatus.* If this explanation is correct, then *huachucanus* shows less environmental adaptability than is usually the case with members of the genus *Pogonomyrmex.* This point is of interest in view of Wheeler's theory that *huachucanus* is a relict species.

According to Wheeler (1) *huachucanus* and the closely allied Chilean species *bispinosus* are the remains of a primitive *Pogonomyrmex* fauna which originated from the genus *Myrmica* in boreal America and subsequently spread southward through the arid portions of both North and South America. This primitive *Pogonomyrmex* fauna was later replaced in large part by more adaptable, modern species. The replacement left relict species at widely isolated points in the orignal range. This theory, which was designed to explain the close structural similarities which mark *huachucanus* and *bispinosus,* was necessarily based upon the characteristics of the worker of *huachucanus.* Wheeler knew nothing of the male of *huachucanus.* The structure of the male is of particular importance in phylogenetic considerations and it is interesting to find that this caste shows features which agree well with Wheeler's view. The general appearance of the male of *huachucanus* is quite unlike that of the males of the other North American species of *Pogonomyrmex.* The latter are good sized insects as ant males go, with a length of nine millimeters or more. This is true even when the worker caste is comparatively small, as is the case with *desertorum.* The surface sculpture is variable but it is never heavy enough to produce a completely dull surface and, in most cases, the body is distinctly shining. The erect body hairs are long, thin, flexuous and very abundant. They often mat together but, even when they do not mat, they are close enough to each other to obscure the parts on which they occur. The antennal scape is at least as long as the first three funicular joints taken together. The male of *huachucanus* is an exception to each of the above features. It is a small insect, not more than seven millimeters long. The sculpture of the head and thorax is dense, giving these parts a dull appearance. The erect body hairs are well separated, stout, evenly curved and notably shorter than those of the other species. They do not mat together nor do they obscure the parts on which they occur. The antennal scape is less than half as long as the first three funicular joints taken together. As to whether these features can be considered primitive is a debatable point, but it is certainly true that they give to the male of *huachucanus* an appearance which is much more like that of a *Myrmica* male than is usual for a male of *Pogonomyrmex*. It would be interesting to know if the male of *bispinosus* also shows these characteristics. At present this caste appears to be known only from Spinola's original description (5) which is too imperfect to be of much service.

There is one more point that may have a bearing on the primitive status of *huachucanus*. As already noted, several nests of *huachucanus* were excavated to determine their structure. In particular, two of them were completely exposed with all of the passages opened up. I had expected to find stores of seeds in these nests but failed to do so. Yet this species certainly garners seeds, for one occasionally encounters small quantities of chaff on the excavated fans at the nest entrance. It seems possible that the harvesting habit is poorly developed in *huachucanus,* it gathers seeds but it may fail to store them. If true, this would be a further proof of the primitive character of this species. It is to be hoped that additional observations will give us more light on this point. If nests of *huachucanus* can be examined in the fall, winter and spring and not just during the summer months, it should be possible to show the existence of stores of seeds if this ant makes them.

The general features of all three castes of *P. huachucanus* are shown in the figures on Plate 4. The following descriptions deal mainly with details not shown in the above figures.

Worker: Length: head (exclusive of the mandibles) 2.25 mm.; thorax 2.75 mm., overall length 5-5.5 mm.

The entire upper surface of the head covered with wavy longitudinal rugae, those at the middle of the head diverging toward the occipital corners. Over most of the upper surface of the head the rugae rarely form reticulations but on the genae and the posterior quarter of the head they are

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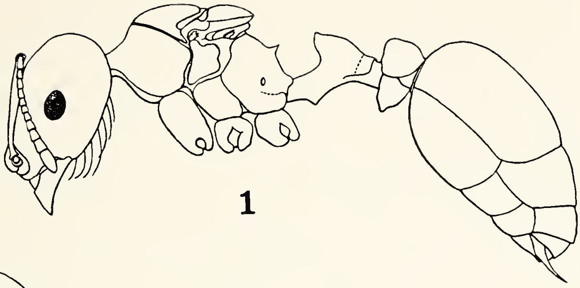
EXPLANATION TO PLATE 8

Pogonomyrmex huachucanus Wheeler. Fig 1. Female. Fig. 2. Worker. Fig. 3. Male. Fig. 4 Head of female. Fig. 5. Head of worker. Fig. 6. Head of male.

Figs. 1-3 are drawn to the same scale; figs. 4-6 are drawn to the same scale.



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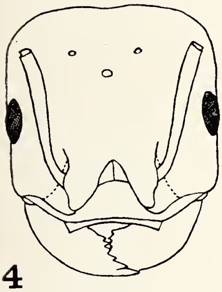

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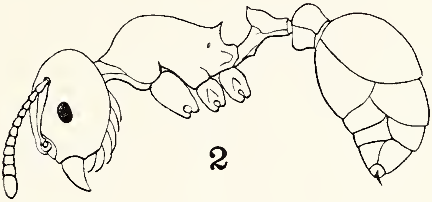

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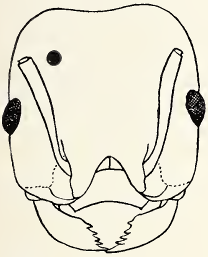

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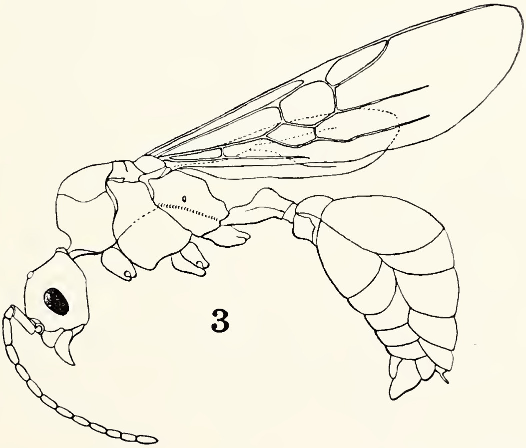

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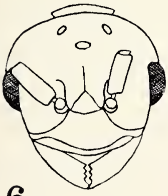

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Creighton—*Pogonomyrmex huachucanus*

distinctly reticulate. The surface between the rugae is densely and minutely granulose with the granules appearing in certain lights as tiny, crater-like rings. The upper surface of the head is dull or very feebly shining except for the anterior ends of the frontal lobes which are rather strongly shining. Mandibles with coarse longitudinal rugae, the surface between the rugae not sculptured, the entire mandible rather strongly shining. Antennal scapes moderately shining with prominent longitudinal rugules.

Thoracic rugae notably reticulate and not parallel on the pronotum. Those on the mesonotum and the mesopleurae also reticulate but with more of a tendency to form roughly parallel, longitudinal ridges. These reticulate rugae turn upward and become transverse on the basal face of the epinotum. The granulate interrugal sculpture of the thorax is more feeble than that of the head and this makes the thorax somewhat more shining than the head. Posterior face of the node of the petiole reticulo-rugose. The interrugal areas, the front of the node and the entire postpetiole densely and finely granulose, dull or at most very feebly shining. Peduncle of the petiole and the coxae with fine punctures which are more widely spaced and do not dull the shining surface. Gaster very strongly shining with minute, widely scattered piligerous punctures. Femora strongly shining with extremely delicate reticulate sculpture. Tibiae more coarsely sculptered and not so strongly shining.

Erect hairs on the upper surface of the head stout, tapered and rather variable in length. Those on the front of the clypeus long and stout, their length equal to that of the longer hairs in the gular ammochaetae. The hairs in the latter structures rather sparse, less than a dozen present at each side of the head. Hairs of the mandibular ammochaetae much shorter and finer than those of the gula. Erect hairs of the thorax very irregular in length, abundant on the promesonotum but sparser on the epinotum, where they are largely confined to an area just behind the meso-epinotal suture. Erect hairs on the petiole and post-petiole very similar to those of the thorax. Erect gastric hairs more uniform in length than those of the thorax, their length increasing gradually from the base of the gaster to its tip. Antennal scapes, coxae, femora, tibiae and tarsi with numerous, somewhat finer, erect hairs. Erect hairs on the antennal funiculi numerous and fine and grading to pubescence on the terminal segments.

Color: deep ferrugineous red to orange red, the mandibular borders piceous brown. Edge of the first gastric segment often marked with brown.

Female: Length: head (mandibles excluded) 1.75 mm.; thorax 2.25 mm.; overall length 7-7.5 mm.

Cephalic sculpture very similar to that of the worker but with the longitudinal rugae at the center of the head finer and more regular. The interrugal sculpture is less pronounced than in the worker so that the entire head, especially the middle third, is more shining than that of the worker. Mandibles and antennal scapes as in the worker.

Thoracic rugae everywhere coarse and prominent except on the neck of the pronotum and the declivious face of the epinotum. The neck of the pronotum is transversely rugulose at its anterior edge. Behind this rugulose area is a band of dense, though shallow, punctures interspersed with extremely delicate rugules which extends back to the coarse, reticulate rugae on the humeral angles. Rugae of the scutum highly variable. In some specimens transverse, in others longitudinal. Rugae of the scutellum usually longitudinal. Mesothoracic sternite and episternite longitudinally rugose, the rugae turning upward on the sides of the epinotum and becoming transverse on the basal face of the epinotum. Declivious face of the epinotum with two or three feeble, widely spaced rugae. Interrugal sculpture of the thorax like that of the worker but a little more feeble so that the thorax is slightly more shining than that of the worker. Sculpture of the petiolar nodes, gaster and legs like that of the worker.

Erect hairs on the upper surface of the head, thorax, petiolar nodes and gaster slightly more numerous than those of the worker. Erect hairs elsewhere very similar to those of the worker.

Color ferrugineous red, the masticatory margin of the mandibles and the lateral edges of the dorsum of the first gastric segment banded with piceous brown.

Male: Length: head (mandibles excluded) 1.25 mm.; thorax 2 mm.; overall length 6.5-7 mm.

Upper surface of the head with fine, wavy, longitudinal rugae over most of its middle third. These rugae form few reticulations. The rugae of the lateral portions of the head, the occipital angles, the entire occipital border and the gula, notably reticulate. The surface between the rugae dull and densely punctured, the punctures appearing as tiny craters under high magnification. Frontal groove, frontal area and the clypeus slightly shining. Mandibles longitudinally striate and a little more shining than the clypeus.

Entire thorax feebly shining to dull with punctato-rugose sculpture, the punctures very dense. Rugae on the pronotum, mesothoracic sternite and episternite feeble, often replaced by punctures on the front part of the segments. Scutum, paraptera and scutellum with moderately developed, longitudinal, reticulate rugae in addition to the dense punctures. Metathoracic sternite with coarse longitudinal rugae which turn upward on the sides of the epinotum. Basal face of the epinotum with coarse, reticulate rugae. Rugae on the declivious face of the epinotum transverse. Anterior peduncle of the petiole finely punctate and more shining than the remainder of the petiole. The anterior face of the node of the petiole densely and more coarsely punctate. Crest and rear face of the node and the posterior peduncle with reticulate rugae in addition to the punctures. Postpetiole densely punctate but not rugose. Abdomen smooth and shining with extremely fine, scattered, piligerous punctures. Coxal joints, antennal scapes, fore femora and tarsi delicately reticulo-punctate. Middle and hind femora with similar but feebler sculpture.

Erect hairs of moderate length, yellow-brown, evenly curved, tapered and well-separated. Abundant on the dorsum of the thorax, except on the basal face of the epinotum, where they are restricted to the angle between the basal and the declivious faces. Erect hairs on the head about equally numerous on the upper and lower surfaces. Erect hairs on the petiolar nodes notably sparser than those of the thorax. Erect hairs on the gaster very fine, much shorter than those of the thorax and largely limited to the rear edge of each segment. The remaining gastric hairs very short and usually fully appressed, rarely a few of them suberect. Antennal scapes and funiculi with dense, short, pubescence.

Color: head, thorax, petiolar nodes and femora piceous black. Antennae, toothed border of the mandibles, tibiae and tarsi blackish brown. Gaster clear, golden yellow.

Wings hyaline, iridescent, the veins and stigma brown in some specimens and white in others. The wings evenly covered with small scattered hairs.

The sexual forms were described from nineteen deälated females and forty-nine males taken by the writer at Springerville, Arizona, July 30, 1950.

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AUDIO MIMICRY: AN ADJUNCT TO COLOR MIMICRY

By Albro T. Gaul
Brooklyn, New York

During the summer of 1951, while I was working on some aspects of Vespine wing muscle physiology, I had the opportunity to study some of the wing sounds of certain Vespine mimics. The work was done at Windsor, Mass., with specimens of *Dolichovespula arenaria* F. (Vespidae) and *Spilomyia hamifera* Lw. (Syrphidae). A comparison of the wing tones of these two species has led to the following considerations.

In color pattern, this fly bears a very close resemblance to the wasp, although the abdomen of the fly is somewhat more robust. It is very difficult for me to tell these species apart when they are in flight. Even when the insects are at rest, the longitudinal fuscous band along the wing of the fly makes visual determination difficult without close scrutiny. It is not known just what, if any, function is served by this likeness; nor can it be definitely determined which insect is the mimic and which the model. It is not a unique relationship between the two genera, since *Spilomyia fusca* Lw. closely resembles *Dolichovespula maculata* Linn. in size and color pattern.

The original wing experiments involved the use of a microphone and an electro-mechanical transducer to pick up wing beat tones and thoracic vibrations. The output from these instruments was played through a high fidelity preamplifier and amplifier system and was then led into the input terminals of either an audio-frequency meter or an oscilloscope. With either instrument it was possible to measure the wing-beat frequencies of the insects. A direct comparison of frequencies was therefore made between the wing tones of *S. hamifera* and *D. arenaria.* The more or less standard wing frequency of workers of *arenaria* is

150 strokes per second; while that of *hamifera* is 147 strokes per second. This places both tones between D and D#. These readings were made with 42 *arenaria* workers and 8 *hamifera* adults. The accuracy of the meter was within 1 cycle per second, at this low frequency range. The variation in the wing beats was within plus or minus 2 strokes per second. Temperature is probably not a factor in wing frequency in insects of this size[1].

With the average wing beat differing by only 2 strokes per second, or 1.33%, it is apparent that the average person, including the author, can detect no significant difference in the sounds produced. Even close attention to sound recordings of the two species cannot show any appreciable distinction. It is thus apparent that there is a new form of mimicry, the mimicry of sounds, which in one case at least accompanies color mimicry.

There is little evidence that the color mimicry of these wasps and flies serves any particular function. Perhaps there is common protection against predators, who have only to learn one color pattern. The introduction of sound mimicry into the picture forces us to accept one of two possible conclusions. Either the similarity of wing tone is a chance phenomenon, or we must postulate a significant function to this similarity of wing beats. In the latter case, we should further have to show that certain predators of *Spilomyia* and *Dolichovespula* can detect their prey through sound ranging but are unable to detect the differences which exist between the two sound mimics.

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PSYCHE

Vol. 59 September, 1952 No. 3

A NEW GENUS AND SPECIES OF SALDIDAE FROM SOUTH AMERICA (HEMIPTERA)[1]

By Carl J. Drake and Ludvik Hoberlandt
Iowa State College, Ames

Through the kindness of Dr. P. J. Darlington, Museum of Comparative Zoology (Harvard), the writers have been permitted to study some undetermined semiaquatic Hemiptera from widely separated areas of the world. The present paper contains the description of a new genus and new species of shore bug found on the beach of a small lake at an elevation of nearly 3,000 meters in the lofty Sierra Nevada de Santa Marta, Colombia, northern South America. The unit of measure is such that the formulas may be converted into millimeters by dividing by 80. The authors are indebted to Mrs. R. E. Froeschner for the illustration of the type.

Oiosalda, n. gen.

Small, elongate-ovate, strongly convex above, remotely indistinctly pitted, black, shining. Head long, slender, almost porrect, slightly deflected, without distinct swellings or callosities, even in front. Eyes moderately large, distinctly excerted, moderately convergent anteriorly, deeply roundly notched within just a little back of the middle, the hind margins slightly removed from anterior margin of pronotum. Ocelli tiny, not placed on a raised area or tubercle, very widely separated, with the width of the space between them about three times the diameter of an ocellus, the space between an ocellus and an eye subequal to or feebly greater than the distance between the ocelli. Pronotum shallowly roundly emarginate behind, the collum not distinctly set-off, also no pronotal lobes;

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

central part of pronotum strongly swollen and very wide, strongly and uniformly convex for its entire length, the swollen area extending laterally so as to leave no explanate margins, the lateral margins very narrow, carina-like, linear for its entire length. Scutellum slightly wider at base than median length. Hemelytra of brachypterous form strongly convex, decurved on the side so as to cover the sides of the abdomen, strongly coriaceous with areas and veins coalesced and obliterated; membrane entirely coriaceous with veins and cells indistinguishable, inseparable from the corium. Rostrum long, reaching between hind coxae. Legs moderately long, rather slender. Antennae rather long, quite slender; segment I moderately incrassate, stoutest; II longest, slender; III and IV slender, scarcely thicker than II. Macropterous form unknown.

Type of genus, *Oiosalda caboti,* n. sp.

Superficially, *Oiosalda* resembles the genus *Lampracanthia* Reuter, but it is easily differentiated by the very slender antennae, smaller and widely separated ocelli, and the indistinctly marked-off collum. In *Lampracanthia,* the antennae are strongly swollen, ocelli larger and approximate, humeral angles acutely produced, and the entire dorsal surface sparsely clothed with long erect hairs. The same characters as noted above also distinguish the new genus from *Salda* Fabricius.

Oiosalda caboti, n. sp.

Brachypterous form: Deep black, smooth, practically nude, very shining, the entire dorsal surface with only a few scattered, very short, inconspicuous, almost fleck-like pubescence of a golden color.

Size: Length, 3.00 mm; width, 1.20 mm.

Head: Width across eyes, 0.60 mm.; median length, 1.20 mm. Interocular space practically subequal to the width of an eye. Head black, feebly rugulose, without median longitudinal groove, without any callosities or strongly swollen areas, with two flavous spots on each side (one between an ocellus and an eye and other farther forward and just back

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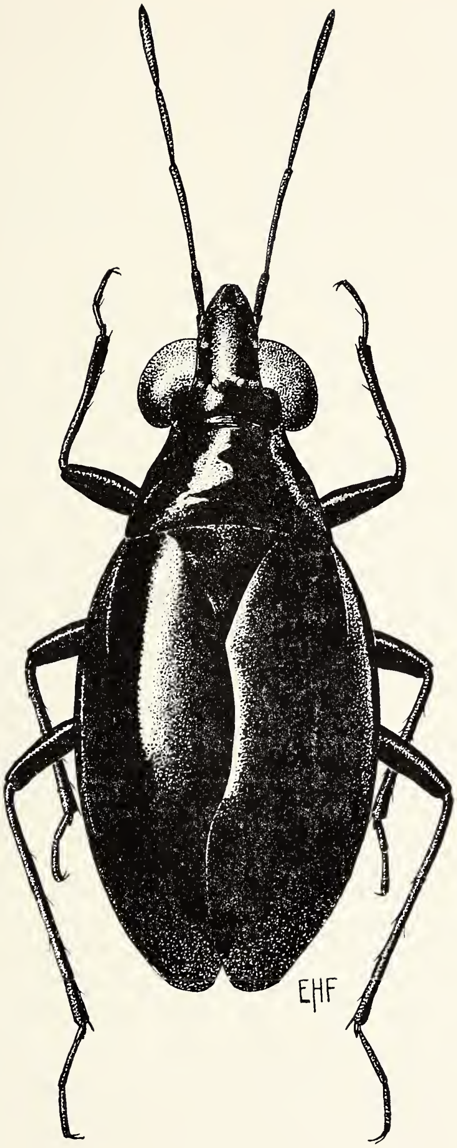
EXPLANATION OF PLATE 9

Oiosalda caboti, new genus and species.



