The Ant Larvae of the Subfamily Formicinae (Hymenoptera; Formicidae): Supplement[1]

GEORGE C. WHEELER AND JEANETTE WHEELER[2]
Department of Biology, University of North Dakota, Grand Forks

ABSTRACT

An earlier study on the larvae of the Formicinae was published by the authors in 1953. The present supplement contains descriptions of the larvae of 44 additional species in the genera *Acropyga, Calomyrmex, Camponotus, *Diodontolepis, Gesomyrmex, Melophorus, *Myrmecocystus, Myrmecorhynchus, Notoncus, *Opisthopsis, Paratrechina, *Polyergus, Polyrhachis, *Prolasius* and **Stigmacros*. Genera marked with an asterisk are new to the authors' collection and are characterized here for the first time. Necessary revisions are made in earlier descriptions and additional references to the literature are cited.

Subsequent to the publication of our article on the larvae of the subfamily Formicinae (Wheeler and Wheeler 1953), we have collected or received from other myrmecologists so much additional material that it has become necessary to publish a supplement before we can generalize about the subfamily as we did with the Myrmicinae (Wheeler and Wheeler 1976).

The purpose of this supplement, then, is (1) to characterize the 7 genera acquired since the previous publication; (2) to describe the 15 species in those genera; (3) to describe 29 additional species in 8 previously studied genera; (4) to revise our published characterizations as required by the new material; and (5) to cite additional references to formicine larvae in the literature.

SUBFAMILY FORMICINAE

Bernard, 1951b: "Larves à tête petite, omnivores ou spécialisées; hypocéphales, bien segmentées; poils variés, souvent crochus" (p. 1041). "Larves bien segmentées, tête et thorax mobiles, généralement à fortes mandibules et pilosité variée. Tête recourbée ventralement (larves *hypocéphales*). Glandes labiales normales. Rectum souvent très grand. Cocon très général" (p. 1074.)

Tribe MELOPHORINI Forel

Revision. — Thorax and first abdominal somite curved ventrally and forming a rather stout neck; remainder of abdomen elongate, straight and subcylindrical. No uncinate body hairs. Head small. Head hairs few and moderately long. Labrum bilobed. Anterior surface of labium with a median protuberance near the base. Praesaepium and chiloscleres lacking.

Genus *Diodontolepis* Wheeler

In addition to tribal characters: anus terminal; cranium transversely subelliptical; body hairs simple, bifid or trifid.

Diodontolepis spinisquamis (Ern. André)
(Fig. 1)

Length (through spiracles) about 10 mm. Thorax and first abdominal somite forming a rather stout neck; remainder of abdomen moderately slender and nearly straight; posterior end rounded; anus terminal; leg and wing vestiges present. Posterior to each abdominal spiracle there are 2 structures of unknown nature and function. Integument of ventral surface of prothorax with minute spinules in short transverse rows, also a few transverse rows on dorsal surface of posterior somites. Body hairs abundant and uniformly distributed, 0.15–0.35 mm long, with slender tapering tip, with or without alveolus and articular membrane, simple, bifid or trifid. Head small. Cranium transversely subelliptical in anterior view; mouth parts large; gula spinulose. Head hairs few, 0.04–0.11 mm long, each with a few minute denticles near the tip. Each antenna with 3 sensilla, each of which bears a small spinule. Labrum bilobed; anterior surface of each lobe with 5 sensilla and 3 or 4 hairs (0.015–0.03 mm long) on the anterior surface near the ventral border; posterior surface densely spinulose, the spinules minute and in numerous subtransverse rows, the rows grouped in 2 subtriangles which have their bases near the middle; posterior surface with about 13 sensilla on each half. Mandibles subtriangular, rather stout and moderately sclerotized; wedgeshaped, with the edge medial; apical tooth sharply defined, short, moderately slender, round-pointed and nearly straight; medial border convex and without teeth; anterior and posterior surfaces roughened with numerous longitudinal ridges bearing minute spinules. Maxillae with the apex conoidal; the surface furnished medially with short arcuate rows of minute spinules and laterally with small papillae; palp a skewed peg bearing 2 apical, 2 subapical, and 1 lateral sensilla; galea digitiform with 2 apical sensilla. Labium with a median anterior prominence near the base, which is furnished with a few minute spinules in short transverse rows; remainder of anterior surface with numerous spinules in short arcuate rows; palp a short peg with 2 apical, 2 subapical, and 1 lateral sensilla; with a sensillum between each palp and the opening of the sericteries; the latter salient. Hypopharynx densely spinulose, the spinules minute and arranged in subtransverse rows, the rows grouped in 2 subtriangles which have their bases near the middle.

Material Studied.—Numerous larvae from Victoria, courtesy of Dr. W. L. Brown.

[1] Accepted for publication February 28, 1967.
[2] Present address of both authors: Desert Research Institute, University of Nevada, Reno, Nevada 89507.

Genus *Melophorus* Lubbock

Revision.—Body hairs very short; of 1 or 2 types: (1) with the basal half smooth and the distal half denticulate; (2) simple, with long flexuous tip.

Melophorus turneri Forel

Length (through spiracles) about 5.2 mm. Similar to *M. bagoti,* except in the following characters: Body hairs sparse. Of 2 types: (1) 0.1–0.25 mm long, simple, with long flexuous tip, on metathorax and abdominal somites I–VII; (2) 0.1–0.25 mm long, with the distal half denticulate, varying from slender to very stout, on thorax and abdominal somites IX and X. Head hairs somewhat shorter, 0.045–0.08 mm long. Medial surface of maxilla with rows of minute spinules; palp digitiform. Labium with the spinules in short arcuate rows; palp a low cluster of 5 sensilla.

Material Studied.—Numerous larvae from Queensland, courtesy of Rev. B. B. Lowery.

Genus *Prolasius* Forel

Thorax and first abdominal somite curved ventrally and forming a rather stout neck; remainder of abdomen elongate, straight, subcylindrical and rather slender. Body hairs moderately numerous; of 4 types. Antennae minute. Maxillae not papillose.

Prolasius sp.

(Fig. 2)

Length (through spiracles) about 3.25 mm. Thorax and first abdominal somite forming a rather stout neck which curves ventrally, remainder of abdomen moderately slender and nearly straight. Anus terminal. Leg and wing vestiges present. Integument of ventral surface with a few minute spinules in short transverse rows. Body hairs moderately numerous and uniformly distributed; without alveolus and articular membrane. Of 4 types: (1) 0.035–0.075 mm long, denticulate, generally distributed; (2) on prothorax, 0.11–0.15 mm long, few, denticulate; (3) on remainder of body, 0.09–0.17 mm long, simple, a row around the middle of each somite; (4) on the abdomen, 0.035–0.065 mm long, branched. Cranium transversely subelliptical in anterior view. Gula with short transverse rows of minute spinules. Head hairs denticulate, few, 0.03–0.085 mm long, with alveolus and articular membrane. Antennae minute, on a slight knob and bearing 3 sensilla, each of which is furnished with a spinule. Labrum bilobed, anterior surface of each lobe with 3 sensilla near the ventral border; posterior surface with about 10 sensilla, spinulose, the minute spinules arranged in subparallel rows, the rows grouped in 2 subtriangles with their bases near the middle. Mandibles subtriangular, moderately sclerotized, narrowing to a smooth slightly curved apical tooth; anterior and posterior surfaces roughened with numerous oblique subparallel ridges. Maxillae with the apex conoidal and spinulose, the spinules minute and in short rows, the rows subparallel and concentric around the base of the galea; palp a rather stout peg with 4 apical and 1 lateral sensilla; galea digitiform with 2 apical sensilla. Labium with the anterior surface sparsely spinulose, the spinules minute and in rows; palp a small peg bearing 5 sensilla; opening of sericteries wide and salient. Hypopharynx densely spinulose, the spinules exceedingly minute and arranged in subtransverse rows, the rows grouped in 2 subtriangles which have their bases near the middle.