DRAKE AND HOBERLANDT — OIOSALDA CABOTI

of front margin of eyes); clypeus rather narrow not quite twice as long as wide; labrum wide at base, roundly narrowed apically, shield-shaped, pointed at tip, almost twice as long as basal width, the base a little wider than apex of clypeus; apex of head, including labrum and corium, flavous. Rostrum rufo-fuscous, rather slender, extending between hind coxae. Head beneath black, clothed with short pale hairs. Antennae brownish fuscous, pubescent; formula-I, 20; II, 44-48; III, 30; IV, 35.

Pronotum: Pronotum almost twice as wide at base as median length (80:42), median length and width at anterior end nearly equal (42:45); humeral angles not produced or prominent; distinctly convex along its entire length, margins extremely narrow, carina-like, of uniform width from base to apex, very finely pitted. Scutellum almost flat, feebly transversely impressed at middle, a little wider at base than median length (50:40).

Hemelytra: Slightly wider at base than pronotum, decurved downwards on sides so as to envelope abdomen, indistinctly pitted, black, very shining, the outer margins narrowly turned outwards and there slightly embrowned; areas and veins all coalesced and not visible.

Legs: Moderately long, slender, brownish with femora mostly fuscous, sparsely clothed with short pale hairs; tibiae with usual dark brown spines. Acetabula, coxae and sternum black, the metasternum sometimes a little reddish. Abdomen beneath brown to black, clothed with short pale hairs. Male parameres not removed from type. Last venter of female whitish behind.

Type (male) and allotype (female), south side of the Sierra Nevada de Santa Marta, on shore of a small lake, 1941, Colombia, northern South America, collected by Dr. T. D. Cabot, in the Museum of Comparative Zoology (Harvard). Paratype, 1 male, in collection of C. J. Drake. Named in honor of the collector, Dr. Cabot.

This peculiar and striking little shore bug is so different from other species that it was necessary to erect a new genus for its reception; it is thus not readily confused with other described species.

ADDITIONS TO THE MECOPTEROUS FAUNA OF FORMOSA[1]

By Fung Ying Cheng
Harvard University

The scorpion-flies described below are part of a collection secured at several localities in Formosa in 1948.

Family Panorpidae

Panorpa lintienshana, n. sp.

Figures 3-5, 8-10

Vertex black, with a median reddish brown mark posteriorly; rostrum yellowish brown with broad and slightly blackish brown stripe on each side; thorax yellowish brown laterally, blackish brown dorsally, meso- and meta-notum with a broad yellowish brown median band; 1st-6th abdominal segments of both male and female blackish brown dorsally and ventrally, last few abdominal segments yellowish brown, anal horn of male absent. Fore wing: length, 13 mm.; width, 3.2 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete, with a broad basal branch and a separated and reduced apical branch; basal band prominent; apical band broad and ill-defined, represented by many small spots; both basal and marginal spots very small; pterostigma not prominent. Hind wing: length, 12.3 mm.; width, 3.2 mm.; similar to fore wings, except that the basal band, basal spot and marginal spot are entirely lacking. ♂ genitalia: genital bulb oblong; coxopodites rather short; harpagones slender, the outer margins slightly concave at the middle, inner margin with a median angle and a large basal concave area; hypandrium short, branches of hypovalvae slightly divergent, never reaching to the base of the harpagones; parameres simple, stout, each consisting of a single rod, with tooth-like apex and bearing on its inner apical margin a number of distinct stiff hairs and a small dark sharp tooth-like process; pre-

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

ëpiproct slightly narrow towards apex, with deep U-shaped distal incision; aedeagus with truncated apical processes and rounded lateral processes, the inner margins nearly parallel with each other. ♀ genitalia; subgenital plate broad at the middle, narrow towards the apex, with V-shaped distal incision; internal skeleton large, the plate with a pair of elongated less sclerotized areas, the posterior margin of the plate with V-shaped incision, the axis extending beyond the plate nearly half its length.

Holotype (♂): Lin-tien-shan, Karenko, Formosa; May 15-20, 1948; Cheng; in Cheng Collection.

Allotype (♀): Same collecting data as holotype; in Cheng Collection.

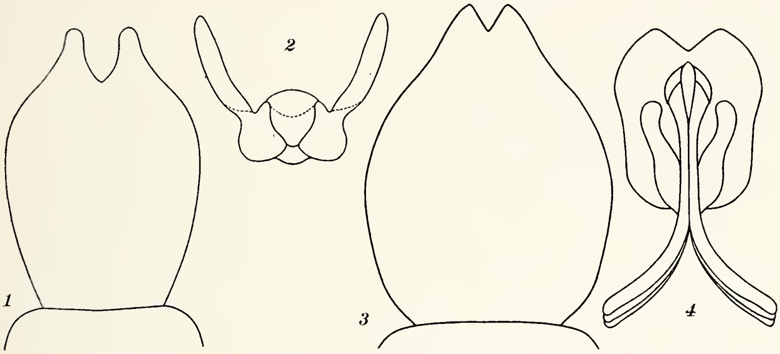
Paratypes: 1♂, 1♀, same collection data as holotype, in the Museum of Comparative Zoology; 4♂♂, 1♀, same collecting data, in the Museum of Taiwan University.

This species, which has the characters of the Formosan *deceptor*-group, is closely allied to *Panorpa angustistriata* Issiki; however, the shape of the parameres of the male and the subgenital plate of the female are quite different from those of the latter.

Neopanorpa k-maculata, n. sp.

Figures 1, 2, 6, 14-16

Body mostly brown; vertex deep brown posteriorly, reddish brown anteriorly with small black mark enclosing ocelli; rostrum uniformly reddish brown; prothorax blackish brown dorsally; meso- and meta-notum yellowish brown with blackish brown median streak and anterior margin; the 1st-5th abdominal segments of male reddish brown dorsally and ventrally, last few abdominal segments long, twice the length of their preceding segments, uniformly reddish brown in color; median process of 3rd tergite small and short, just reaching to the process of the median 4th tergite; the 1st-6th abdominal segments of female blackish brown dorsally, last few segments reddish brown. Fore wing: length, ♂, 18 mm., ♀, 20.5 mm.; width, ♂, 4.5 mm., ♀, 4.8 mm.; membrane slightly brown; markings sooty brown; veins of the basal half of wing mostly sooty brown, those of the apical half show two kinds of colors according to their position, those within the markings usually sooty brown and those situated in the hyaline areas usually yellowish brown; pterostigmal band complete with broad basal branch and apical branch; basal band incomplete, represented by a lower spot and some upper fragmentary thread-like cross-bands along the veins; apical band large with two very small hyaline spots and a lower small additional mark; basal spot absent; marginal spot large, band-like, extended downward to meet the basal branch of pterostigmal band so as to form a K-shaped mark; pterostigma not very prominent. Hind wing: length, ♂, 16.5 mm., ♀, 19 mm.; width, ♂, 4.3 mm., ♀, 4.5 mm.; similar to the fore wing. ♂ genitalia: genital bulb oval; coxopodites short with rounded apex; harpagones long and slender, its median part covered with dense hairs, the outer margin concave at the middle, inner margin with a tooth-like angle and a basal square-shaped lobe; hypandrium rather broad; branches of hypovalvae stout, broadened towards apex, their inner margins bearing dense long hairs, the basal half blackish brown in color, slender, their basal inner margins with a pair of curved ear-shaped lobes, the apical half less sclerotized, more or less hyaline with many dot-like markings, its distal end bent inwardly with rounded apex. Parameres stout, each consisting of a very



Figs. 1-4. Fig. 1. *Neopanorpa k-maculata,* n. sp., subgenital plate of female (allotype). Fig. 2. *Neopanorpa k-maculata,* internal skeleton of eighth segment of female. Fig. 3. *Panorpa lintienshana,* n. sp., subgenital plate of female (allotype). Fig. 4. *Panorpa lintienshana,* internal skeleton of eighth segment of female.

short stalk, which gives rise to two strong branches, the inner branch free, spine-like with sharp and crooked distal apex, the outer branch twice the length of the inner one, its apex united with the outer margin of the aedeagus, the two parameres usually joined basally to each other by a strongly sclerotized U-shaped bar; preëpiproct narrow towards the apex with a shallow V-shaped distal incision, the outer margins slightly concave medially, prolonged downward to form a finger-like lobe distally; aedeagus simple, the apical processes knob-like, extended upward, with a little concave apex, the lateral processes not prominent. ♀ genitalia: subgenital plate broad with deep V-shaped distal incision, the distal outer margin of the plate concave; internal skeleton small, the plate small, less sclerotized, posterior arms finger-shaped with black and stout base, connected to each other by a narrow brown bridge.

Holotype (♂): Ta-shu-lin, Takao Hsien, Formosa; April 27, 1948; Cheng; in Cheng Collection.

Allotype (♀): Same collecting data as holotype; in Cheng Collection.

Paratypes: 7♂♂, 1♀, same locality and date as holotype, Cheng, Yie, in the Museum of Taiwan University; 2♂♂, 1♀, same collecting data, in the Museum of Comparative Zoology.

This species is easily recognized by its K-shaped median wing marking and the peculiar shape of both its male and female genitalia. This is the largest species of all Formosan *Neopanorpa* which I have examined; the female of this species is usually much larger than that of *Neopanorpa magna* Issiki.

Neopanorpa gradana, n. sp.

Figures 7, 11-13

Body yellowish white; vertex yellowish brown with two deep brown marks, the anterior one enclosing the median ocellus, the posterior one behind the lateral ocelli; compound eyes as well as ocelli blue in color; rostrum yellowish brown with deep brown longitudinal stripe on each side of its upper portion; prothorax deep brown dorsally, meso- and meta-notum yellowish white with blackish brown median longitudinal streak; the 1st-6th abdominal segments of male brown dorsally, 6th segment prolonged, 7th and 8th segments nearly same length as 6th segment, yellowish white in color, median process of 3rd tergite short, extending a little beyond the hind margin of the 4th tergite, the middle of 4th tergite protruded to form a convex process. Fore wing: length, 12.5 mm.; width, 3.2 mm.; membrane slightly yellow, markings grayish brown; pterostigmal band complete with broad basal branch and apical branch; basal band represented by two large spots; apical band large with a large hyaline band which crosses the veins to form six cells; basal spots small, two in number; marginal spots three in number, connected to each other;

Figs. 5-7. Fig. 5. *Panorpa lintienshana*, n. sp. (holotype). Fig. 6. *Neopanorpa k-maculata*, n. sp. (holotype). Fig. 7. *Neopanorpa gradana*, n. sp. (holotype).

pterostigma not prominent. Hind wing: length, 11.5 mm.; width, 2.8 mm.; similar to fore wings, except that the basal band is represented only by a single spot and both basal and marginal spots are entirely lacking. ♂ genitalia: genital bulb oval; coxopodites rather long with truncated apex; harpagones rather stout, the outer margin slightly concave at the middle, inner margin with a median rounded protruded portion and a basal produced process; hypandrium very broad; branches of hypovalvae short, slightly contracted basally, rather broad distally, with rounded apices which overlap each other, the outer margins folded upward to form half cone-shaped lobes; parameres consisting of a very weak and slender stalk, which gives rise to two strong branches, the inner branch free with broad lobes distally, the outer branch united with the lateral process of aedeagus; preëpiproct narrow towards apex with shallowly concaved distal margin; apical processes of aedeagus covered with membrane, united together, lateral processes tooth-like, extended upward and strongly sclerotized.

♀ unknown.

Holotype (♂): Karenko, Formosa; March 23, 1948; Hu; in Cheng Collection.

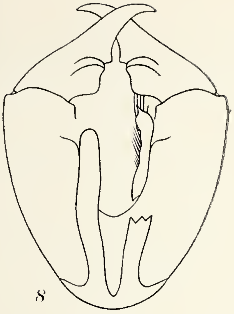
This species is easily recognized by the yellowish white color of the body by the hyaline spots within its apical band, and by the peculiar shape of its male genitalia. This is the smallest species of all Formosan *Neopanorpa* which I have ever seen.

EXPLANATION OF PLATE 10

Figs. 8-10. *Panorpa lintienshana,* n. sp. Fig. 8. Genital bulb of male (holotype). Fig. 9. Preëpiproct of same. Fig. 10. Genital bulb of male, hypovalvae removed (holotype).

Figs. 11-13. *Neopanorpa gradana,* n. sp. Fig. 11. Genital bulb of male (holotype). Fig. 12. Preëpiproct of same. Fig. 13. Genital bulb of male, hypovalvae removed (holotype).

Figs. 14-16. *Neopanorpa k-maculata,* n. sp. Fig. 14. Genital bulb of male (holotype). Fig. 15. Preëpiproct of same. Fig. 16. Genital bulb of male, hypovalvae removed (holotype).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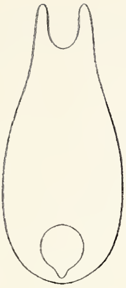
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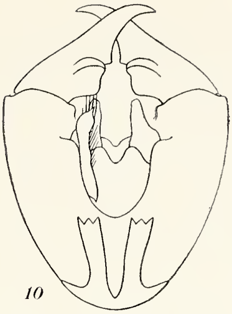
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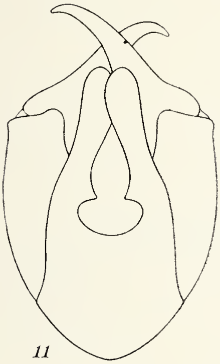
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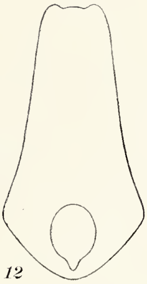
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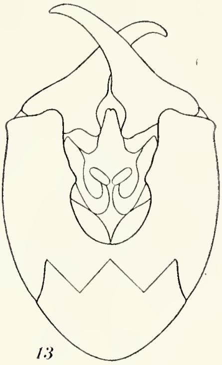
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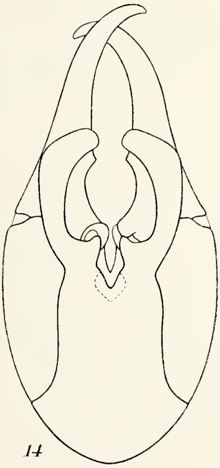
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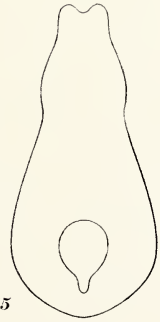
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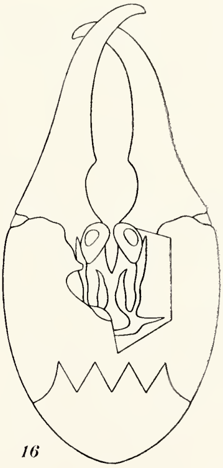
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Cheng — Formosan Mecoptera

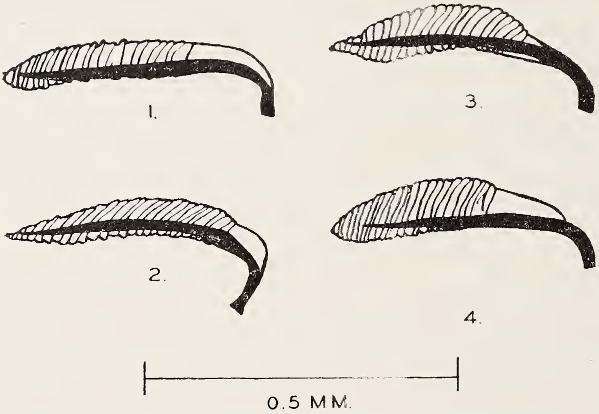
THE TAXONOMIC VALUE OF THE OVIPOSITOR IN THE NEW ENGLAND SPECIES OF THE GENUS *CORYTHUCHA* STÅL (HEMIPTERA: TINGIDAE)

By Albert Edward Feldman* and Norman S. Bailey†
Department of Biology, Boston University

The purpose of this paper is to present evidence that the ovipositor of the New England species in the genus *Corythucha* Stål is of taxonomic value in the separation of the species. This work is based upon a study of thirteen species, of which over 450 whole mounts have been prepared and examined.

I. Procedure for the preparation of the ovipositor

To prepare the entire ovipositor for study the abdomen was first separated from the insect and placed in a cell of a white porcelain spot-plate (Coors #000). Five percent sodium hypochlorite solution was used to clear



Figs. 1-4. Lateral view of valve one. Fig. 1. *C. pergandei.* Fig. 2. *C. marmorata.* Fig. 3. *C. cydoniae.* Fig. 4. *C. pruni.*

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* The material in this paper was included in a thesis written by Mr. Feldman in partial fulfillment of the requirement for the degree of Master of Arts at Boston University.

† Now of Wiscasset, Maine.

the abdomen. Clearing was continued until the last few segments became transparent. Depending on the maturity of the insect, considerable variation in the time of clearing was encountered. A somewhat teneral (incompletely pigmented adult) female cleared sufficiently in 30 minutes whereas an older one required as much as three hours. The specimen was washed, stained with 5 percent acid fuchsin, dehydrated, and mounted ventral side up in permount on a microscope slide.

Preparation of the valves of the ovipositor requires ten minutes. Abdomens from insects previously stored in 70 percent alcohol, can be run up to 95 percent alcohol, then put into absolute alcohol, and clearing agent. With a pair of *minuten nadeln* mounted in needle holders, the valves are dissected and mounted on a microscope slide.

II. Morphology of the abdomen and ovipositor

The abdomen of the female consists of nine segments with a much reduced tenth segment, represented by a pair of lateral plates and a single tergite. Snodgrass[1] showed that in *Anasa tristis* DeGeer the sternum of the first segment is absent; the first ventral plate of the abdomen is therefore the second sternite. This is also true of *Corythucha*. The dorsal aspect of the abdomen is flat but the ventral side is convex. Sternite VII is modified along its posterior medial border to form a single lobe, the subgenital plate. Sternites VIII, IX, and X are paired and modified to form the ovipositor.

In a typical case exhibited by *Corythucha heidemanni* Drake, the ovipositor comprises two fifths of the entire length of the abdomen, the pregenital segments making up the remaining three fifths (figure 18). The shape of the abdomen from the ventral aspect is elliptical. The posterior segments progressively diminish in size so that the terminal part of the abdomen tapers more or less to a rounded point.

From the ventral view the upper pair of valves is valve one. These are symmetrical and possess a score or more ridges over the entire surface except the dorsal side

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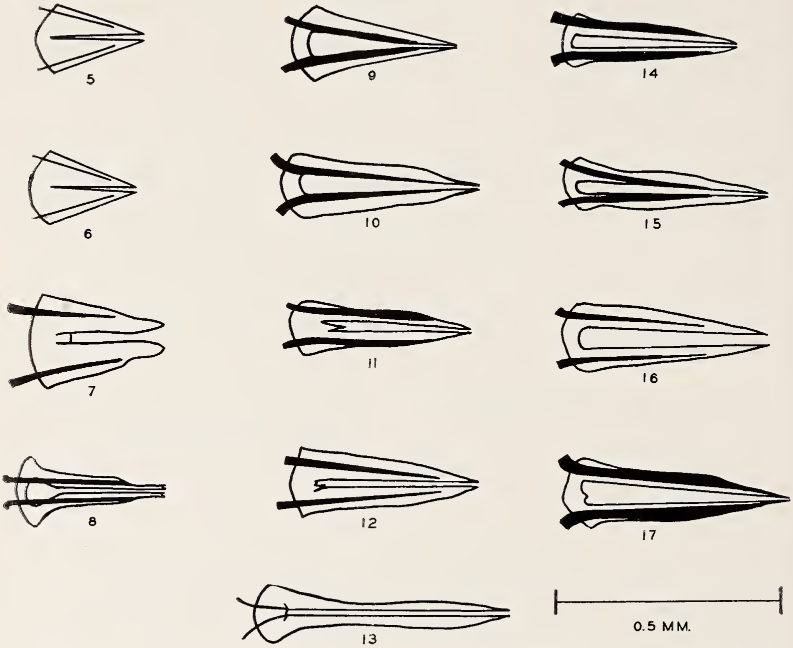
[1] 1933. Morphology of the Insect Abdomen. Part II. The genital ducts and the ovipositor. Smithsonian Misc. Coll., 89(8): 1-148.

and the anterior end of the valve. A fold of tissue connects these two valves along their medial borders. On each valve is inserted a ramus which is a prolongation of the first valvifer, the basal plate or lobe which supports the valves of the ovipositor.



Figs. 5-17. The second valves in ventral aspect. Fig. 5. *C. mollicula.* Fig. 6. *C. arcuata.* Fig. 7. *C. cydoniae.* Fig. 8. *C. marmorata.* Fig. 9. *C. pruni.* Fig. 10. *C. juglandis.* Fig. 11. *C. ulmi.* Fig. 12. *C. caryae.* Fig. 13. *C. ciliata.* Fig. 14. *C. pergandei.* Fig. 15. *C. coryli.* Fig. 16. *C. heidemanni.* Fig. 17. *C. pallipes.*

The first valvifer is rectangular, with a lobed posterior medial margin. The dorsal surface of the first valves bears two parallel ridges; between these is a groove into which fits a ridge on the ventral surface of the corresponding second valve.

The second valves are above or dorsal to the first valves. They are united with each other at their proximal ends by a common base. Valve two is elongate and sharply pointed distally and each valve is connected to the corresponding first valve by a slide and groove arrangement.

The second valvifer is an oblong plate lying lateral and somewhat dorsal to the first valve. Its proximal end fits snugly posterior to the ramus of the first valve. At the distal end of the second valvifer is a much reduced third valve.

In all cases valve one is measured from the most proximal part of its ramus to the distal end of the valve. Valve two is measured from the common base to the distal end.

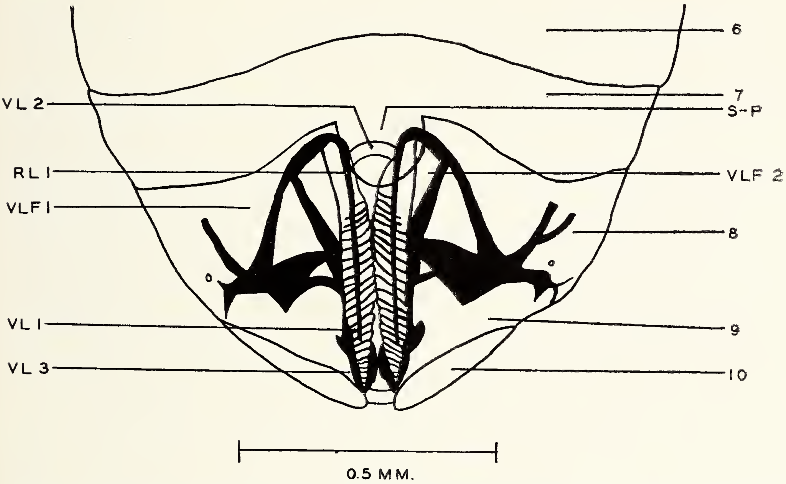


Fig. 18. Ovipositor of *Corythucha heidemanni* Drake in ventral aspect. (Vl 1) valve one, (Vl 2) valve two, (Vl 3) valve three, (Vlf 1) valvifer one, (Vlf 2) valvifer two, (S-P) subgenital plate, (Rl 1) ramus of valve one.

C. arcuata (Say)

The length of valve one varies from 0.29-0.33 mm. and its average length is 0.31 mm. Valve two varies in length from 0.25-0.28 mm. with an average length of 0.26 mm. The shape of valve two is triangular from the ventral aspect (fig. 6). On the basis of the shape of valve two, this species can readily be differentiated from all other species studied with the exception of *C. mollicula*. The second valves of these two species are identical. The subgenital plate is circular.

C. caryae Bailey[2]

The average length of the first valve is 0.50 mm. and it varies from 0.46-0.53 mm. Valve two has a ridge present on the posterior margin of the common base connecting the two valves. Variation in the length of these valves ranges from 0.40-0.44 mm. and the average length is 0.43 mm. Valve two is elongate. The subgenital plate is subcircular and is approximately twice as large as that of *C. arcuata.*

C. ciliata (Say)

This species exhibits the longest valves of any species studied. By comparing the length of each valve of this species with those of other species, *C. ciliata* can readily be separated from all others. The length of valve one ranges from 0.53-0.61 mm. and its average length is 0.58 mm. The configuration of the ventral aspect of valve two affords a second excellent method of separating this species from all others (fig. 13). Its shape is extremely elongate and narrow compared to other species. The average length of valve two is 0.53 mm. and it varies from 0.50-0.56 mm. The subgenital plate is elliptical.

C. coryli Osborn and Drake

The average length of valve one is 0.46 mm. with variation occurring from 0.43-0.48 mm. Valve two is elongate with its anterior lateral angles pointed (fig. 15). Lengths of the latter valve vary from 0.42-0.43 mm. with an average length of 0.43 mm. The subgenital plate is elliptical.

C. cydoniae (Fitch)

The length of valve one varies from 0.36-0.43 mm. and its average length is 0.40 mm. The diagnostic character separating this species from all others is the convex shape of valve one (fig. 3). Valve two varies from 0.31-0.35 mm. and its average length is 0.33 mm. The shape of valve two is very diagnostic since it is unique (fig. 7). The subgenital plate is almost square with the posterior margin rounded.

C. heidemanni Drake

The length of valve one in this species varies from

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[2] 1951. The Tingoidea of New England and their Biology. Ent. Amer., 31 n.s.: 1-140.

0.49-0.52 mm. and its average length is 0.51 mm. Valve two has an average length of 0.45 mm. and its range of variation is 0.44-0.47 mm. The shape of this valve is elongate and its anterior lateral margins are rounded (fig. 16). The subgenital plate is elliptical.

C. juglandis (Fitch)

The length of valve one varies from 0.47-0.53 mm. and its average length is 0.49 mm. Valve two ranges from 0.42-0.47 mm. and its average length is 0.45 mm. The latter valve is elongate and its anterior lateral margins are pointed. The subgenital plate is elliptical.

C. marmorata (Uhler)

On the average, valve one measures 0.39 mm. and its range of variation extends from 0.36-0.41 mm. The shape of this valve in lateral view is unique (fig. 2). Valve two presents an interesting configuration which by itself is highly diagnostic. The anterior halves of these valves together form a shape not unlike that of a mushroom (fig. 8). The average length of the second valves is 0.32 mm. and it varies from 0.30-0.32 mm. The subgenital plate is much broader than long.

C. mollicula Osborn and Drake

Valve one has an average length of 0.31 mm. and its range of variation is 0.29-0.34 mm. The shapes of valves one and two are identical to those of *C. arcuata* (fig. 5). Valve two measures on the average 0.26 mm. and its variation ranges from 0.23-0.28 mm. The subgenital plate is circular.

C. pallipes Parshley

Valve one varies in length from 0.52-0.54 mm. and its average length is 0.54 mm. Valve two varies from 0.47-0.52 mm. and the average measurement is 0.49 mm. The subgenital plate is elliptical.

C. pergandei Heidemann

Valve one varies from 0.44-0.50 mm. with an average length of 0.47 mm. The shape of the distal end of this valve is abruptly pointed (fig. 1). Valve two is elongate and tapers posteriorly (fig. 14). Its measurements vary from 0.37-0.45 mm. and its average length is 0.41 mm. The subgenital plate is elliptical.

C. pruni Osborn and Drake

The average length of valve one is 0.42 mm. with variation between 0.40-0.45 mm. Valve two varies from 0.34-0.41 mm. and its average length is 0.38 mm. Valve two is triangular with a convex base. The subgenital plate is circular.

C. ulmi Osborn and Drake

Valve one varies in length from 0.47-0.44 mm. and its average length is 0.46 mm. Valve two varies in length from 0.32-0.41 mm. and its average length is 0.37 mm. The shape of valve two is elongate and tapers at its distal end. The subgenital plate is elliptical.

III. Characters of taxonomic value

The features of taxonomic value in separating the New England species of *Corythucha* are: the shape of the ventral aspect of a pair of second valves, the length of valve two, the shape of the lateral aspect of valve one, the length of valve one, and the shape of the subgenital plate.

On the basis of the above characters, ten species can be easily separated. The remaining three species which could not be separated in this way are: *C. juglandis*, *C. heidemanni*, and *C. coryli*.

	1 Vl		2 Vl	
C. arcuata	0.31 mm.	(10)	0.26 mm.	(4)
C. mollicula	0.31	(13)	0.26	(9)
C. marmorata	0.39	(12)	0.32	(9)
C. cydoniae	0.40	(13)	0.33	(5)
C. pruni	0.42	(9)	0.38	(3)
C. coryli	0.46	(7)	0.43	(6)
C. ulmi	0.46	(6)	0.43	(6)
C. pergandei	0.47	(17)	0.41	(4)
C. juglandis	0.49	(7)	0.45	(4)
C. caryae	0.50	(11)	0.43	(6)
C. heidemanni	0.51	(13)	0.45	(6)
C. pallipes	0.54	(9)	0.49	(5)
C. ciliata	0.58	(11)	0.53	(6)

Table 1. Average comparative lengths of valves one and two. The numbers in parenthesis indicate the actual number of measurements determined for each case.

IV. A key to the New England species of the genus *Corythucha* Stål based upon characters of the ovipositor.

1. Second valvulae broad, the length of either valve 2 never more than two and one-half times the width of their common base (fig. 5-9) 2

   Second valvulae elongate, the length of either valve 2 at least 3 times the width of their common base (figs. 10-17) 5

2. Common base of the second valves mushroom shaped (fig. 8) . . . . *C. marmorata*
   Not as above 3

3. Base of second valves markedly broad, 0.31-0.35 mm. long, subgenital plate elliptical . . . . *C. cydoniae*

   Base of second valves not so broad, subgenital plate circular 4

4. Second valves larger, 0.34-0.41 mm. long; first valves larger, 0.40-0.45 mm. long . . . . *C. pruni*

   Second valves smaller, 0.23-0.28 mm. long; first valves smaller, 0.29-0.34 mm. long . . *C. arcuata, C. mollicula*

5. Valve 2 extremely elongate; its length at least four times the width of its common base; valve 1 long, 0.53-0.61 mm. . . . . *C. ciliata*

   Valve 2 never more than four times longer than its common base 6

6. Subgenital plate circular . . . . *C. caryae*
   Subgenital plate elliptical 7

7. Distal end of valve 1 abruptly pointed . . . . *C. pergandei*
   Not as above 8

8. Posterior margin of common base of valve 2 with a median projection, valve 2 longer, 0.52-0.54 mm. *C. pallipes*

   Posterior margin of common base of valve 2 with a median ridge, valve 2 shorter, 0.32-0.41 mm. . *C. ulmi*

V. Conclusion

On the basis of the characters of the female genital segments and their appendages, ten of the New England species of *Corythucha* were separated. These were: *C. marmorata, C. cydoniae, C. pruni, C. arcuata, C. mollicula, C. ciliata, C. caryae, C. pergandei, C. pallipes*, and *C. ulmi.* The remaining species could not be separated: *C. heidemanni, C. juglandis,* and *C. coryli.*

Composition of the Ant Tribe Typhlomyrmicini. — In 1911, Emery (Gen. Ins. 118: 32) raised a subtribe of his tribe Ectatommini to include the genera *Typhlomyrmex* Mayr, *Prionopelta* Mayr and *Rhopalopone* Emery, and named this subtribe Typhlomyrmicini. It has already been proposed on morphological grounds that *Prionopelta* be removed to tribe Amblyoponini and *Rhopalopone* remain in tribe Ectatommini, while *Typhlomyrmex* has been seen as the sole group representing an isolated line (Brown, 1950, Wasmann Jour. Biol., San Francisco, 8: 243-244.) The tribal name Typhlomyrmicini is hereby placed in use to include the Neotropical genus *Typhlomyrmex.* Tribal distinction is considered to be complete.

The male specimen without head, doubtfully referred by me in 1950 (*loc. cit.*) to *Prionopelta,* is now definitely recognized as a *Typhlomyrmex* of unknown species. It appears characteristic of *Typhlomyrmex* males that vein Mf1 arises basad of *cu-a.* Other characters of the genus and tribe will be brought out in a forthcoming key to the ponerine genera.

Examination of a cotype ("Zig-zag, Venezuela") of Forel's *Prionopelta marthae* (1909, Deutsch. ent. Zeitschr., p. 240, worker) in the Museum of Comparative Zoology shows that this species must be removed from *Prionopelta* and placed as a **new synonym** of *Typhlomyrmex rogenhoferi* Mayr (1862, Verh. zool.-bot. Ges. Wien 12: 737, worker; 1887, Ibid. 37: 538, ♀ ♂). Comparison was made with workers of *T. rogenhoferi* determined by Mann and Wheeler from Pará, Brazil (Mann *leg.*), and these proved closely similar. The *marthae* type differs distinctly from types of *T. pusillus* Emery and *T. robustus* Emery in the Museum of Comparative Zoology. — William L. Brown, Jr., Museum of Comparative Zoology.

THE ANT LARVAE OF THE MYRMICINE TRIBE MYRMICINI[1]

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The tribe Myrmicini comprises four genera: the New World *Pogonomyrmex,* with some three dozen species; the rare Ethiopian *Cratomyrmex* (which may not even belong in this tribe), with only two species; the common Holarctic (and also Indomalayan) *Myrmica,* with about 30 species; and the Holarctic *Manica* with half a dozen species.

This tribe is interesting partly because it includes harvesters (*Pogonomyrmex* and *Cratomyrmex*), but chiefly because it is the most primitive tribe of the subfamily Myrmicinae. (Wheeler, Bull. Mus. Nat. Hist. 45:660. 1922). Wheeler (*ibid.,* p. 24) regarded *Hylomyrma* as the most primitive genus in the tribe, with *Pogonomyrmex* next. Emery (Genera Insectorum, 1921-22), however, placed the Metaponini first, the Pseudomyrmini second and the Myrmicini third; within the Myrmicini he put *Myrmica* first, *Cratomyrmex* second and *Pogonomyrmex* third; *Hylomyrma* is treated as a subgenus of *Pogonomyrmex.* Our studies on the larvae support Wheeler's arrangement of *Pogonomyrmex* and *Myrmica. Pogonomyrmex* larvae are certainly more primitive than *Myrmica* larvae, as is evidenced by the following characters: the lack of anchor-tipped hairs on the abdomen; spinules on the posterior surface of the labrum coarse and isolated; mandibles stouter, with two large coarse mesal teeth and without mesal blade or concavtiy.

In this article we have described the larvae of three species of *Pogonomyrmex* and eight species of *Myrmica.* References from the literature are cited for one other genus and five additional species making a total of three genera and sixteen species considered.

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

Tribe MYRMICINI (F. Smith)

Stout; diameter greatest at the fourth or fifth abdominal somite; slightly attenuated anteriorly; thorax very stout (when mature) and arched or bent ventrally, but not differentiated into a neck; posterior end broadly rounded. Antennae each with three (rarely two or four) sensilla, each of which bears a stout spinule. Head hairs short to long; mostly denticulate. Labrum small and short; breadth twice the length; bilobed; anterior surface of each lobe with 2-5 minute hairs and 1-5 sensilla; posterior surface spinulose and with 8-18 sensilla. Mandibles rather small or moderate-sized (ratio of head width to mandible length 2.1-2.9, average 2.5); stout (ratio of length to width at base 1.8-2.4, average 2.1); heavily sclerotized; no spinules. Apex of maxilla usually spinulose; palp and galea paxilliform, bearing respectively five and two sensilla; palp slightly shorter than or equal to galea. Anterior surface of labium usually spinulose; palp a low elevation bearing four or five sensilla; opening of sericteries a short transverse slit (concealed in a groove). Hypopharynx usually sparsely spinulose, the spinules minute and generally in transverse rows.

Genus *Pogonomyrmex* Mayr

Stout; diameter greatest at the fourth or fifth abdominal somite; slightly attenuated anteriorly; thorax very stout (when mature) and arched or bent ventrally, but not differentiated into a neck; posterior end broadly rounded; anus terminal or subterminal. Body hairs moderately numerous; mostly denticulate; anchor-tipped hairs lacking. Antennae each with three sensilla, each of which bears a stout spinule. Head hairs short to long; sparsely denticulate on the distal half. Labrum small and short; breadth twice the length; bilobed; anterior surface of each lobe with two or three minute hairs and 3-5 sensilla; ventral border of each lobe spinulose and bearing two contiguous sensilla; posterior surface with a few coarse spinules and numerous sensilla. Mandibles with the apex forming a rather long and moderately slender tooth which is round-pointed and which tapers slightly.

Wheeler & Bailey, 1920, p. 251: "Certain agricultural ants, which feed on seeds (*Pogonomyrmex, Messor*) also nourish their young with the same food."

Wheeler (1928, p. 202) stated that the larvae of this genus are fed with fragments of seeds, but the very youngest larvae are fed on regurgitated food. (=1926, p. 243.)

Pogonomyrmex barbatus (F. Smith)
(Pl. 11, figs. 14-22)

Stout; diameter greatest at the fifth abdominal somite, slightly attenuated anteriorly; thorax very stout and arched ventrally but not differentiated into a neck; posterior end broadly rounded. Anus subterminal. Leg, wing and gonopod vestiges present. Nine differentiated somites. Integument sparsely spinulose on the ventral surface of mesothorax, metathorax and anterior abdominal somites and on the dorsal surface of the last few abdominal somites. Body hairs moderately numerous and rather uniformly distributed; with the distal half finely denticulate. Of two types: (1) short (0.05-0.12 mm), uniformly distributed; (2) long (0.31-0.42 mm), moderately abundant on the ventral surface of the thorax, elsewhere reduced to a single row around the middle of each somite. Cranium subcircular in anterior view, but with the genal outlines somewhat flattened. Antennae small slightly raised discs each with three sensilla, each of which bears a moderately long sharp spinule. Head hairs numerous, short to long (0.045-0.14 mm), with the distal half sparsely denticulate. Labrum small and short (breadth 2X length), bilobed, not narrowed ventrally; anterior surface of each lobe with two minute hairs, five isolated sensilla and a few minute spinules; ventral border of each lobe with two sets of two contiguous sensilla and a few spinules; posterior surface of each lobe with two contiguous and about five scattered sensilla, sparsely spinulose, the spinules coarse and isolated or in short rows. Mandibles robust and heavily sclerotized; apical tooth moderately long, moderately slender, tapering only slightly to a round point; medial teeth short, robust and round-pointed, the proximal curved medially and posteriorly, the distal pointed anteroventrally. Maxillae with the apex conoidal and spinulose, the spinules minute and isolated or in short rows; palp paxilliform with four apical and one lateral sensilla; galea paxilliform with two apical sensilla. Labium with the anterior surface spinulose, the spinules minute and isolated or in short transverse rows; palp a short protuberance with five apical sensilla; opening of sericteries a short transverse slit (concealed in a groove). Hypopharynx sparsely spinulose, the spinules minute and in short subtransverse rows. (Material studied: numerous larvae from Texas.)