Material Studied.—A dozen larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Genus *Notoncus* Emery

Notoncus ectatommoides (Forel)

Immature Larva. — Length (through spiracles) about 4.4 mm. Generally similar to *N. foreli,* except as follows: Thorax and first abdominal somite forming a neck, remainder of abdomen inflated. Type 1 body hairs 0.05–0.15 mm long; (2) 0.075–0.2 mm long, with simple or denticulate tip.

Young Larva.—Length (through spiracles) about 3.3 mm. Generally similar to the immature larva except in the following details: Integument of the ventral surface and of the dorsal surface of posterior somites with minute spinules in short transverse rows. Body hairs sparse and uniformly distributed. Of 3 types: (1) 0.04–0.1 mm long, branched (mostly bifid); (2) 0.035–0.09 mm long, with denticulate tip; (3) 0.01–0.15 mm long, simple, attenuated.

Very Young Larva.—Length (straight) about 1.6 mm. Entire integument with minute spinules in short transverse rows. Body hairs on thorax and abdominal somites I–V only. Of 3 types: (1) 0.01–0.06 mm long, simple, stout to very slender; (2) 0.03–0.08 mm long, with bifid or denticulate tip; (3) about 0.04 mm long, on the ventral surface, 4- to 6-branched. Head hairs simple, 0.005–0.035 mm long. Mandibles with the apical tooth more curved medially, sharper and shorter. Otherwise similar to mature larva.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Notoncus enormis Szabó

(Fig. 3)

Length (through spiracles) about 6.6 mm. Similar to *N. foreli,* but stouter. Head hairs simple or with fuzzy tip.

Young Larva.—Length (through spiracles) about 3.2 mm. Differing from the mature larva in the following particulars: Body with the branched hairs 0.06–0.20 mm long, longest and slenderest ventrally; (2) simple or fuzzy-tipped hairs 0.08–0.16 mm long. Head hairs mostly simple; a few with denticles near the tip.

Very Young Larva.—Length (through spiracles) about 2.6 mm. Slender, subcylindrical, arcuate. Integument with spinules in short rows. Body hairs sparse, moderately long, uniformly distributed. Of 2 types: (1) simple, 0.03–0.16 mm long, stout dorsally, longest and slenderest ventrally; (2) 0.055–0.17 mm long, 2- or 3- branched. Head hairs simple.

Material Studied.—Numerous larvae from Queensland, courtesy of Rev. B. B. Lowery.