Forel, 1921, Fig. 1B on p. 23; larva in side view (after Wheeler). (=1928, Vol. I, Fig. 1B.)

Wheeler, 1900: "Still another modification of the 'poils d'accrochages' is seen in *Pogonomyrmex barbatus*, the young larvae of which have the longer bristles serrate on the apical half, so that they remind one of the hairs of certain mammals" (p. 21). Fig. 9*a*, nearly mature larva; *b*, young larva; *c*, hair of latter (p. 20).

Wheeler, 1910: Fig. 42 on p. 76 repeats 1900, fig. 9; Fig. 36 on p. 70, photograph of five larvae. "The larvae, as in *E. imberbiculus*, are fed with pieces of crushed or broken seeds. In my artificial nests these pieces were coated with saliva by the workers before being administered to the brood, a precaution which may insure the conversion of starch into sugar and facilitate its assimilation by the larvae" (pp. 290-291).

Wildermuth and Davis, 1931: The larvae are "cream

Explanation of Plate 11

Pogonomyrmex occidentalis (Cresson), Figs. 1-13,—1, head in anterior view, X44; 2, labrum (left half of drawing shows posterior view, right half, anterior view) X118; 3, labium in anterior view, X118; 4, right labial palp in anterior view, X340; 5, left mandible in anterior view, X118; 6, left mandible in medial view, X118; 7, left antenna in anterior view, X340; 8 and 9, two long denticulate body hairs, X95; 10, mature larva in side view, X10; 11, simple body hair, X95; 12, short denticulate body hair, X95; 13, submature larva, X10.

Pogonomyrmex barbatus (F. Smith), Figs, 14-22. — 14, head in anterior view, X44; 15, labrum (left half of drawing shows posterior view, right half, anterior view) X118; 16, left mandible in anterior view, X118; 17, left mandible in medial view, X118; 18, right antenna in lateral view, X340; 19, right antenna in anterior view, X340; 20, mature larva in side view, X10; 21, submature larva in side view (hairs omitted), X10; 22, two body hairs, X95.


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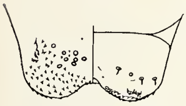
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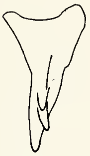
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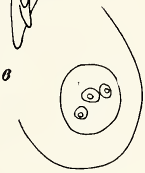
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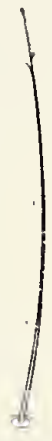
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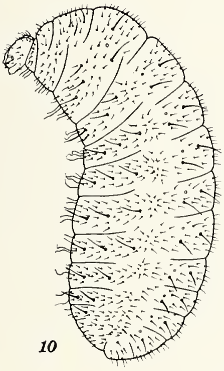
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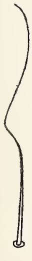
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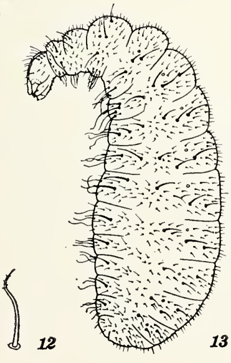
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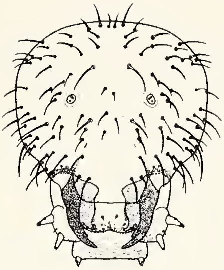
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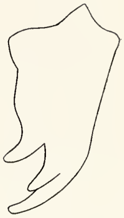
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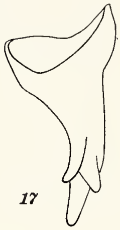
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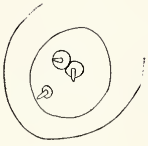
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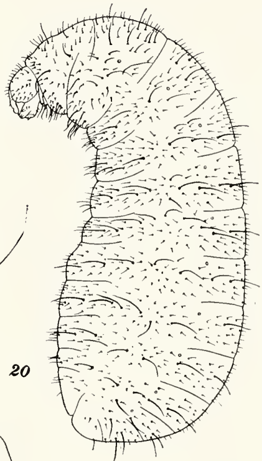
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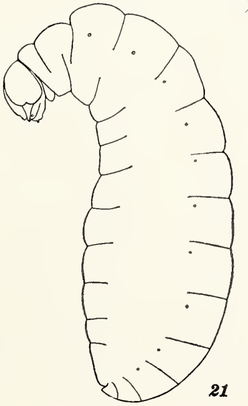
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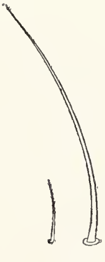
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colored and are shaped like crooknecked squashes, the smaller crooked portion ending in a very small head. The length of the full-grown larva, not including the portion turned back is about one-fourth of an inch" (p. 3). Fig. 1D, larva in side view.

Pogonomyrmex occidentalis (Cresson)

(Pl. 11, figs. 1-13)

Stout; diameter nearly uniform throughout but with the thorax somewhat attenuated and bent ventrally; no neck; posterior end broadly rounded. Anus terminal. Leg, wing and gonopod vestiges present. Nine differentiated somites. Body hairs moderately numerous, uniformly distributed. Of three types: (1) short (0.036-0.08 mm), with the distal half finely denticulate and the base stout to slender, uniformly distributed; (2) long (about 0.27 mm) hairs with the distal half finely denticulate; a few in a single row around the middle of each somite and also on the venter of the prothorax and of the last abdominal somite; (3) smooth and long (0.18-0.35 mm), with slender base and long flexible tip, restricted to the ventral surface. Cranium transversely subelliptical, somewhat broader than long. Antennae small slightly raised discs, each with three sensilla, each of which bears a short stout spinule. Head hairs moderately numerous, short, to long (0.045-0.11 mm), sparsely denticulate on the distal half. Labrum small and short (breadth 2X length), bilobed, somewhat narrowed ventrally; anterior surface of each lobe with three minute hairs, an isolated sensillum near the middle and a pair of contiguous sensilla near the ventral border; ventral border of each lobe with spinules and a pair of contiguous sensilla; posterior surface of each lobe with three or four isolated and one or two sets of two or three sensilla each and a few coarse and mostly isolated spinules. Mandibles robust, heavily sclerotized; apical tooth long, tapering only slightly to a rounded point; the two medial teeth are shorter but still quite long, subequal and round-pointed. Maxillae with the apex paraboloidal and spinulose, the spinules coarse and isolated; palp paxilliform with two apical, two subapical and one lateral sensilla; galea paxilliform, shorter than palp, with two apical sensilla. Labium with the anterior surface moderately spinulose, the spinules minute and isolated or in short transverse rows; palp a stout subcone bearing three apical and one lateral sensilla; opening of sericteries a short transverse slit (concealed in a groove).

SUBMATURE: Shaped somewhat like a crookneck squash, the thorax forming a moderately slender neck which is strongly arched ventrally, the abdomen elongate, subellipsoidal and moderately stout; posterior end narrowly rounded. Anus subterminal. Otherwise as in the mature larva.

(Material studied: numerous larvae from North Dakota.)

Pogonomyrmex (*Ephebomyrmex*) *imberbiculus* Wheeler

Wheeler, 1902, p. 90: House flies were "cut into pieces and fed to the larvae in the same manner as I have described for the Ponerinae and some Myrmicinae. On one occasion nearly every larva in the nest could be seen munching a small piece of house fly. But a still more remarkable method of feeding was adopted after a few days, when the supply of insect food was exhausted. Then the ants were seen to bring seeds from their granary, crack them open with their strong mandibles, and, after consuming some of the softer portions themselves, to distribute the remainder among their larvae. The latter could be seen under the lens cutting away with their mandibles and devouring the softer starchy portions of the seeds . . These observations show that *the larvae of certain ants are not only able to subsist on solid food, but even on food of a vegetable nature.* The adaption of what were probably once exclusively carnivorous ants to a vegetable diet, although not yet complete, is, nevertheless, so far advanced that the larva already participates in the peculiar feeding habits of the adult insect. The *P. imberbiculus* seem not to possess the power of feeding one another or their larvae by regurgitation. At any rate they were not seen to make use of this method in the artificial nests." (Brief mention by Wheeler, 1910, p. 284 and 1933, p. 15 and by Wheeler and Bailey, 1920, p. 251.)

Pogonomyrmex (*Ephebomyrmex*) *naegelii* Forel

Eidmann, 1936, p. 39: "Die spärlich beborsteten Larven zeigen ebenso wie die nackten Puppen keine bemerkenswerten Besonderheiten."

Pogonomyrmex (*Forelomyrmex*) *mayri* Forel

Apparently similar to *occidentalis* except for the following characters: Head oval in anterior view, somewhat longer than broad. Head hairs few. Anterior surface of each lobe of labrum with two minute hairs and four sensilla; posterior surface with five scattered sensilla on each lobe. Mandibles larger and more elongate, the medial teeth more blade-like. Labial palp with four apical and one lateral sensilla. (Material studied: three integuments (without hairs) from Colombia.)

Genus *Myrmica* (Latreille)

Stout; diameter greatest at the fifth abdominal somite; slightly attenuated anteriorly; thorax very stout and arched ventrally, but not differentiated into a neck; posterior end broadly rounded; anus posteroventral. Body hairs sparse; minute to long, of three types — (1) simple, (2) denticulate and (3) anchor-tipped; anchor-tipped hairs in transverse rows of 2-4, restricted to the dorsal surface of the 5-8 anterior abdominal somites, one row on each somite. Antennae each with three (rarely two or four) sensilla, each bearing a stout spinule. Head hairs few, short to long, mostly denticulate. Labrum small and short, breadth twice the length; bilobed; anterior surface of each lobe with 2-4 minute hairs and usually one or two sensilla; ventral border of each lobe with two sets of two contiguous sensilla each; posterior surface with minute spinules arranged in rows and with 8-18 sensilla. Mandibles with the apical third stout, sharp-pointed and slightly curved medially; anterior surface produced mesally into a thin blade, which usually bears one small stout tooth and which may be denticulate near the base; mesal surface concave.

Adlerz, 1886: "Some larvae with hairs shorter and simple or moderately branched at the tip, some with longer hairs which are either provided with short lateral spines or are shortly branched at the tip. The tips of the uncinate hairs vary but the anchor-like shape is the most common" (p. 259; translated from Swedish by Professor Edith E.

Larson). Transitional types occur (p. 258). Pl. 7, fig. 6, four hair tips. Internal anatomy, p. 58.

Donisthorpe, 1915, p. 109: "Yellow, narrow anteriorly, broad posteriorly; the segments gradually increasing in width until quite close to the base. The whole body covered with hairs, which are much more abundant in the young larvae. The first to the sixth abdominal segments are furnished on the dorsum with a pair of long anchor-tipped hairs, which are generally absent in the full-grown larvae. Some of the other long hairs possess a single hook instead of an anchor-tip, some hairs are serrate, and some bifurcate or trifurcate." (Repeated 1927*a*, p. 117.) Fig. 44 on p. 32 in both editions: Two hairs "on *Myrmica* larva".

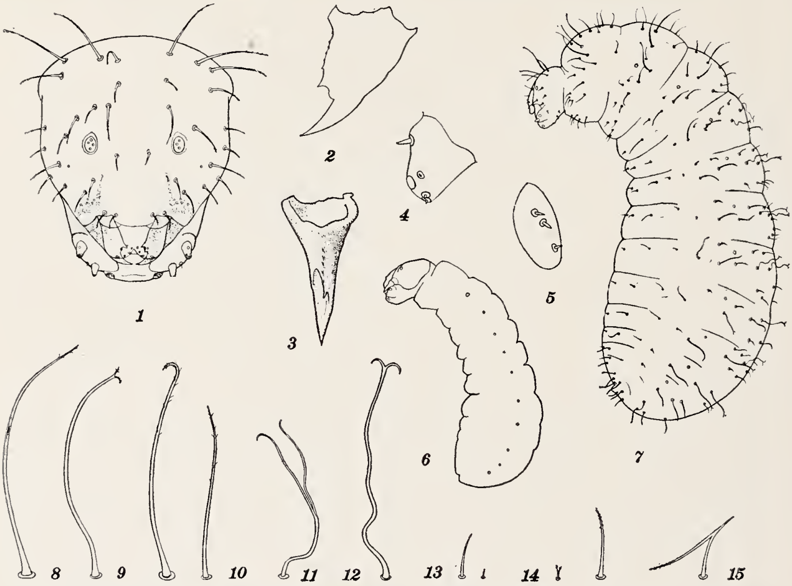
Donisthorpe, 1927*b*: Staphylinid beetles of the genus *Atemeles* prey upon the larvae of *Myrmica* (p. 17). Staphylinid beetles of the genus *Lamprinus* and their larvae devour *Myrmica* larvae (p. 72).

Janet, 1904, pp. 31-32: "Quant aux petites larves, elles s'accrochent les unes aux autres par des poils spéciaux. Chez la Myrmica, et chez bon nombre d'autres Myrmicidae, cet accrochage se fait par de longs poils terminés par des crochets simples ou double. Ces poils sont disposés régulièrement en petit nombre sur chaque anneau. Les nouveaux poils, formés à la suite d'une mue, ne sont pas exactement semblable à ceux de la cuticule exuviée."

Stärcke, 1948, pp. 26 and 28: "The ordinary hookform with the head bent perpendicularly to the body or even a little further, the thoracal segments ranged fan-like, the abdomen next without any special demarcation, straight, and only the extremity a little swollen, with some whitish spots of urate cells shining through. Usually the head is for one third sunk into the prothorax. With the fullgrown larva, the head grows still more into the prothoracical segment, until more than half its volume is situated there . . . There are 13 postcephalic segments of which the last 3 or 4 are not clearly marked. Newly emerged larvae are portly and hooklike from the start . . . The head, of a 3 mm larva is 0.42 mm long and at the rear end 0.36 mm broad, the mouth parts are 0.24 mm broad. The most protruding part is the distal sensilla-turret of the maxilla, but the labrum and mandibula do not stay back very far."

Myrmica emeryana Forel
(Text fig. 1, figs. 1-3 and 6-15)

Stout; diameter greatest at the fifth abdominal somite, slightly attenuated anteriorly; thorax very stout and arched ventrally but not differentiated into a neck; posterior end broadly rounded. Anus posteroventral. Leg, wing and gonopod vestiges present. Eleven differentiated somites. Integument spinulose on the dorsal surface of the posterior somites and on the ventral surface of the mesothorax, metathorax and first few abdominal somites; the spinules sparse and minute, isolated or in short transverse rows.



Text figure 1. *Myrmica emeryana* Forel, Figs. 1-3 and 6-15. — 1, head in anterior view, X67; 2, left mandible in anterior view, X185; 3, left mandible in medial view, X185; 6, very young larva in side view (hairs omitted), X20; 7, mature larva in side view, X20; 8-10, four long denticulate body hairs, X121; 11, an atypical body hair, X121; 12, anchor-tipped body hair, X121; 13, two simple body hairs, X121; 14, two small denticulate body hairs, X121; 15, and atypical denticulate body hair, X121.

Myrmica monticola Wheeler, Figs. 4-5. — 4, left maxillary palp in lateral view, X340; 5, right antenna in lateral view, X340.

Body hairs sparse, somewhat sparser on the ventral surface of the abdomen, minute to long. Of three types: (1) simple, minute to short (0.003-0.054 mm), generally distributed; (2) denticulate, minute to long (0.012-0.28 mm), the most abundant type, (3) anchor-tipped, long (about 0.28 mm), with the shaft flexuous, four in a row across the dorsal surface of each abdominal somite I-VIII. The denticulate hairs are extremely variable, the denticles may be few to numerous, limited to the tip or extending halfway to the base, closely applied to the shaft or suberect, the tip may be nearly straight, strongly curled or bifid. Only simple hairs are found on the ventral surface. Cranium as broad as long, broadest at the dorsal corners which bulge laterally, occipital outline rounded. Antennae with three (rarely four) spinulose sensilla each. Head hairs few, short to long, longest near the occipital border. Of two types: (1) denticulate, 0.05-0.21 mm; (2) simple, 0.035-0.07 mm. Labrum small, short (breadth 2X the length), bilobed, somewhat narrowed ventrally; anterior surface of each lobe with three or four minute hairs and a sensillum; ventral border with two sets of two contiguous sensilla each; posterior surface of each lobe with a central spinulose area, the spinules minute and in short transverse rows; six or seven scattered sensilla on the posterior surface of each lobe. Mandibles rather small and heavily sclerotized; distal third forming a stout, sharp-pointed apical tooth which is curved medially and which has a concavity on its mesal surface; anterior surface produced medially into a narrow blade, the edge of the blade variable but usually with one small, stout tooth near the base of the apical tooth and with a few denticles on the proximal half. Maxillae with the apex paraboloidal; palp a skewed peg with two apical, two subapical and one lateral sensilla; galea a frustum with two apical sensilla. Labial palp a low rounded elevation with five sensilla; opening of sericteries a short transverse slit (concealed in a groove). Hypopharynx with a very few rows of minute spinules. (Material studied: numerous larvae from Massachusetts, Michigan and North Dakota.)

YOUNG: Length 2 mm. Similar to the mature larva except in the following details: Body curved ventrally. Anchor-tipped hairs may occur on the mesothorax and metathorax (2-4 on each) and the long denticulate hairs on the lateral surfaces of the mature larvae may be replaced by anchor-tipped hairs to a total of eight per somite. No spinules on the ventral surface.

Myrmica americana Weber

Similar to *emeryana* except in the following details: Hairs about twice as numerous on the thorax and four times as numerous on the abdomen. Anchor-tipped hairs usually reduced to two per somite and restricted to abdominal somites I-V, even some of these may be replaced by hairs with bifid denticulate tips. Posterior surface of labrum more generally spinulose; posterior surface of each lobe with five isolated and a cluster of two to four agglomerated sensilla. Mandibles with the apical tooth more slender and the mesal border serrate. Labium with anterior surface sparsely spinulose, the spinules minute and in short transverse rows. Hypopharynx sparsely spinulose, the spinules minute and in widely spaced transverse rows. (Material studied: numerous larvae from North Dakota.)

Tanquary, 1913, Pl. LXIV, fig. 36: an embryo just before hatching. The ant was called *M. sabuleti.*

Myrmica brevinodis Emery

Similar to *emeryana* except in the following details: Simple body hairs attain a much greater length (0.009-0.25 mm), the denticulate hairs are not so short (0.072-0.25 mm), anchor-tipped hairs only two per somite. Posterior surface of labrum sparsely spinulose throughout, the spinules minute and in short transverse row basally, while the distal rows become arcuate and form a reticulate pattern; the posterior surface of each half with two isolated and two agglomerated sensilla. Apical tooth of mandible sharper and more curved medially. Labium with the anterior surface spinulose, the spinules in short transverse rows. Hypopharynx sparsely spinulose, the spinules minute and in a few short transverse rows.