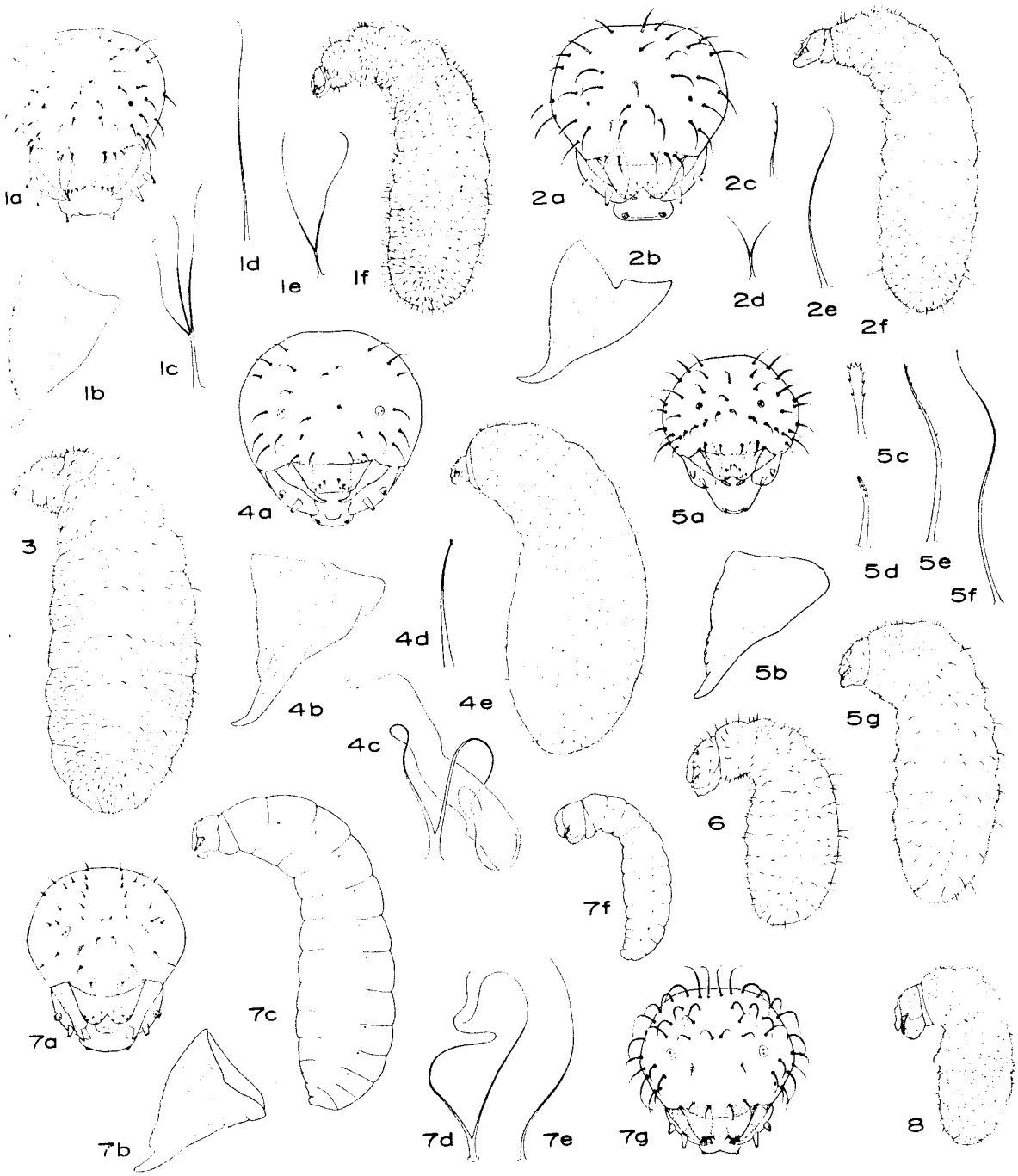

FIG. 1.—*Diodontolepis spinisquamis:* a, head in anterior view, ×42; b, left mandible in anterior view, ×208; c–e, 3 body hairs, ×169; f, larva in side view, ×6. FIG. 2.—*Prolasius* sp.: a, head in anterior view, ×83; b, left mandible in anterior view, ×269; c–e, 3 body hairs, ×208; f, larva in side view, ×17. FIG. 3.—*Notoncus enormis:* larva in side view, ×12. FIG. 4.—*Myrmecorhynchus emeryi:* a, head in anterior view, ×85; b, left mandible in anterior view, ×333; c, d, 2 body hairs, ×333; e, larva in side view, ×13. FIG. 5.—*Stigmacros acutus:* a, head in anterior view, ×85; b, left mandible in anterior view, ×333; c, d, 2 views of hairs with flattened tips, ×423; e, f, 2 other body hair types, ×423; g, larva in side view, ×28. FIG. 6.—*S. barretti:* young larva in side view, ×28. FIG. 7.—*Gesomyrmex luzonensis:* a, head in anterior view, ×60; b, left mandible in anterior view, ×167; c, mature larva in side view (hairs omitted), ×16; d, e, 2 body hairs, ×333; f, very young larva in side view, ×22; g, head of very young larva in anterior view, ×85. FIG. 8.—*Paratrechina bruesi:* young larva in side view, ×33.

Notoncus foreli Ern. André

Mature Larva.—Length (through spiracles) about 4.3 mm.

Immature Larva. — Length (through spiracles) about 3.5 mm. Thorax slenderer than remainder of body and of approximately uniform diameter; abdomen with ventral profile straight, dorsal curved; diameter greatest at abdominal somites IV and V, tapering posteriorly. Anus ventral. Head smaller than thorax. Body hairs of 2 types: (1) 0.06–0.33 mm long, generally distributed, 2- to 6-branched, longest with extremely long attenuated branches, longest on venter of abdomen; (2) 0.07–0.17 mm long, stout, with simple or branched tip, in a row around the middle of each somite.

Very Young Larva.—Length (through spiracles) about 2.7 mm. Slender; head of same diameter as the neck and on the anterior end; body arcuate, diameter greatest at abdominal somites IV and V. Integument with minute spinules in short transverse rows. Body hairs sparse. Of 2 types: (1) simple, 0.005–0.16 mm long, generally distributed, longest on abdomen; (2) 0.03–0.16 mm long, on dorsal and lateral surfaces, some with very slender flexuous branches. Head hairs simple, 0.015–0.03 mm long. Antennae each mounted on a slight irregular knob and with 3 sensilla each. Mandibles with the apical tooth more tapered, curved medially and sharp-pointed.

Material Studied.—Numerous larvae from Victoria, courtesy of Dr. W. L. Brown.

Brown 1955, p. 484: "G. C. and J. Wheeler (1953, pp. 130, 211, pl. 1, figs. 6–11) have described the larva of *N. ectatommoides* (= *N. foreli*) in their comparative study of formicine larvae. Possibly in part as a result of ideas I once expressed to them in a letter, the Wheelers speculatively suggest the possibility that the ectatommine ponerines may have given rise to the original *Notoncus* stock." Our statement on p. 130 refers to *Melophorus* and that on p. 211 to the Melophorini. We did not mention *Notoncus* in this connection.

Tribe MYRMECORHYNCHINI Wheeler

Stout. No neck. Without uncinate hairs, praesaepium, or chiloscleres.

Genus *Myrmecorhynchus* Ern. André

Stout. No neck. Thorax slightly curved ventrally. Body hairs sparse and short. Of 2 types: (1) with the apex denticulate; (2) simple or deeply bifid, with the distal portion very long, slender, and flexuous. Head small. Antennae small. Head hairs few and short. Labrum subtrapezoidal. Mandibles with the apical tooth very long.

Myrmecorhyncus emeryi Ern. André
(Fig. 4)

Worker Major.—Length (through spiracles) about 5.2 mm. Very stout; no neck; thorax slightly curved ventrally; posterior end round-pointed. Anus posteroventral. Leg and wing vestiges present. Integument of posterior somites and ventral surface of anterior somites with minute spinules in short transverse rows; a pair of integumentary structures on ventral surface of each abdominal somite I–VII. Body hairs sparse and uniformly distributed. Of 2 types: (1) 0.02–0.1 mm long, with short denticles on the tip, on all somites; (2) 0.06–0.2 mm long, simple or deeply bifid, with the distal portion very long, slender and flexuous. Head small; cranium subhexagonal in anterior view; broader than long. Head hairs few, short (0.035–0.05 mm long), the tip short-branched or bearing a few denticles. Antennae small, low on the head, each with 3 sensilla each of which bears a minute spinule. Labrum subtrapezoidal, breadth more than twice the length; anterior surface with 6 hairs and 4 sensilla; ventral border with 4 sensilla and a few rows of rather long spinules; posterior surface with 2 large and 7 or 8 small sensilla and numerous rather long spinules in long rows radiating from the dorsolateral angles. Mandibles subtriangular, in anterior view; wedge-shaped, with the edge medial; apical tooth very long, with the tip curved medially and heavily sclerotized; anterior and posterior surfaces with longitudinal rows of spinules. Maxillae with the apex conoidal and with a few rows of spinules on the medial surface; palp an irregular peg bearing 5 sensilla (2 encapsulated and 3 bearing a spinule each); galea digitiform, with 2 apical sensilla. Labium narrow, anterior surface with a few rows of minute spinules in 2 lateral patches; palp a slight elevation bearing 5 sensilla (2 encapsulated and 3 bearing a spinule each); an isolated sensillum between each palp and the opening of sericteries; the latter a short transverse slit. Hypopharynx densely spinulose, the spinules arranged in subtransverse rows, the rows grouped in 2 subtriangles, which have their bases near the middle.