Male larva similar to worker larva but larger.

(Material studied: numerous larvae from Connecticut and North Dakota.)

Wheeler (1907) stated that the larvae and immature pupae of var. *sulcinodoides* Emery had a peculiar greenish yellow color and oily luster, which he had not observed in any of the other varieties (p. 75). The larvae and young pupae of var. *canadensis* Wheeler were pearly white (p. 77).

Myrmica brevispinosa Wheeler

Similar to *emeryana* except in the following details: Simple body hairs all minute (about 0.003 mm); anchor-tipped hairs reduced to two per somite and restricted to abdominal somites I-VI. Head with the genal borders nearly straight. Posterior surface of labrum completely but sparsely spinulose, the spinules longer than in *emeryana* and in longer rows; each lobe with two to three isolated and a cluster of two or three contiguous sensilla. Anterior surface of labium with numerous short arcuate rows of minute spinules. Hypopharynx with minute spinules in moderately long subtransverse rows. (Material studied: two larvae and one semipupa from North Dakota.)

Myrmica lobicornis fracticornis Emery

Similar to *emeryana* except in the following details: Simple body hairs shorter (0.003-0.036 mm); denticulate hairs longer (0.045-0.32 mm); anchor-tipped hairs shorter (0.21 mm), restricted to the dorsal surface of abdominal somites I-VII. The cranium lacks the dorsolateral bulges. Posterior surface of labrum more generally spinulose; posterior surface of each lobe with four isolated and one set of two contiguous sensilla. (Material studied: a dozen larvae from North Dakota.)

Myrmica monticola Wheeler

(Text fig. 1, figs. 4-5)

Similar to *emeryana* except in the following details: Abdominal hairs twice as numerous. Denticulate hairs 0.036-0.18 mm long; anchor-tipped hairs shorter (0.18 mm) and restricted to abdominal somites I-V. Head hairs all denticulate. Labrum narrowed dorsally; posterior surface sparsely spinulose, the spinules minute and in subtransverse rows. Mandibles without denticles on the proximal half of the mesal border. Apex of maxillae sparsely spinulose, the spinules isolated and rather coarse. Anterior surface of the labium with a few minute spinules in short transverse rows. Hypopharynx sparsely spinulose, the spinules minute and in short transverse rows. (Material studied: numerous larvae from North Dakota)

Myrmica rubra (Linnaeus)

Adlerz (1886, p. 52) stated that overwintering larvae were remarkably hairy. (Referred to as *ruginodis.*)

Donisthorpe, 1915 (=1927), Pl. I: an excellent photograph of a larva in side view. (Referred to as *ruginodis.*)

Gösswald (1934/35, p. 125) has recorded this species as a mermithid host; presumably the nematode larvae had been parasitic in the ant larvae. (Referred to as *ruginodis.*)

Hagmeier (1912, p. 529) reported the larvae of the nematode *Mermis brevis* Hagmeier in the larvae of this ant.

Janet, 1904, Fig. 11 on p. 32: hairs. The one-hooked hair is refigured by Escherich 1906, Fig. 32 (=1917, Fig. 38B).

Latreille, 1802, p. 7: "La larve ressemble à un petit ver sans pied, dont le corps est composé de douze anneaux, et dont la tête est ordinairement penchée vers la poitrine."

Lubbock (1882, p. 7) observed a larval period of less than a month. (Mentioned by Adlerz, 1886, p. 53) (Referred to as *ruginodis.*)

Schwammerdam, 1693, Pl. IX: Fig. III shows a larva (probably *rubra*) in ventral view; Fig. IV, in side view.

Stärcke (1948, p. 29) compared this larva with that of *M. schencki*: "Oncochaetae occur on Th. II and Th. III also, and on 7 abdominal segments, and they are longer, with 3 larvae 222 Micron was found. The Acrochaeta measures 91 to 128 Micron, exceptionally 164 (length of larva 1.57 mm, head 0.38 mm)." (Referred to as *ruginodis.*)

Myrmica rubra laevinodis Nylander

Similar to *emeryana* except in the following details: Anchor-tipped body hairs restricted to the dorsal surface of abdominal somites I-VI. Head hairs shorter (0.009-0.13 mm). Labrum narrowed dorsally; anterior surface of each lobe with two minute hairs and one or two isolated sensilla; posterior surface of each lobe with one or two sets of two or three contiguous sensilla and two or three isolated sensilla; the whole posterior surface sparsely spinulose, the spinules minute and in subtransverse rows. Hypopharynx sparsely spinulose, the spinules minute and in short subtransverse rows. (Material studied: numerous larvae from Massachusetts.)

DeGeer, 1778, Pl. XLIII: Fig. 7, larva in side view; Fig. 8, head showing antennae ("yeux"), mandibles ("dents") and maxillary palp and galea ("barbillons"). Probably *laevinodis*.

Donisthorpe, 1927*b*, pp. 116 and 118: The caterpillars of *Lycaena arion* L. pass the winter in the nests of this ant and devour its larvae.

Eidmann, 1943, p. 224: This species overwinters with larvae.

Gösswald (1934/35, p. 125) reported this species as a host of mermithids. Presumably the nematode larvae were parasitic in the ant larvae.

Myrmica sabuleti Meinert

Chapman (1915/16): See under *scabrinodis*.

Stärcke, 1948, p. 29: The larva of this species "does not show any perceptible difference as to hairs with that of *M. schencki*". Figs. 20, 22, 24, 33 and 34.

Myrmica scabrinodis Nylander

Chapman (1915/16) found that the larvae of *M. scabrinodis* var. *sabuleti* were preyed upon by the caterpillars of *Lycaena arion* L. Plates XL, XLI, XLVII, XLVIII and XLIX are photomicrographs which show fragments of ant larvae in the feces of the caterpillar. Donisthorpe (1927*b*, pp. 116 and 118) and Wheeler (1928, p. 260 = 1926, p. 313), in discussing this relationship, refer to the ant as *M. scabrinodis*.

Donisthorpe, 1915 (=1927) Fig. 43 on p. 31: Part of the larval head. This figure is inaccurate in that the labium and antennae are shown on the same surface of the head.

Eidmann, 1943, p. 226: Larvae overwinter in the nest.

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

Myrmica schencki Emery

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

Stärcke, 1948: "Hairs. These are of three types. 1. ACROCHAETAE, straight or only slightly curved, pointed. Looked at through the immersion lens they appear to be armed with a number of very short and small thorns. Length 164-183 Micron, exceptionally up to 219 Micron. 2. MICROCHAETAE. Just the same, but shorter, 73-128 Micron, occasionally even shorter still. 3. ONCOCHAETAE (WHEELER; APTOCHETE MENOZZI 1936), simple and flexible, not pointed but tipped with double hooks in the shape of an anchor. Length 164-201 Micron. With the living larva or the larva kept in formaline they are straight, but as most investigators keep their larvae in alcohol, in which the oncochaetae shrink and become flexuous, they have been pictured that way by most authors and so I did the same. Each segment bears a transversal row of Acrochaetae, numbering five on both sides of the thorax, and two or three less regular rows of Microchaetae. The ventral side of the abdominal segments does not wear hairs, except for the last segments and even there they are very rare. On the ventral side of the prothorax there is also this row of Acrochaetae and some less regularly placed Microchaetae, but they are shorter than anywhere else. The mesothoracal and metathoracal segments have only one irregular row of Microchaetae each on their ventral side. Dorsally and on the sides these segments possess from 6 to 10 Acrochaetae; the two or three irregular rows of Microchaetae are diffused ventrally into one transversal row of short hairs. The function of these hairs on the ventral side of the thorax may be to form a kind of trophothylax or food-bag, preventing the pieces of insects laid down there by the workers from slipping off, so the larva can grasp them with her mandibles. On the ventral side the first 6 abdominal segments are completely bald. Dorsally the row of Acrochaetae is replaced by a row of Oncochaetae, which reaches till halfway down the sides. Further down on the ventral half of the sides — but not on the ventral side itself — these Oncochaetae are again replaced by Acrochaetae with this peculiarity however that they have their ends cleft into two or four ramifications (only discernible with the use of the immersionlens) or even somewhat plumose. With the younger stages of the larva the Oncochaetae occur on the first 5 abdominal segments, with the full-grown larva only on the first 3. Occasionally they occur on 4 or 6 segments but never on 7 as is the case with *M. ruginodis*. The number of hairs can only vary after moulting, so that if small and hungry larvae look more hairy than well-fed ones there is still no real difference. Their distance from each other is somewhat less than their length; the Oncochaetae f.i. are implanted circa 120 Micron one from the other in each row. The anchor-shaped hooks have a width of 22 to 55 Micron, according to the point of observation. The last 3 abdominal segments look hairy on all sides like the prothorax, but only apparently so, as these segments are curved towards the ventral side, the caudal end of the body being formed by the dorsal face of the last 2 or 3 abdominal segments and the proctodaeum opening on the ventral side. Orally from it there are no hairs or at least very few on the ventral side of the abdomen. The transversal rows are less regular. On the head there are only hairs of the smaller type; 3 on each side along the occiput, an irregular row of 4 longitudinally near the coronal suture, a row of 4 in zigzag formation slanting obliquely from the mandibula to the back of the head, a row of 4 small ones on the cheek slating upwards to the back of the head, and 2 on each side of the clypeus" (pp. 28-29).

"The *Mandibulae*, the most sklerotized parts, internally coated with epithelium and in the centre with tracheal and nervous tissue, both up to the point where the teeth begin. A mandibula consists of a vertical elongated triangular plate, connected with the frenum and on which the muscles are inserted, and a medial plate joined perpendicularly, that gradually merges into the vertical plate and bears the teeth, an awl-shaped apical one, two large incisive teeth and several ranges of pointed tubercles that are suitably adapted to serving as molar teeth. . . The *Sensilla turrets* of the *Maxilla* are often indicated as larval palps, and so are the sensilla turrets of the *Labium*. The maxilla possesses two of them, usually one, somewhat broader, lateral or proximal one and one, slenderer, medial or distal one; the former is according to the authors a homologon of the adult maxillary palp, the latter of the galea etc. of the adult insect. The much lower *turrets* of the *Labium,* one pair, situated somewhat laterally and distally of the orificium of the labial gland on the premental part, are designed as labial palps of the larva. Both wear entrenched short conical sense-hairs, which apparently have a taste function and are connected with special nervestems and ganglia belonging to the gnathal brainganglion. More sensilla of this kind and also of the type sensilla basiconica, but somewhat taller and thicker-skinned, are dispersed over the labrum, the maxilla and the labium. . . The *Antennal plate,* a slightly convex oval plate of thickened cuticula, partly covering the discus antennae. Excentrically it bears a still more thickened plate with three sensilla of the typus s. basiconica. This number is constant with all the ant larvae I examined. Only once I saw a *schencki* larva with 4 sensilla on it. . . The antennal plate of the *schencki* larva is 36 Micron in length and 30 wide; the yellowish sklerotized central part measures 18 Micron (unstained total pr.), 18 Micron by 14 (KOH - ac. fuchsin). Proximal maxillary turret high 22, broad 20 Micron; distal (medial) turret high 31, broad 20 Micr. The shape and dimensions of the turrets have systematical value. Myrmicine larvae have no spinnerets" (pp. 34-35). "The orificium is shaped like a horse-shoe and is situated on the dorsal 1/3 of the labium, without any spinneret in *Myrmica.*" (p. 47). "The egg stage lasts (at 68-80 degrees F.) about 4 weeks, the larval stage 3 to 5 weeks if well-fed, but much longer — up to 6 months — if insufficiently fed, the praenymphal stage 6 to 7 days and the nymphal stage 7 to 14 days. The egg, the newly emerged larva and the nymph require a higher temperature than the majority of the larvae and are usually carried off to drier places" (p. 39). "The hatching of the larva from the egg progresses as follows. At the posterior or caudal end the embryo separates itself from the eggshell. Then the cuticula of the oral third of the egg detaches itself like the lifting of a lid and the anterior part of the larva issues gradually. This larva I does not yet show any hairs. She grows rapidly under the care of the workers and soon attains a length of about 1,2 mm. In the period between attaining this length and that of 2 mm there occurs a moulting, which begins at the margins of the segments. The hairs that appear first are those which fringe the back of the head. A few hours later the hairs on the dorsal face of the thorax follow and after these gradually the other ones. The erecting hairs lift the skin which then cleaves and is licked off by the workers.. . . This first moulting happens on the second or third day, occasionally already on the first. The larva II attains a length of 2,28 mm. Between this length and 2,37 mm there must occur a second moulting" (p. 37). "Spontaneous movement and position-reflexes of the larva," pp. 63-64. Table on p. 37: age, length of head, length of larva, head hairs. Table on p. 38: length of male larvae, length of hairs. Figs. 2-4, 9-21, 29 and 33-36 depict wholly or chiefly external anatomy; the remaining figures and most of the text treat internal anatomy and histology.

Myrmica smythiesi dshungarica Ruzsky

Similar to *emeryana* except in the following details: Simple body hairs longer (0.009-0.09 mm); anchor-tipped hairs shorter (about 0.18 mm). Head hairs shorter (0.045-0.1 mm). Labrum narrowed dorsally; anterior surface of each lobe with two or three minute hairs and one or two isolated sensilla; posterior surface with four to six isolated and a cluster of two or three contiguous sensilla; the whole posterior surface sparsely spinulose, the spinules longer and in short subtransverse rows. Hypopharynx sparsely spinulose, the spinules longer and in moderately long subtransverse rows. (Material studied: six larvae from Siberia).

Genus *Manica* Jurine

Manica rubida (Latreille)

Forel, 1874, p. 388 =1920. p. 265: Les larves "sont rondes et épaisses en arrière, longues et effilées en avant, également arquées d'avant en arrière."

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NOTES ON *BRACHYONYCHUS* CHD. (COLEOPTERA, CARABIDAE, PANAGAEINI)[1]

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Brachyonychus is a genus of large and striking panagaeine Carabidae, distinguished from the better-known *Craspedophorus* by the form of the tarsi (4th segment more deeply emarginate and 5th shorter in *Brachyonychus*) and confined to the Indo-Chinese Subregion of the Oriental Region. The genus is rare in collections. It was therefore a pleasant surprise to find a series of 48 unstudied specimens, from several localities, in the collection of the United States National Museum. These specimens, with a single one previously in the Museum of Comparative Zoology, justify the following notes.

Previously described *Brachyonychus* differ very little among themselves except in one character: the extent of punctation of the elytral intervals. The latter vary from entirely punctate (and pubescent) to nearly impunctate (and glabrous) with only the 9th and the outer edges of the 8th intervals punctate at the sides of the elytra. These differences and other slight ones chiefly of form and markings have been treated as specific characters in the past, but the series before me suggests that the elytral punctation and other characters, though fairly constant in any one locality, vary geographically in such a way as to suggest that there is only one real species of *Brachyonychus* with several geographical subspecies, as follows.

(1) Elytral intervals all punctate (but 1st and 2nd ones sometimes less densely so).

Brachyonychus sublaevis sublaevis Chd. (*humeratus* Chd.)	Cochin-China & Cambodia
sublaevis perraudierei Bts.	Indo-China (Pnomh Pen.)
sublaevis punctipennis Gestro	Laos

(2) Elytra with a small discal area impunctate, including 1st. and 2nd. intervals near middle of elytral length.

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

Brachyonychus sublaevis medius n. subsp. (see below) Lower Siam

(3) All discal intervals of elytra impunctate; lateral intervals 9, 8, and (sparsely) 7 punctate.

Brachyonychus sublaevis parumpunctatus Bts. Tenasserim, part of Siam, Malay Pen.

(4) Only lateral intervals 9 and outer edge of 8, and base of elytra, punctate.

Brachyonychus sublaevis andersoni Bts. Mergui Arch. (Elphinstone Is.) etc.

(5) Only lateral intervals 9 and outer edge of 8 punctate.

Brachyonychus sublaevis laevipennis Chd. Part of Siam, Cochin-China

References to the original descriptions of the named forms will be found in Andrewes' Catalogue of Indian (Oriental) Carabidae (Part 18 of the Catalogue of Indian Insects, published by the Government of India, Calcutta, 1930).

It will be seen that, generally speaking, individuals with the most extensive elytral punctation (typical *sublaevis* etc.) occur in Cochin-China (there are 8 examples of this form in the U.S.N.M. material); more northern individuals from Indo-China (*perraudierei* Bts.) and Laos (*punctipennis* Gestro) are fully punctate too, and it remains to be seen whether these two names are recognizable on other characters; and more western specimens, from Siam, Tenasserim, the Mergui Archipelago, and the Malay Penninsula, have the elytral punctation either sparse at middle of disc or absent in a smaller or larger discal area. The only locality listed above which is not consistent with this general distribution is the "Cochin-China" record of *laevipennis.* However, the variation in punctation apparently does not form a simple cline; the exact distribution of the different forms is uncertain because of the indefiniteness of the older type localities, but the distribution of different populations appears to be somewhat irregular. Only more material will show just how many forms are really recognizable, but it is clear that one distinct, intermediate subspecies is undescribed. I propose to call it

Brachyonychus sublaevis medius n. subsp.

Generally similar in form, appearance, and most structural characters to typical *sublaevis* Chd.; dull black, each elytron with a somewhat irregular, slightly transverse, yellow or reddish-yellow blotch behind the humerus (from the outer side of interval 2 or 3 to and including interval 9) and another before the apex (from intervals 3 to 7 inclusive); elytra lightly striate, the striae finely punctulate; elytral intervals punctate and pubescent except in a small, poorly defined discal area at and behind the middle and including the first 2 intervals of each elytron — actually the transition from impunctate to closely punctate areas involves several additional intervals. Length (in straightened individuals) 23-27; width about 10-12.5 mm.

Holotype ♂ (dissected) (U.S.N.M.) and 10 paratypes (6 in U.S.N.M., 3 in M.C.Z., 1 in British Museum) from TRANG ("Trong"), LOWER SIAM, not dated, collected by W. L. Abbott; and 3 additional paratypes (2 in U.S.N.M., 1 in M.C.Z.) from KAO CHONG, TRANG PEN (INSULA), SIAM, 1,000 ft. altitude, VIII (19)33, collected by Hugh M. Smith.

This new subspecies is sufficiently compared with previously known forms above.

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THE BIOLOGY OF NEARCTIC LEPIDOPTERA. II. FOODPLANT AND PUPA OF *HEMIARGUS ISOLUS*

By Charles L. Remington
Osborn Zoological Laboratory, Yale University

In early July 1943, about 10 mi. S. of Abilene, Taylor Co., Texas, I discovered a lycaenid larva feeding on a large pod of mesquite, *Prosopis juliflora* (Swartz) DC. It was confined and fed, and on 18 July it pupated. The imago emerged on 25 July and proved to be *Hemiargus* (*Echinargus*) *isolus* (Reak.). This was of considerable interest, since the life-history and foodplants of this very common Blue were wholly unknown. During August and September *H. isolus* was abundant in *Prosopis* groves, but no more larvae were found. While *Prosopis* may be the primary foodplant in the Southwest wherever it occurs, it obviously is not the only plant; *H. isolus* ranges far beyond the limits of *Prosopis* in the West and even appears to have endemic colonies east of the Mississippi (Remington, 1942). Other species of *Hemiargus* have been recorded feeding on *Prosopis, Mimosa, Macroptilium, Chamaecrista, Abrus, Pithecolobium, Guilandina, Astragalus,* and *Medicago.* The foodplant record for *H. isolus* in Klots' new book (1951, p. 159) is based on a verbal communication from the writer.

This being the first record of early stages of *H. isolus*, a brief description, prepared from the pupal shell, is given as follows: length 6.2 mm.; length of dorsum of abdomen (ignoring curvature) 4.0 mm.; width of abdomen just caudad of wing cases 1.9 mm.; length of maxillary sheath 2.2. mm. (extending 1.0 mm. beyond tip of sheath of prothoracic legs and 0.3 mm. beyond sheath of mesothoracic legs and exceeded by wing cases and antennae by 4.0 mm.); hairs very sparse, especially on dorsum, but of highly distinctive shape — columnar and very rough in outline, not strongly capitate, never slender or smooth, rarely spiculately branched; longest hairs less than 0.15 mm. long; spiracles of abdominal segments II and III very far laterad, touching margin of tergal plates, sparsely surrounded by hairs and by papillae, the latter most numerous caudad of spiracle; three well-separated groups of hooklets near end of abdomen ventrally: — a median ventro-caudal clump of about 30 hooklets on extreme end of last dorsal plate (terga IX-X?) and a pair of ventro-lateral clumps of about 23 hooklets each, on anterior edge of last ventral plate (sterna VIII-X?).

The combination of characters given above distinguishes the pupa of *H. isolus* from all Lycaenidae known to me. The pupa was held firmly to its substratum by a strong girdle.

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PSEUDOMYRMEX APACHE, A NEW SPECIES FROM THE SOUTHWESTERN UNITED STATES (HYMENOPTERA: FORMICIDAE)[1]

By William S. Creighton

Department of Biology, College of the City of New York

The majority of the material on which this paper is based was secured during 1951 and 1952. At that time the writer was engaged in a field survey of the ants of the border region. This work was made possible by a fellowship from the John Simon Guggenheim Memorial Foundation. My sincere thanks go to the Foundation for the support which made this work possible.

The taxonomy of the genus *Pseudomyrmex* presents an unusual number of difficulties. Even the generic name has not escaped the hazard of uncertainty. The name *Pseudomyrma,* which has been accepted for more than a century, has recently been challenged. Twice in the past two years Dr. M. R. Smith has introduced prior names for the genus. The latest choice is *Pseudomyrmex* Lund which, on the basis of data presented by Dr. Smith in 1952 (Proc. Ent. Soc. Wash., Vol. 54, No. 2, p. 97) has a priority of thirteen years over *Pseudomyrma* Guérin. But any difficulty with the generic name is a minor matter in contrast to the deplorable incertitude which marks a large number of the species in this genus. The taxonomy of many of them is in such confusion that specific recognition is largely a matter of guess-work. With this fact in mind, the writer has hesitated for some time to describe the material treated here. It would seem, however, that we can no longer avoid dealing with this material for, whatever its taxonomic status may be, it is certain that its presence in the southwestern United States has not previously been recognized. It is probable that the older records for this ant have been attributed to *Ps. pallida.* The two insects are superficially

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

similar and they occur in the same stations in the southwest. As long as it was believed that only *pallida* occurred in this area, there was little reason to suspect the existence of a second species.

The writer first encountered *Ps. apache* in 1932. In September of that year a single, deälated female was taken in Ramsey Canyon in the Huachuca Mountains of Arizona. This insect had a clear, yellow color similar to that of *Ps. pallida*, but it differed from the female of *pallida* in its much greater size and in a number of other structural features. Since no workers were associated with the above female, its status was problematical and it was not included in my 1950 monograph on North American ants. In the spring of 1949, after that paper had gone to press, Dr. L. F. Byars sent me a number of workers of a large, yellow *Pseudomyrmex* which had come from three colonies taken in southern Arizona. These seemed to be the same species as the female from Ramsey Canyon, but this was not verified until the following summer. In 1950 a colony containing all three castes was taken by the writer in Garden Canyon in the Huachuca Mountains. Since that time the writer has secured forty-five additional colonies of this ant in fifteen different stations. These stations extend from the Brownsville area of Texas to the mountains of southern California. It is clear that this ant is abundant in the southwestern United States and some cognizance must be taken of it. The difficulty is to decide how this insect should be treated.

The writer first believed that this ant represented *Ps. decipiens* or a northern race of it. Dr. W. M. Wheeler had identified as *decipiens* a series of specimens taken in Costa Rica. These specimens were similar to those coming from the southwestern United States but there were several differences, particularly in the shape of the petiole. In 1949, when the above comparison was made, there was not enough material to evaluate these differences. As a result the writer told Dr. Byars that the insect probably represented some form of *decipiens*, but that no certain statement could be made until more data was available. In the meantime the writer attempted to discover how Dr. Wheeler had identified the Costa Rica specimens. As far as could be ascertained there are no types of *decipiens* in American collections. Nor do there seem to be any specimens other than types which Forel might have determined. Apparently Dr. Wheeler used Forel's description as the basis for his identification and, as will be shown, this is a bad business at best. The original description of *decipiens* appeared in the ant section of the *Biologia Centrali-Americana.* It was based upon specimens coming from Teapa, a small town in the state of Tabasco, Mexico. The description is brief, but this is not the worst than can be said for it. It is sufficiently explicit to show that it does not accord in several important respects with the figure which is supposed to accompany it. These differences are so marked that there is justification for the view that the description and the figure can scarcely have been drawn from the same insect. In the figure the size of the eyes, the length of the antennal scapes and the proportions of the petiolar joints do not correspond at all to the description. Forel did not prepare the figure but he undoubtedly wrote the description, hence the latter seems more reliable as an indication of the characteristics of *decipiens.* Wheeler had evidently reached this conclusion, for his Costa Rica specimens agree much better with Forel's description than with his figure. But it should be clear that there can be no certainty as to the exact nature of Forel's *decipiens* until the types can be re-examined.

At the same time it seemed to the writer that it should be possible to clarify the status of specimens coming from the southwestern United States by collecting in northern Mexico. If the southwestern specimens were a northern race of *decipiens,* the two should intergrade at some point between Tabasco and the southern border of the United States. The survey work mentioned above gave an ideal opportunity to test this in the field. During January and February of 1952 careful vertical surveys were made in the mountains of eastern Mexico at three latitudes. The southernmost of these was in the Tamazunchale area. This survey ranged from three hundred feet to eight thousand feet. Similar studies were made in the mountains west of

Linares (1300-6200 feet) and in those south and west of Monterrey (2000-7200 feet). By this time it was apparent that *Ps. apache* prefers to nest in old live oak limbs. Many hundred limbs of live oaks were examined in the areas mentioned above. While three different species of *Pseudomyrmex* were encountered in these limbs, none of them showed the slightest relation to *apache*. The coastal plain was less thoroughly studied, but collections made in the area between Mante and Tampico showed no trace of *apache*. The only abundant *Pseudomyrmex* in that area is a particularly vicious, light brown species which lives in the thorns of the bull-horn Acacia. In northwestern Mexico the situation is essentially similar. *Ps. apache* is abundant in the mountains at the northern end of the main chain of the Sierra Madre Occidental. But the writer failed to find it in several lesser ranges in northern Sonora. It may be added that in some of these ranges the conditions seemed ideal for this ant and the writer felt certain that it would be found. Negative evidence of this sort does not prove the absence of *Ps. apache* in the areas mentioned above, but it does prove that the insect is less abundant in these areas than in stations further north. This would not be true if this ant were a northern fringe of some southern species, for in that case its incidence should increase to the south. But, since all available evidence points to the fact that the area of greatest abundance for this ant lies in southern Arizona and that its incidence decreases to the south, it is safe to conclude that the insect is not a northern race of *decipiens* but a separate species.

Since all three castes have been figured on the plate which accompanies this article, the descriptive material which follows is largely limited to details of sculpture and pilosity that could not be shown in the figures.

Pseudomyrmex apache sp. nov.

Plate 12

Female: head (mandibles excluded) 1.35 mm.; thorax 2.2 mm.; overall length 7-8 mm.

Upper surface of the head covered with small, shallow, circular punctures. These punctures close set from the anterior margin of the head to the level of the median ocellus. From that level to the occipital border the punctures are much more widely spaced with the surface between them delicately coriaceous or reticulate and very feebly shining. The punctures on the genae and gula are notably smaller and more widely spaced than those on the front of the head. Both genae and gula are feebly shining. Clypeus and frontal lobes without distinct punctures and rather strongly shining. Mandibles with coarse, oval, piligerous punctures, the surface between them finely shagreened. Antennal scapes with numerous fine punctures, their surface more shining than the front of the head but less shining than the frontal lobes. Punctures on the thorax smaller, more shallow and more widely spaced than those on the front of the head, the surface between the punctures with a very delicate, reticulate sculpture. Pronotum and epinotum feebly shining. Scutum, scutellum, mesothoracic sternite and episternite a little more strongly shining. Punctures on the petiole very sparse and fine. Postpetiole and gaster with only a few, scattered, piligerous punctures. The delicate coriaceous sculpture becomes feebler as one passes from the petiole to the gaster and the parts become progressively more shining, with the gastric segments particularly so. Fore femora laterally compressed. Middle and hind femora not laterally compressed. Both femora and tibiae with numerous, very small punctures which do not dull the shining surface.

Erect hairs rather sparse over most of the body. Mandibles and antennal scapes with moderately numerous, short, erect hairs. Those on the upper surface of the head and on the gula much sparser, widely separated and very irregular in length. Dorsum of the pronotum with six or eight erect hairs. Scutum and scutellum with about a dozen erect hairs of varying lengths. Epinotum without erect hairs. Petiole and postpetiole with eight or ten erect hairs each. These hairs are often, but not always, confined to the posterior half of each node. Erect gastric hairs largely confined to a broad band at the rear edge of each segment. Legs virtually devoid of erect hairs, except for one or two on the fore coxae and the fore femora. Tarsal joints and antennal funiculi densely covered with fine, semi-erect hairs which grade into pubescence. Pubescence elsewhere very fine and so sparse that it is not usually noticeable except under considerable magnification or in very oblique light.

Color: clear, golden yellow, the inner border of the mandibles blackish brown. Edges of the thoracic sclerites and gastric segments a slightly deeper brownish yellow than the rest of the surface. Wings slightly iridescent, faintly tinged with yellow, the veins a deeper yellow, the stigma brown.

Male: head (mandibles excluded) 1.0 mm.; thorax 2.0 mm.; overall length 6.5-7.0 mm.

Upper surface of the head finely coriaceous and feebly shining except for the area between the median ocellus and the antennal insertions, where the coriaceous sculpture is largely replaced by fine punctures. Mandibles a little more heavily sculptured and less shining than the rest of the head. Antennae finely and densely granulose, opaque. Lateral portions of the pronotum feebly coriaceous, less shining than the median portion which is covered with rather coarse, scattered punctures. Scutum and scutellum heavily coriaceous and dull except for an irregular, shining band down the middle of each. This band is coarsely punctate and very feebly coriaceous. Epinotum feebly coriaceous and rather strongly shining above, more heavily coriaceous and punctate on the sides. Mesothoracic sternite strongly shining and coarsely punctate, the episternite feebly coriaceous and strongly shining. Petiolar nodes feebly shining and weakly coriaceous. The gaster very feebly sculptured and much more shining than the petiolar nodes.

Erect hairs present on the ocellar area of the head, the scutum and the scutellum. Dorsum of the epinotum, the petiolar nodes and the dorsum of the anterior gastric segments with one or two erect hairs each at most, often hairless. Dorsum of the terminal gastric segment with several erect hairs. There are numerous erect hairs, which form

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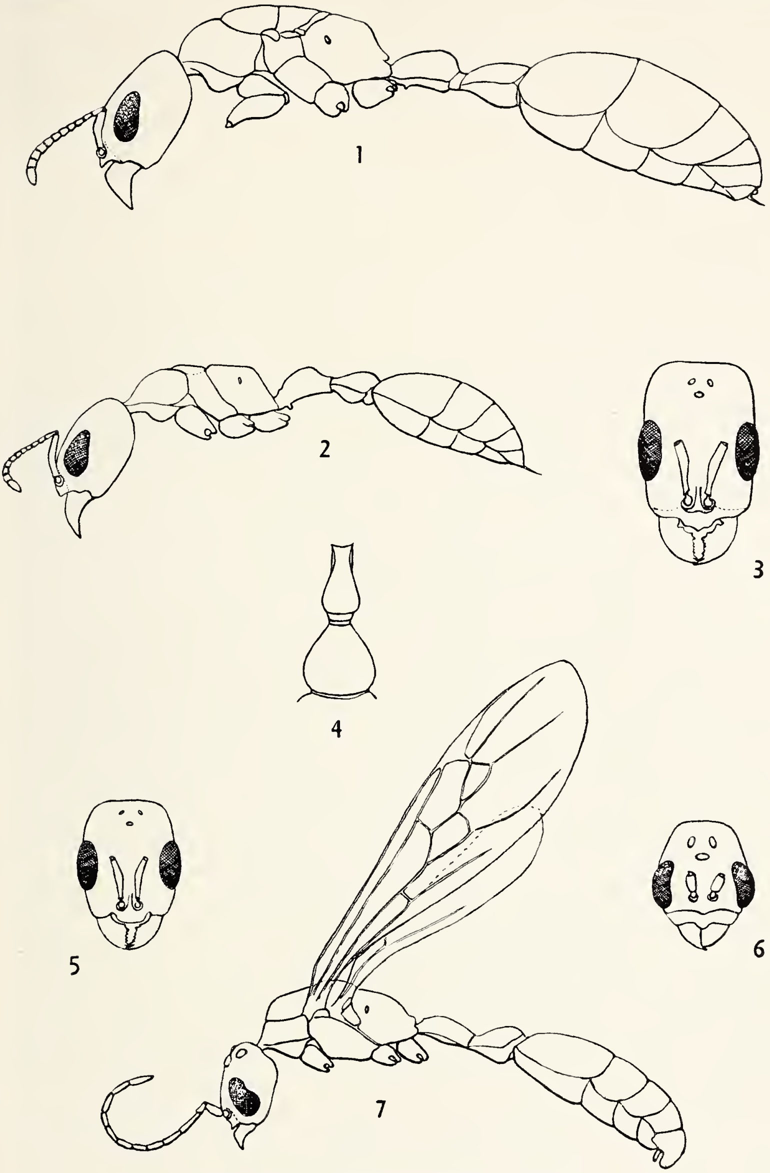
EXPLANATION OF PLATE 12

Pseudomyrmex apache sp. nov. Fig. 1. Female, profile view. Fig. 2. Worker, profile view. Fig. 3. Head of female. Fig. 4. Petiole and postpetiole of worker, from above. Fig. 5. Head of worker. Fig. 6. Head of male. Fig. 7. Male, profile view.



CREIGHTON — PSEUDOMYRMEX APACHE

a distinct fringe, at the ventral edge of each gastric segment. Eyes with a number of short and extremely fine erect hairs. Mandibles with numerous, coarse, erect or semierect hairs. Pubescence abundant and fully appressed on the rear half of the head, semierect on the anterior half and on the gula. Pubescence on the thorax and the petiolar nodes much more dilute than on the head. Pubescence extremely dilute on the dorsum of the gaster but more abundant on its sides and ventral surface. Antennae and tarsi with abundant, short, appressed or semierect hairs which grade into pubescence. Femora and tibiae with less abundant pubescence than the tarsi.

Color: thorax, gaster, legs and antennae dirty yellowish brown. The scutum and the head a darker, more piceous brown. Mandibles dingy yellow. Wings pale, yellowish brown, the veins and stigma darker.

Worker: head (mandibles excluded) 1.15 mm.; thorax 1.5 mm.; overall length 5-6 mm.

Upper surface of the head covered with circular punctures, as in the female, but with the coriaceous sculpture between the punctures much less pronounced, particularly on the rear half of the head. This gives the surface a slightly more shining appearance than in the female. Mandibles much smoother than those of the female, the piligerous punctures notably smaller and, for the most part, circular or nearly so. Punctures on the thoracic dorsum obscured by the even, coriaceous sculpture. This sculpture is also present on the sides of the thorax. Both dorsum and sides of the thorax feebly shining. Sculpture of the petiolar nodes and the gaster the same as in the female. Fore femora much less laterally compressed than in the female, not greatly different in shape from the middle and hind femora. The fine, coriaceous sculpture on the appendages more distinct than in the female, often obscuring the punctures, hence the legs are less shining than in the female.

Pilosity on the head very similar to that of the female. Erect hairs on the thoracic dorsum, when present, sparse and confined to the pronotum and mesonotum. A few erect hairs are present on the petiole, the postpetiole and the dorsum of each gastric segment, especially the last. Pubescence fine and obscure, very dilute on the head, more abundant on the thorax, petiolar nodes and gaster, but nowhere conspicuous.

Color: uniform, clear, golden yellow. In some specimens the posterior gastric segment is slightly infuscated.

Types of female, male and worker deposited in the collection of the Museum of Comparative Zoology, Cambridge, Mass.; the type locality is Brown Canyon (4400′), Baboquivari Mts., Arizona. Type nest taken on Sept. 2, 1951, in *Quercus oblongifolia.*

Because of its clear, yellow color and dilute pubescence *apache* is not likely to be confused with any of our other species except *pallida.* There is little likelihood of confusion between these two species if all castes are present, for *apache* is larger than *pallida* and this difference is particularly striking in the sexual forms. Workers from young nests of *apache* are, however, sometimes no larger than those of *pallida.* In such cases recognition depends upon other criteria which will separate the two species regardless of size. Thus the worker of *apache* is more heavily sculptured than that of *pallida,* particularly on the upper surface of the head. In *apache* the cephalic punctures and the delicate, coriaceous sculpture between them can be readily seen, even under medium magnification, and the surface of the head is feebly shining. In *pallida* the cephalic sculpture is notably finer. The punctures are scarcely distinguishable from the sculpture between them, even under high magnification, and the surface of the head is moderately shining. The head of *apache* is broader in proportion to its length, with the sides more convex than is the case with *pallida.* The greatest length of the eye in *apache* is slightly less than one half the distance from the insertion of the mandible to the occipital margin. In *pallida* the greatest length of the eye is slightly more than one half the above distance. The petiolar node of *apache,* seen in profile has a broadly rounded crest, from which both the anterior and the posterior face slope away at about the same angle. Thus the outline of the node appears as a flattened and slightly lopsided arc. In *pallida* the rear face of the node of the petiole descends much more abruptly than the front face, hence, in profile the node presents a wedge-shaped rather than an arcuate outline.

The distributional records for *apache* are presented below. Unless otherwise noted all specimens were taken by the writer. The elevations of the majority of these records were checked with topographic sheets and an altimeter, the remainder with one or the other.