Worker Media (length through spiracles about 3.8 mm) and *Worker Minor* (length through spiracles about 3.6 mm).—Generally similar to major worker but relatively stouter and with type 1 hairs on the prothorax only.

Young Larva.—Length (through spiracles) about 1.7 mm. Thorax and first abdominal somite curved ventrally to form a slender neck; remainder of abdomen with the ventral profile straight and the dorsal C-shaped; posterior end pointed; anus ventral. Whole integument with minute spinules in short arcuate rows. Body hairs numerous and moderately long (0.04–0.12 mm), the longest with alveolus and articular membrane; simple to 4-branched. Otherwise similar to the mature larva.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Tribe PLAGIOLEPIDINI Forel

Without praesaepium, chiloscleres, or uncinate hairs.

Genus *Plagiolepis* Mayr

Bernard 1951b, p. 1018: "Les larves agiles, à pièces buccales saillantes, ont habituellement un régime insectivore, et sont capables de dévorer seules les frag-

ments de proies que les ouvrières déposent dans leurs voisinage."

Plagiolepis crozi Santschi

Bernard, 1951b, p. 1018, fig. 935B: drawing of larva in side view (after Athias-Henriot).

Genus *Acropyga* Roger

Acropyga australis Forel

Immature.—Length (through spiracles) about 2.1 mm. Generally similar to *A. moluccana papuana* Mann, except as follows: Thorax strongly arched; diameter of abdomen greatest at third and fourth somites; ventral surface nearly straight, dorsal curved. Body hairs with or without alveolus and articular membrane, 0.04–0.12 mm long. Of 2 types: (1) simple; (2) 2- to 4-branched. Head hairs shorter (0.06–0.13 mm long). Mandibles with the apical tooth more acute. Maxillary palp with 5 sensilla (3 with a spinule each and 2 with a tall cap); galea conoidal. Anterior surface of labium without spinules; opening of sericteries a narrow slit in a shallow depression on the anterior surface.

Very Young Larva.—Length (through spiracles) about 1.3 mm. Subcylindrical and crescentic; head of same diameter as body. Anus ventral. Integument with minute spinules in short rows. Body hairs sparse, moderately long, fewer on the ventral surface. Of 2 types: (1) simple, 0.03–0.11 mm long, longest and most numerous on the abdomen; (2) 2- or 3-branched, 0.05–0.08 mm long. Head hairs short (0.04–0.08 mm long). Maxillary palp with 5 sensilla (3 with a spinule each and 2 with a tall cap); galea an irregular knob with 2 sensilla.

Material Studied.—Numerous immature larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Genus *Acantholepis* Mayr

Acantholepis frauenfeldi Mayr

Bernard 1951a, p. 93: "La forme externe et la pilosité ne sont pas sensiblement modifiées par rapport aux espèces hygrophiles des mêmes genres. Il n'y a pas lieu de retenir les déductions de Santschi (1908), basées sur *Leptothorax arenarius* des oueds tunisiens, selon lesquelles des poils crochus aideraient les larves à se maintenir dans le sable croulant. D'une part, *Cataglyphis bombycina*, éminemment sabulicole, a des poils simples et courts; d'autre part, une foule de *Leptothorax* et de *Crematogaster* habitant les roches lisses ont des poils crochus." Bernard 1951b, fig. 937A on p. 1020: internal anatomy (after Athias-Henriot). Bernard 1953, p. 13: "La forme externe larvaire ne parait pas offrir de traits spéciaux aux Fourmis xérophiles, mais l'anatomie interne a . . . quelques particularités . . . . Leurs larves sont relativement riches en corps gras, de nature à faciliter la rétention d'eau par les tissus. Les glandes labiales sont petites et à cellules réduites: peut-êtres y a-t-il économie de salive. La vésicule rectale . . . est très grande et reployée autour de l'intestin, suggérant une récupération possible de l'eau des excreta." Valentini 1951, fig. 2 on p. 253: internal anatomy of young larva.