ARIZONA:

Huachuca Mountains: Ramsey Canyon (5500′) single deälated female; Garden Canyon (5800′) three colonies in *Quercus emoryi;* Carr Canyon (5400′) two colonies in *Q. emoryi.*

Santa Rita Mountains: Madera Canyon (5900′) one colony in *Q. emoryi;* Sweetwater (5800′) three colonies in *Q. emoryi.*

Dragoon Mountains: Cochise Stronghold (5200′) one colony in *Q. emoryi.*

Chiricahua Mountains: Chiricahua National Monument (5400′) one colony in *Q. emoryi.*

Peloncillo Mountains: Cottonwood Canyon (4800′) two colonies in *Q. emoryi.*

Baboquivari Mountains: Baboquivari Canyon (3500′) one colony in *Q. oblongifolia;* Brown Canyon (4200-4400′) type locality, nine colonies in *Q. emoryi* or *Q. oblongifolia.*

Ajo Mountains: (Organpipe Cactus National Monument) Alamo Canyon (2200-2800′) ten colonies, eight in *Prosopis juliflora,* two in *Q. turbinella.*

Growler Mountains: (Organpipe Cactus National Monument) La Abra Wash (1300′) two colonies in *Prosopis juliflora.*

Canelo Hills: Canelo Pass (5300′) one colony in *Q. emoryi.*

Pena Blanca Springs (3900′) Santa Cruz Co. Coll. L. F. Byars, one colony without data on nest site.

San Miguel (2400′) Pima Co. Coll. L. F. Byars, one colony in *Prosopis juliflora.*

Organpipe Cactus National Monument Headquarters (1650′) Coll. E. R. Tinkham, one colony, said to have been taken emerging from a rodent's burrow!

CHIHUAHUA:

Sierra de en Medio: Nogales Ranch (5000′) five colonies in *Q. emoryi* or *Q. oblongifolia.*

TEXAS:

Fowlerton (300′) La Salle Co., one colony in *Prosopis juliflora;* Monte Alto (60′), Hidalgo Co., two colonies in *P. juliflora.*

CALIFORNIA:

Agua Tibia Mountains: Dripping Springs (1500′) two colonies in *Q. chrysolepis.*

The records cited above show that *Ps. apache* occurs most frequently in mountainous areas at elevations between 2500 and 6000 feet. In such stations it ordinarily nests in evergreen oaks but, when the range descends below the oak belt, it will nest in mesquite. Whether the ants nest in oak or mesquite they select a good-sized branch or the trunk of the tree as a nest site. They seldom nest in twigs and this response is striking in view of the fact that twigs are a favorite nest site for our eastern species. The branches selected by *apache* are those through which wood-boring insects have driven passages. The ants carefully clean these passages of the detritus left by the insects which made them. In most cases the passages have a diameter several times as great as that of the ants, hence it would seem that the ants could be jarred out of the open ends of the passages without difficulty. This is not the case, for they cling to the walls with great tenacity. To get all the specimens out of a nest it is usually necessary to split the branch into small pieces so that all the passages are exposed. *Ps. apache* is not at all pugnacious. It will bite on occasion but it very rarely stings and the sting is not painful. Since many species of *Pseudomyrmex*, some much smaller than *apache*, sting severely on the slighest provocation, this behavior is rather surprising.

The female of *apache* often becomes physogastric after the colony is well established. The intersegmental membranes do not bulge but are stretched tight between the separated gastric sclerites. Since the latter retain their curvature, the gaster of a physogastric female of *apache* looks like a white tube running through a series of close-fitting, golden rings. In this species brood is usually present during the entire year. In some nests this is also true of the sexual forms. Fully mature males and winged females have been taken from nests as early as March 20th and as late as November 3rd. In southern Arizona and northern Chihuahua most nests are free from sexual forms by the first of October. It seems clear, however, that the sexual forms occasionally remain in the nest over the winter. Four colonies containing mature males and females were taken in the Ajo Mountains of Arizona on March 20th and 21st, 1952. Four days before snow had fallen in this area and the winter had been an unusually cool one. If the males and females in the above nests came from early spring brood it was certainly a remarkable performance. It is more reasonable to suppose that they had overwintered in the nest. It appears that there is no mass egress of males and females in the marriage flight of this species. The writer had it under daily observation during September in 1951. Although there were many males and females in the nests during that period no marriage flight was seen. But during the month of September a number of deälated, nest-founding females were taken. Since these had not been encountered earlier, the presumption is that some sort of marriage flight was taking place during September. If this had been of the usual type it is hard to see how it could have been overlooked. It seems probable that the marriage flight of *apache* extends over much of the month of September, with the males and virgin females leaving the nest in comparatively small numbers at intervals during that period.

THE GENUS *PARADA* HORVATH (HEMIPTERA: TINGIDAE)[1]

By Carl J. Drake
Iowa State College, Ames

Horvath (Ark. Zool., 17A(24) :2-3, 1925) erected *Parada* as a subgenus of the genus *Cysteochila* Stål for the reception of *Cysteochila* (*Parada*) *taeniophora*. Seventeen years later, Drake (Iowa St. Coll. J. Sci., 17(1) :3-4, 1942) raised *Parada* to the generic level and described two new species and a new variety from Australia. The genus is not known to occur elsewhere.

The present paper describes three new species and one new variety of the genus *Parada* from Australia. I am indebted to Dr. Philip Darlington of the Museum of Comparative Zoology, Harvard University, for kindly loaning me the tingids, which he collected in Australia. The disposition of the types is given beneath the descriptions of the new species.

Genus *Parada* Horvath, 1925

Type, *Cysteochila* (*Parada*) *taeniophora* Horvath, 1925

Parada darlingtoni, new sp.

Head brown, with five testaceous spines; median spine short and blunt, the hind pair shorter in type than allotype, appressed. Eyes moderately large, black. Antennae long, rather slender, pale testaceous, the terminal segment almost totally black-fuscous; segment I short, stout, thicker and nearly twice as long as II; III very long, slenderest, smooth, scarcely more than four times as long as IV. Bucculae very wide, meeting in front, testaceous, areolate. Rostrum testaceous, extending to middle of metasternum; rostral laminae testaceous, areolate, subparallel, open behind.

Pronotum strongly convex, closely coarsely deeply pitted, black with hood, paranota, carinae and posterior projection testaceous, the posterior part of pronotum distinctly

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

areolate. Hood moderately large, inflated, not produced over base of head, highest near the center, there feebly higher than long, above narrowed from all sides to the peak; collar testaceous. Paranota moderately wide, mostly triseriate, almost completely reflexed inwardly on surface of pronotum, usually not quite touching pronotal surface at humeral angles. Median carina long, distinctly elevated, not areolate, extending from hood to apex of hind process. Lateral carinae a little sinuate, foliaceous on discal part of pronotum, there completely reflexed inwardly and biseriate in widest part, the space between upper edge and median carina about half as wide as width of lateral carina; lateral carinae on hind part ridge-like and not areolate.

Hemelytra strongly constricted beyond the middle, yellowish brown with four dark fuscous marks on the veins setting off discoidal area, the whitish patch near apex of costal area extending across subcostal into sutural area; costal area moderately wide, composed largely of one row (two at base) of fairly large, clear cells; subcostal area triseriate, the cells smaller than in costal area; discoidal area just reaching to middle of hemelytra, with outer boundary strongly sinuate, widest slightly beyond the middle, there six or seven cells deep; sutural area more widely reticulate, with cells infuscate, with a pale patch near apex; areolae of subcostal, discoidal and sutural area opaque. Wings clouded with dark fuscous, not as long as hemelytra. Hypocostal vein uniseriate. Body beneath black-fuscous, the median part of venter sometimes brownish. Legs testaceous, the tips of tibiae and tarsi reddish brown to fuscous.

Length, 3.50-3.75 mm.; width, 1.20-1.38 mm.

Type (male), National Park, Queensland, McPherson Range, Australia, Alt. 3000-4000 feet, May 11, 1932, collected by Dr. P. J. Darlington, in collection of Museum of Comparative Zoology (Harvard). Allotype, female, taken with type.

This species may be separated at once from other members of the genus by the narrower, biseriate lateral carinae of pronotum. The hood is about the same size as in *P. popla* Drake, but the antennae and legs are distinctly longer. *P.*

absona has a distinctly smaller hood, and wider foliaceous part of lateral carina.

Parada hackeri, new sp.

Moderately elongate, small, oblong. Head flat above, reddish brown with five testaceous spines; median spine short, appressed; anterior pair longer, porrect, with their tips touching; hind pair very long, appressed. Antennae moderately long, moderately stout, indistinctly pilose, testaceous with terminal segment dark fuscous; segment I short, a little stouter and not quite twice as long as II; III slightly more than twice as long as IV; IV thicker in widest part, narrowed at base and apex, clothed with short hairs. Bucculae wide, testaceous, areolate, closed in front. Rostrum testaceous, extending a little beyond middle of mesosternum; rostral laminae testaceous, areolate, open behind. Entire body beneath dark reddish brown.

Pronotum slightly convex, closely deeply pitted, reddish brown with carinae, paranota, hood and posterior projection of pronotum testaceous; hood moderately large, only slightly raised, about one cell high, flat above, not produced anteriorly. Paranota moderately wide, mostly triseriate, almost totally reflexed inwardly, not quite resting on dorsal surface of pronotum at humeral angles. Lateral carinae long, foliaceous on convex part of pronotum, there reflexed inwardly and triseriate, continuing on hind part of pronotum as a raised vein, which terminates a little before the apex. Median carina profound, not areolate. Hind process of pronotum about as widely areolate as discoidal area.

Hemelytra slightly constricted a little beyond middle, brownish; costal area narrow, uniseriate, the cells small and mostly longer than wide, testaceous with some scattered dark fuscous spots on outer vein; discoidal area wider, biseriate, with larger cells; discoidal area large, extending considerably beyond middle of hemelytra, set off from other areas by raised veins (especially inner boundary), narrowed at both base and apex, slightly elevated at apex and at dark spot on outer boundary, widest near middle, there five cells deep, the outer marginal vein only slightly sinuate; sutural area more widely areolate, with veinlets yellowish brown and areolae dark fuscous. Wings black-fuscous, almost as long as hemelytra. Legs rather short, testaceous.

Length, 3.00 mm.; width, 1.00 mm.

Type (male), Mt. Gipps, Queensland, Australia, April 20, 1930, H. H. Hacker, in collection of C. J. Drake.

This is the smallest described species in the genus. It can be distinguished from its congeners by the non-inflated hood, narrow costal area, feebly convex pronotum and flat dorsal aspect of head as well as smaller size of body.

Parada absona, new sp.

Oblong, testaceous, with the last antennal segment, and anterior and discal parts of pronotum black, also a long mark on raised boundary veins (beyond middle) between discoidal and subcostal areas, a small spot beyond apex of discoidal area and a subapical spot in discoidal area dark fuscous. Hood, collar, carinae, paranota and posterior part of pronotum testaceous.

Head black, with five testaceous spines. Antennae long, indistinctly pilose; segment I short, stouter and a little longer than II; III three times as long as IV. Rostrum testaceous, extending a little beyond mesosternum. Rostral laminae areolate, testaceous, open behind. Bucculae, wide, testaceous, closed in front. Legs moderately long, testaceous.

Pronotum strongly convex, deeply coarsely closely pitted, tricarinate; hood rather small, inflated, not very high, bell-shaped, not extending posteriorly over convex part of pronotum; paranota moderately wide, triseriate, almost completely reflexed, not quite touching surface of pronotum opposite humeral angles. Median carina profound, moderately raised, without distinct areolae. Lateral carinae sinuate, moderately wide and foliaceous on pronotum proper, there completely reflexed inwardly, each continued as a raised nerve on hind process, the space between upper edge of foliaceous part and median carina about half as wide as carina.

Hemelytra moderately constricted beyond the middle; costal area moderately wide, mostly uniseriate, biseriate for a short distance at base, the cells moderately large and hyaline; subcostal area a little wider, biseriate; discoidal area long, about three-fourths as long as hemelytra, with outer boundary only a little sinuate, widest beyond middle, there six cells deep, narrowed at both base and apex; sutural area with cells a little larger; hypocostal vein uniseriate. Wings deeply clouded with dark fuscous, not as long as hemelytra.

Type (male), Lake Barrine, Queensland, Australia, El. 2900 feet, April 19, 1932, P. J. Darlington, in Museum Comparative Zoology (Harvard). Allotype and 4 paratypes, taken with type.

This species is most closely allied to *P. torta* Drake, but is easily separated from it by the longer body, much shorter and smaller hood, longer carinae and shape of discoidal area. The hood of *P. torta* is much larger and projects backwards over anterior part of convex pronotum.

Parada torta Drake

Parada torta Drake, Iowa St. Coll. J. Sci., 17 (1) :4, 1942.

Six specimens, Mt. Wilson, Blue Mts., N. S. W., Australia, El. 8500 feet, Jan., 1932, P. J. Darlington. Known heretofore only from the type locality, Mt. Gipps, Queensland.

Parada torta pulla, new var.

Separated from typical form by the black head, pronotum, hood, paranota, carinae and discoidal and large part of subcostal areas of hemelytra. Size same as typical form, 3.00 mm. long.

Type (female), Mt. Wilson, Blue Ridge, El. 8500 feet, N. S. W., Australia, P. J. Darlington, in Museum Comparative Zoology (Harvard).

Parada popla Drake

Parada popla Drake, Iowa St. Coll. J. Sci., 17 (1) :3, 1942.

Numerous specimens, National Park, McPherson Ridge, Queensland, Elevation 3,000-4,000 feet, March 11, 1932, P. J. Darlington.

Parada taeniophora Horvath

Cysteochila (*Parada*) *taeniophora* Horvath, Ark. Zool 17A(24) :2, p. 2. 1925.

Several specimens, Mt. Surgeon, N. Q., Australia, El. 3,500-4,000 ft., July 28, 1932; Lake Barrine, Atherton Tab., El., 2,800 feet, April 28, 1932, all by P. J. Darlington.

STUDIES ON ARIZONA ANTS (4) *CAMPONOTUS* (*COLOBOPSIS*) *PAPAGO*, A NEW SPECIES FROM SOUTHERN ARIZONA[1]

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This paper deals with ten colonies of *Colobopsis* taken by the writer in southern Arizona during the summers of 1950 and 1951. The work done during the second summer was made possible by a fellowship from the John Simon Guggenheim Memorial Foundation. Most of the observations on habits carried in this paper were made during the first months of a fifteen month survey of the ants of the southwestern United States and northern Mexico. I am happy to take this opportunity to express my sincere appreciation for this fellowship. I wish to thank Mr. Harry Stevens, the United States Agent in charge of the Papago Indian Reservation at Sells, Arizona, for his kindness in permitting us to use the Forestry Cabin on the western slope of the Baboquivari Mountains. We are also grateful to Mr. and Mrs. Forrest Perkins, who generously turned over their ranch house to us during our stay on the eastern slope of the Baboquivaris. The comfortable surroundings provided in each case greatly facilitated the work with the ants.

The older records for the species described in this paper were regarded by W. M. Wheeler as representatives of *C.* (*Colobopsis*) *cerberulus* Emery. For reasons which will be given later, I feel that it is a much sounder procedure to treat this ant as a new species. To do so involves the risk that it may subsequently prove to be *cerberulus*, as Wheeler supposed. But this risk must be taken if we are ever to get out of the fog which has obscured *cerberulus* from the time of its original recognition. In 1920 Emery described *cerberulus* from a single, winged female taken in the state

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

of Michoacan, Mexico (1). It is hard to understand why Emery felt that this specimen should be named. During the fifty years of entomological work which lay behind him, Emery had often struggled with the difficulties that result whenever a new species of ant is based on a dissociated female. Moreover, by 1920 the importance of accurate field data to an original description was clearly recognized. Yet Emery elected to describe an insect which wholly lacked significant field data. That the ant was known to have been taken in Michoacan is of scant significance, for that state has a singularly diverse topography and a corresponding diversity of biotic associations. Finally, Emery's description of *cerberulus* was brief and without figures. It was certain from the start that this description would be a source of trouble for, under the circumstances, nothing but a miracle could prevent subsequent confusion in the case of *cerberulus*.

Most of Emery's short description of *cerberulus* consists of a comparison of his unique type with the female of Wheeler's *etiolatus*. From the nature of this comparison it is evident that Emery had specimens of *etiolatus* at the time that he wrote the description of *cerberulus*. When Wheeler described *etiolatus* in 1904 (2) he presented no figure of the female and his description of that caste lacks certain features which Emery later cited. It is certain, therefore, that Emery had authentic material of *etiolatus*, probably from that part of the type series which Wheeler sent to Forel. It would otherwise have been impossible for Emery to have presented the characterization of the *etiolatus* female which he used in his comparison with the female of *cerberulus*.

The fact that this comparison utilized the female of *etiolatus* may well be what led Wheeler to believe that he could recognize the essential features which distinguish *cerberulus;* for Wheeler had type females of *etiolatus* in his own collection and with these as a guide he could secure a much more exact idea of the female of *cerberulus* than would be expected from Emery's brief account of that insect. It is now certain that Wheeler overestimated the utility of Emery's description. It is good enough to give a general idea of the female of *cerberulus* but it lacks the finer points which are necessary for the work that Wheeler attempted.

In 1920 Wheeler had in his collection a number of males and females of *Colobopsis* taken in southern Arizona. These specimens came from Texas Pass in the Dragoon Mountains, Sabino Basin in the Santa Catalina Mountains and Black Dike Prospect in the Sierrita Mountains. The specimens from Texas Pass had been taken by Wheeler at light. No field data accompanied the other specimens. Soon after Emery published his description of *cerberulus,* Wheeler identified the above specimens as that species. But no reference was made to them until 1934. In that year Wheeler published a paper (3) in which he attributed the Arizona material to *cerberulus.* He also described as *cerberulus* three major workers which Dr. Elizabeth Skwarra had collected near the city of Vera Cruz, Mexico. These specimens were taken in a hollow spine of *Acacia sphaerocephala.* Wheeler's association of the Arizona females with the Michoacan type was made on the basis of Emery's description. This could be defended, since the same caste was involved in each case. but the association of the Vera Cruz majors with *cerberulus* was a different matter. It was based on a comparison of the Vera Cruz majors with the Arizona females and on Wheeler's unsupported belief that the former represented the unknown major caste of *cerberulus.* I was forced to deal with this extraordinary double association when I was preparing the *Colobopsis* section of *The Ants of North America* (4). Since I could see no possibility of validating Wheeler's treatment of the Vera Cruz majors, *cerberulus* was omitted from the key. I commented on certain geographical discrepancies, which made Wheeler's association seem unlikely, but pointed out that there was little hope for bettering the matter until someone secured a nest of this ant in which both major worker and female were present.

It was, therefore, very gratifying to find such a colony in Garden Canyon, Huachuca Mountains, in July 1950. This colony was a fragment of a larger one, to judge from those subsequently taken, for it contained only eight individuals. One of these was a deälated female, three were major workers and four were minor workers. The nest was found in a dead limb of *Quercus emoryi.* As soon as possible I took this nest to Harvard for comparison with material identified as *cerberulus* in the Wheeler Collection. This was put at my disposal through the courtesy of Dr. Joseph Bequaert whom I wish to thank for this kindness. The material labelled as *cerberulus* in the Wheeler Collection consisted of Skwarra's specimens from Vera Cruz and a series of females from Texas Pass in the Dragoon Mountains. To save possible confusion in the future it seems well to note that on the locality labels of these specimens the name is mispelled as the "Dragon Mountains". Texas Pass is a low pass at the western end of the Dragoon Mountains, through which the highway between Willcox and Benson now runs. The specimens from Sabino Basin and Black Dike Prospect, which Wheeler mentioned in 1934 could not be found. It is probable that these specimens are now in the collection of the American Museum of Natural History.

As I had expected, the female from Garden Canyon proved to be identical with those from Texas Pass. But the Garden Canyon majors were not the same as those from Vera Cruz. I have presented the differences in detail on a subsequent page. They need not be discussed here other than to state that, in my opinion, these differences clearly show that the two insects belong to separate species.

While the above comparison does not cover the second part of Wheeler's double association, it has given results significant to it. The head of the major of *Colobopsis,* like that of most species of ants in which this caste is present, differs more or less from that of its accompanying female. But there is no rule which governs the degree of difference. The amount of differentiation varies with the species and this circumstance defeats any attempt at anticipating the finer structure of one caste from that of the other. Since this is the case it should be obvious that nothing can be done with *cerberulus* until the unique female type can be proven identical with a female whose major worker is known. That this could be done by using Emery's description appears to the writer to be utterly impossible. Nor do I believe that a comparison of Emery's type with material now present in American collections would necessarily be conclusive. Since the Vera Cruz specimens are specifically different from those which occur in southern Arizona, there is good reason to suppose that the Michoacan type is also different. In all likelihood, therefore, a comparison of Emery's type with females taken in southern Arizona would merely substitute a new problem for an old one. For, unless the two proved identical, we would still have no idea as to the characteristics of the major of *cerberulus*. In all probability the nature of Emery's *cerberulus* will remain enigmatical until extensive collections of arboreal ants can be made in Vera Cruz and Michoacan. When complete colonies of *Colobopsis* can be taken in these states and compared with Emery's type the primary difficulty in the *cerberulus* problem may be overcome.

But we cannot wait until this is done to deal with a secondary difficulty which has resulted from Wheeler's unfortunate association. Since the Vera Cruz majors are specifically different from specimens coming from southern Arizona, the least that can be done is to provide a new name for one or the other of these insects, in order that the two species can be handled without violating nomenclatorial rules. I am convinced that it is best to treat the Arizona material as a new species for the following reasons:

(1). If only one new name is proposed the remaining species will have to be considered as *cerberulus* until this can be definitely authenticated or certainly disproved.

(2). From the standpoint of proximity it is much more likely that the Vera Cruz majors should be the same as the type of *cerberulus*. Southern Arizona lies seven hundred miles to the north of Vera Cruz and Michoacan. But the two states themselves are separated by less than two hundred miles and they lie in approximately the same latitudes.

(3). Any additional description in the case of the *cerberulus* complex should deal with adequate material about which there must be no occasion for speculative association. The Arizona material fully meets this condition. The Vera Cruz majors obviously do not. In connection with this last point it seems worth noting that in the ten colonies on which this study was based there were 23 females, 2 males, 104 major workers and 194 minor workers. These totals do not include 20 additional females taken at light.

There follows the description of the above material:

Camponotus (Colobopsis) papago sp. nov.

Major worker: head 1.06 mm., thorax and petiole 1.5 mm., overall length 4.5 mm. (Plate 13, figure 3)

Truncated portion of the head distinctly concave, with a low, serrate flange bordering either cheek but not continued across the top of the clypeus. The entire clypeus raised slightly above the level of the adjacent portions of the cheeks, which slope downward to the clypeus from the bordering flange. Sculpture of the truncated portion of the head consisting of coarse, irregular ridges which form reticulations. These reticulations and the areas which they surround, are covered with numerous, very fine, crater-like punctures. These punctures do not dull the shining surface. Sculpture on the mandibles rough but not distinctly reticulate. Seen from above the frontal lobes are covered with even reticulations which surround circular or nearly circular depressions. This reticulate sculpture extends almost to the level of the single median ocellus, with the depressions becoming shallower and more widely spaced towards the rear. The rear third of the head is finely shagreened and notably more shining, particularly at the occipital corners, than is the heavily sculptured front of the head. The reticulation on that part of the clypeus which lies behind the truncation is much less even than that on the frontal lobes. Reticulation on the cheeks less even and somewhat coarser than that on the frontal lobes. The entire anterior half of the head with the same fine, crater-like punctures which occur on the truncated portion. A very feeble frontal furrow is visible in certain lights. Antennal scapes rather strongly shining with small, white, appressed hairs. Hairs on the truncated portion of the clypeus and on the front face of the mandibles very strongly clubbed and shaped like tear drops. Hairs along the outer border of the mandibles, on the frontal lobes and on the sides of the head behind the truncation long, curved, blunt and often clavate but rarely as strongly clubbed as those of the clypeus.

Thorax, petiole and gaster more finely shagreened than the head with the surface strongly shining. In addition to the shagreening there are very small scattered punctures present, from which arise short, delicate, fully appressed hairs. No erect hairs present on the thorax, those on the crest of the petiole very short and fine. Erect hairs rather sparse on the gaster, mainly confined to the row at the posterior edge of each segment. Legs finely shagreened and strongly shining with delicate, appressed hairs like those of the thorax. Fore femora expanded dorso-ventrally and strongly compressed laterally. The tarsal joints and the funiculi covered with abundant, short, yellowish, semierect hairs. Color deep blackish brown, the anterior third of the head clear yellowish brown. Tarsi, funiculi, base of the petiole and the sutures of the thorax light brown.

Worker minor: head 0.9 mm., thorax and petiole 1.25 mm., overall length 3.25 mm. (Plate 13, figure 2)

Head, seen from the front, with the eyes notably more convex than those of the major, the sides in front of the eyes narrowing to the insertion of the mandibles. Mandibles with four well-developed teeth. Clypeus moderately convex from side to side, somewhat more strongly convex from front to rear, ecarinate or with a very blunt and indistinct carina. Frontal lobes together forming a trapezoidal area which is a little wider behind than in front. Frontal groove absent. Occiput evenly convex, the lateral portions meeting the posterior border of the eyes without any distinct posterior angles. The antennal scape, when extended straight to the rear, surpasses the occipital border by an amount slightly less than its greatest thickness. Head, thorax and abdomen moderately shining with a rather strong, reticulate shagreening. Appressed hairs as in the major and female. Erect hairs long, tapered and with sharp tips. They are rather numerous on the man-

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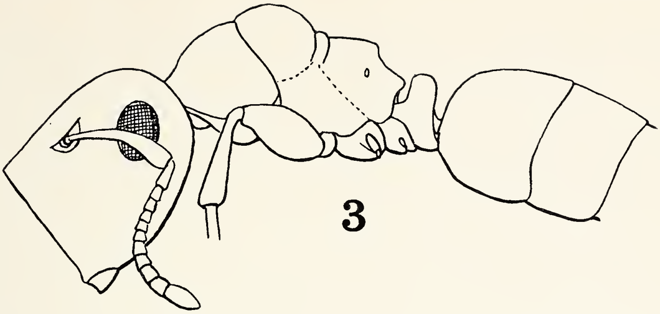
EXPLANATION OF PLATE 13

Camponotus (Colobopsis) papago. Fig. 1. Female. Fig. 2. Minor worker. Fig. 3. Major worker. (All figures drawn to same scale.)



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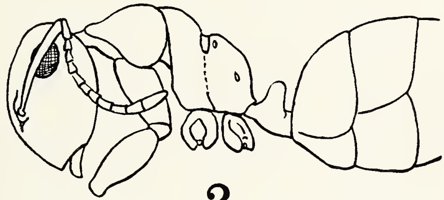

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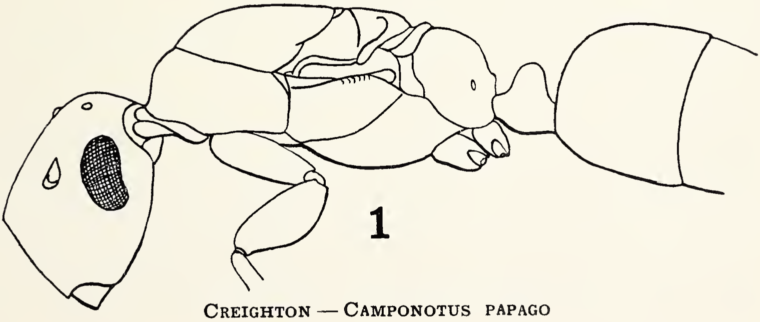

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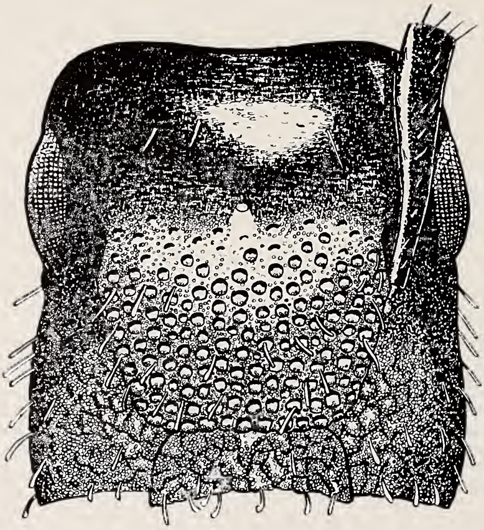
CREIGHTON — CAMPONOTUS PAPAGO

dibles and clypeus, sparser on the front and represented on the occiput by a single pair. Thorax without erect hairs. Crest of the petiole with several very short, delicate erect hairs. Erect hairs on the gaster widely and rather evenly spaced over the dorsum except at the base of the first segment, which is hairless. Fore femora laterally compressed as in the major. Color: blackish brown, the mandibles and tarsal joints light brown.

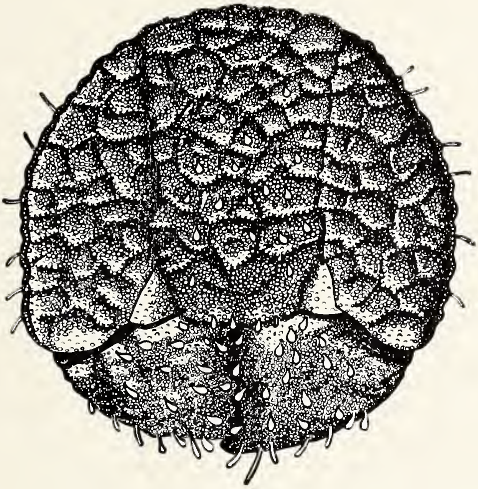
Female: head 1.25 mm., thorax and petiole 2.3 mm., overall length 6.0 mm. (Plate 13, figure 1)

Head similar to that of the major but with all three ocelli large and prominent. Sculpture on the truncated portion of the head identical with that of the major. Reticulate sculpture on the frontal lobes smaller and shallower than that of the major and not extending as far back on the head. Eyes distinctly larger and more convex than those of the major. Hairs on the mandibles and the truncated portion of the clypeus longer and less clubbed than those of the major.



Text-figure 1. Upper surface of the head of the major worker of *Camponotus (Colobopsis) papago* sp. nov.

Thorax feebly shagreened and rather strongly shining, with small, scattered, appressed hairs as in the major. Erect hairs absent on the thorax except for a pair of long, yellowish hairs which arise from the scutellum. Gaster more feebly shagreened and more strongly shining than the thorax but with similar appressed hairs. Erect hairs on the gaster only moderately abundant, mostly confined to a row at the rear of each segment. Erect hairs on the terminal gastric segment distinctly longer than those elsewhere. Fore femora laterally compressed as in the major. Color blackish brown, the anterior quarter of the head, much of the scutum and the middle and hind tarsi yellowish brown. Wings hyaline, iridescent and with pale yellowish veins.



Text-figure 2. Truncated surface of head of major worker of *Camponotus (Colobopsis) papago* sp. nov.

Male: Head 0.7 mm., thorax 1.5 mm., overall length 3.5 mm.

The sides of the head in front of the eyes taper slightly from the anterior edge of the eye to the insertion of the mandible. Behind the eyes the sides of the head are evenly convex from the rear edge of the eye to the lateral ocellus. The occipital border is slightly concave between the lateral ocelli. Anterior border of the clypeus feebly sinuate. Mandibles small, somewhat spatulate and with the teeth represented only by a V-shaped notch on the masticatory margin. Antennal scapes long, surpassing the occipital margin by a little more than one-third their length.

The greatest width of the thorax, when seen from above is approximately equal to that of the head. In profile the neck of the pronotum is short, the anterior face of the scutum is evenly rounded and its dorsal face is flat and on the same level as the anterior edge of the scutellum. The latter is convex in profile and descends sharply in the rear. In profile the epinotum is depressed well below the level of the scutellum, rounded and without a good separation between the basal and declivious faces. Petiole with a short but distinct anterior peduncle, the node low in profile, tapering slightly from base to crest with the latter evenly rounded. Seen from above the node of the petiole is transversely oval, with the width about twice the thickness from front to back. Gaster approximately as long as the thorax. Genitalia small and obscure.

The surface is moderately to strongly shining. Front and genae strongly shining with scattered punctures. Occiput and scutum less shining with a delicate reticulate sculpture. Scutellum very shining with scarcely any sculpture. The remainder of the thorax and the node of the petiole with a reticulate sculpture which is less pronounced than that of the scutum. Gastric sculpture very feeble, shagreened but scarcely reticulate, the surface more shining than that of most of the thorax. Sparse erect hairs are present on the head, the coxae and the gaster. Thorax without erect hairs. Antennal scapes, the femora and the tibiae with very delicate, short, sparse hairs which are fully appressed. Pubescence on the antennal funiculi and the tarsal joints suberect and not particularly prominent. Thorax and gaster dirty, yellowish brown, the head distinctly darker. Wings hyaline and iridescent with the veins very pale.

Types of female, male, major and minor worker deposited in the Museum of Comparative Zoology, Cambridge, Mass. The type locality is Forestry Cabin (Baboquivari Canyon), Baboquivari Mts. (3500′), Arizona. The type nest was taken on July 24, 1951 in *Quercus emoryi*. Four other colonies were taken in this same station. In addition four more colonies were secured near Perkins Ranch in Brown Canyon on the eastern slope of the Baboquivari Mountains. These last colonies were situated at elevations between 4100 and 4600 feet. Mention has already been made of the single colony taken in Garden Canyon in the Huachuca Mountains. The elevation of the station from which this colony came was 5800 feet.[1]

In the following paragraphs are given the results of the comparison between the major workers of *papago* and the three major workers from Vera Cruz which may be *cerberulus*:

1. In *papago* the length of the head is shorter in proportion to its width and the sides of the head in front of the eyes are slightly convex when the head is viewed from above. In the Vera Cruz majors the sides of the head in front of the eyes are straight or nearly so when the head is viewed from above.

2. In *papago* the scape only slightly surpasses the occipital margin. The amount of the scape which projects beyond the margin is notably less than the greatest diameter of the scape. In the Vera Cruz majors the scape surpasses the occipital margin by an amount equal to the greatest diameter of the scape.

3. In *papago* the triangular lateral portion of the mandible is feebly and irregularly concave on its anterior face. In the Vera Cruz majors the triangular, lateral portion of the mandible is so strongly concave on its anterior face that the tip of the triangle appears to point forward.

4. In *papago* the truncated portion of the clypeus is uniformly covered with coarse, reticulate ridges. In the Vera Cruz majors this portion of the clypeus is also reticu-

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[1] Since the above was written nests of *C. papago* have been taken by the writer in Cottonwood Canyon, Peloncillo Mts. (4800′), Arizona and fourteen miles north of Imuris, Sonora (3200′), Mexico. In both cases the ants were nesting in *Q. emoryi*.

late but at the middle of the clypeus there is a heavy, median ridge which runs from front to back. This ridge is wavy but it is not reticulate.

5. In *papago* the portion of the clypeus behind the truncation is not clearly set off from the frontal lobes and the frontal area is indistinct. In the Vera Cruz majors the portion of the clypeus behind the truncation is clearly separated from the frontal lobes and the frontal area, although small, is very distinct.

6. In *papago* the serrate flange at the edge of the truncated portion of the head is lower and less prominent than that of the Vera Cruz majors.

7. In *papago* the erect hairs on the sides of the head are longer, more numerous and less clavate than those of the Vera Cruz majors. In both species most of the hairs on the mandibles and the truncated portion of the clypeus are so strongly clubbed that they are shaped like tear drops. It is strange that Wheeler made no mention of these conspicuous and characteristic hairs. From a practical point of view they furnish the easiest means for distinguishing *papago* from any other species which occurs in the United States. None of our other species have such hairs, hence there is no possibility of confusing *papago* with any other species if these hairs are made the basis for its recognition.

Before concluding this paper I wish to present an account of the habits of *C. papago*. The ten colonies taken to date have all come from evergreen oaks or mesquite trees. The two oaks involved are *Quercus emoryi* and *Q. oblongifolia*. Most nests are constructed in the stubs of broken-off branches which have a diameter of an inch and a half or more. The thickness of the stub seems to be more important than its length. I have taken colonies from stubs less than six inches long but I have yet to see one in a branch that was small enough to be considered a twig. Inside the stub are numerous, narrow passages which roughly parallel the grain of the wood. Several openings lead from these to the outside. It is evident that in a fully developed nest of *papago* there must be several "janitors" on duty at the same time. As mentioned above, this ant does not ordinarily nest in twigs. At first I supposed that this reaction might be due to a scarcity of trees which have twigs with a suitable central pith cavity and this may be a part of the explanation. But it now seems certain that moisture plays a large part in the choice of nest site. I had realized that *papago* usually nests in limb stubs which point upward long before I saw any significance in this response. But on one occasion I was examining limb stubs immediately after a heavy and prolonged rain storm. I found that the stubs which pointed upward caught and held the rain water much as a cistern would. Rain soaked into the fractured upper end of the stub and accumulated at its lower end. The lower end was often so wet that water would drip out of it after the stub was knocked loose from the tree. In contrast, the horizontal stubs and those which pointed downward caught far less rain. The latter were often quite dry inside, despite the fact that they had been drenched with rain for several hours previously. It thus appears that the female of *papago,* in choosing a nest site in limb stubs which point upward, takes advantage of a natural system of water conservation. This could certainly be one reason why the nesting habits of *papago* differ from those of the eastern twig-dwelling species. It may be added that the preference of this ant for nesting in the stubs of broken-off limbs seems to be one factor which has kept it out of the hands of collectors. It was some time before I realized that the most important piece of equipment needed to collect *C. papago* is a heavy axe. The nests are almost always built in sound, hard wood and it is not easy to get the insects out, even after the stub has been knocked loose. The ants which are in the lower passages can often be jarred out by whacking the stub with the back of the axe. But to get all of them the stub must be split into pencil-sized pieces. Anyone who makes a practice of collecting *papago* will never lack for exercise.

The majors of *C. papago,* when disturbed, have a curious habit of exuding from the mouth a sticky, greyish fluid. This often spreads backward over the truncated portion of the head. If it is allowed to dry there it forms a crust that is almost impossible to remove. As to what the use of this fluid may be is hard to say. It may have repellant characteristics for other ants and thus serve as a defensive mechanism which the major employs when acting as a janitor at the nest entrance.

It is safe to infer that *C. papago* forages at night. Although I have examined hundreds of oak and mesquite limbs, some of which later proved to contain flourishing colonies of *papago*, I have never seen a worker outside the nest. This foraging must be a slow business, for *papago* is a rather sluggish ant. The minor workers can move with fair speed but the majors are so slow that it is easy to pick them up. Finally, the marriage flight of *papago* occurs throughout the month of July. In an ordinary year it would thus take place during the first half of the summer rainy season.

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