Tribe MYRMELACHISTINI Forel

With 2 or 3 types of body hairs, 1 of which is long and whiplike. Without praesaepium, chiloscleres, or uncinate hairs.

Genus *Stigmacros* Forel

Short and stout; thorax and first abdominal somite bent ventrally at a right angle to the remainder of the abdomen, which is subellipsoidal. Body hairs sparse; of 2 or 3 types, 1 of which is long and whiplike. Head hairs few.

Stigmacros acutus McAreavey
(Fig. 5)

Length (through spiracles) about 1.9 mm. Stout; thorax and first abdominal somite bent ventrally at a right angle; remainder of abdomen straight; diameter greatest at abdominal somites III–V and diminishing slightly toward either end; posterior end round-pointed. Anus ventral. Integument of ventral surface with minute spinules in transverse rows. Body hairs rather sparse, short to moderately long, uniformly distributed. Of 3 types: (1) the most numerous (but few on the thorax), 0.02–0.05 mm long, the tip flattened and fringed with denticles; (2) most numerous on the thorax, 0.02–0.08 mm long, normally tapered and with denticles; (3) on the metathorax and abdominal somites I–VIII, 0.08–0.12 mm long, simple, flexuous and with the tip extremely attenuated. Head large; cranium transversely subhexagonal in anterior view, a third broader than long; head hairs few, 0.025–0.26 mm long, denticulate. Antennae small, each with 3 sensilla, each of which bears a spinule. Labrum twice as broad as long; narrowed ventrally; bilobed, each lobe with 2 hairs and 2 or 3 sensilla on the anterior surface; posterior surface densely spinulose, the spinules rather large and in short rows, the rows radiating from the dorsolateral angles; with 6 large and 6 small sensilla near the center. Mandibles subtriangular in anterior view, apex strongly sclerotized, becoming less so dorsally width at base ⅔ the length; basal ⅔ stout and wedge-shaped, the edge medial; narrowing to a smooth, slightly curved apical tooth; medial edge with transverse ridges; anterior and posterior surfaces with longitudinal ridges, some of which bear minute spinules. Maxillae lobose, with the apical and medial surfaces spinulose; palp a skewed peg with 2 apical, 2 subapical and 1 lateral sensilla; galea digitiform, with 2 apical sensilla. Labium with the anterior surface spinulose, the spinules small and in short arcuate rows, which are transverse and subparallel; palp a skewed peg with 2 apical, 2 subapical and 1 lateral sensilla; opening of sericteries wide and salient. Hypopharynx densely spinulose, the spinules rather large and in moderately long rows, the rows radiating from the dorsolateral angles and grouped in 2 subtriangles which have their bases near the middle.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Stigmacros barretti Santschi
(Fig. 6)

Length (through spiracles) about 2.8 mm. Generally similar to *S. acutus*. Body hairs of 2 types: (1) 0.03–0.06 mm long, the tip flattened and fringed with numerous denticles, on abdominal somites I–VIII; (2) 0.05–0.08 mm long, tapered and with short denticles, on thorax and abdominal somites IX and X. Mandibles with the apical tooth more curved. Maxillary palp with 3 apical and 2 lateral sensilla.

Young Larva.—Length (through spiracles) about 1.6 mm. Stout, thorax bent ventrally to form a neck, abdomen subellipsoidal; head of same diameter as thorax. Anus posteroventral. Integument with minute spinules in short transverse rows on the ventral surface. Body hairs sparse. Of 2 types: (1) on all somites, 0.02– 0.08 mm long, tip denticulate; (2) 0.02–0.14 mm long, simple, with the tip extremely attenuated, lacking on the prothorax, increasing in number posteriorly. Otherwise similar to the mature larva.

Material Studied.—Numerous larvae from Victoria, courtesy of Dr. W. L. Brown.

Stigmacros (Campostigmacros) sp.

Length (through spiracles) about 1.9 mm. Similar to *S. acutus*, except in the following details: Thorax and first abdominal somite more slender and bent ventrally to about 90°. Body hairs of 2 types: (1) 0.02–0.07 mm long, denticulate, on all somites, usually without alveolus and articular membrane; (2) about 0.18 mm long, simple, tip very slender and flexuous. Labrum with 4 sensilla on the anterior surface of each lobe; posterior surface with 6 large and 10 small sensilla. Mandibles with the apical tooth curved medially and more tapered.

Material Studied.—A dozen larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Tribe BRACHYMYRMICINI Emery

Brachymyrmex depilis Emery

Queen Larva.—Length (through spiracles) about 3.5 mm. Similar to worker (1.7 mm) except that the former has only 1 type of body hairs: 0.04–0.13 mm long and 2- to 6-branched. Antennae minute.

Very Young Larva.—Length (through spiracles) about 0.6 mm. Resembling the mature larva, except in the following details: Body hairs of type 1: simple, bifid or trifid.

Material Studied.—Numerous larvae from Arkansas, Michigan, and North Dakota.

Tribe GESOMYRMECINI Forel

Slender; thorax curved ventrally, but not forming a distinct neck. Body hairs sparse and short. Antennae with 2 sensilla each. Head hairs simple and very short. Without praesaepium, chiloscleres, or uncinate hairs.

Genus ***Gesomyrmex*** Wheeler

Revised Description.—Slender; thorax curved ventrally, but not forming a distinct neck; abdomen straight and subcylindrical; posterior end narrowly rounded. Body hairs sparse, short, and simple or bifid. Antennae small, each with 2 sensilla. Head hairs moderately numerous, simple and very short. Labrum bilobed. Maxillae with the apex subacute and curved medially.

Gesomyrmex luzonensis (Wheeler)
(Fig. 7)

Length (through spiracles) about 5.5 mm. Slender; thorax curved ventrally, but not forming a distinct neck; abdomen straight and subcylindrical; posterior end narrowly rounded. Anus ventral, with a posterior lip. Gonopod vestiges present on venter of abdominal somites VIII and IX. Integument spinulose, the spinules minute and numerous. Body hairs sparse, short and simple or bifid, about 0.12 mm long. Head small; head and mouth parts subpyriform. Head hairs moderately numerous, short (about 0.03 mm long), slender and simple. Antennae small, each with 2 sensilla each of which bears a minute spinule. Labrum narrowed ventrally and strongly bilobed; anterior surface of each lobe with 3 minute hairs and 3 sensilla near the ventral border; ventral border furnished with minute spinules (isolated or in short rows); posterior surface densely spinulose, the spinules minute and in subparallel rows, which radiate from the dorsolateral angles, and with about 20 sensilla. Mandibles subtriangular in anterior view, wedge-shaped with the blade medial; the lateral portion thicker and more heavily sclerotized and terminating in a slightly curved apical tooth; the medial portion thinner and feebly sclerotized; anterior and posterior surfaces with numerous subparallel longitudinal ridges bearing minute spinules. Maxillae with the apex subacute and curved medially; integument with numerous minute spinules in longitudinal rows; palp a short stout peg with 5 sensilla (2 encapsulated and 3 bearing a spinule each); galea digitiform with 2 apical sensilla. Labium with the anterior surface spinulose, the spinules minute and in short arcuate rows; near the base a raised area on which the spinules are longer and the rows longitudinal; palp a low knob with 5 sensilla (2 encapsulated and 3 bearing a spinule each); an isolated sensillum between each palp and the opening of the sericteries; the latter a short transverse slit on the anterior surface. Hypopharynx densely spinulose, the spinules minute and in numerous subparallel rows, the rows grouped in 2 subtriangles which have their bases near the middle.

Young Larva.—Length (through spiracles) about 1.7 mm. Very slender; diameter slightly constricted at abdominal somite I, greatest at abdominal somite V; thorax and abdominal somite I curved ventrally. Head large, on the anterior end and of greater diameter than the neck. Anus ventral. Body hairs sparse, long (0.03–0.09 mm), simple, very slender and flexuous. Cranium subhexagonal in anterior view. Head

hairs long (about 0.07 mm), very slender and flexuous. Mandibles shorter; apex shorter, sharper and directed medially. Anterior surface of labium with all spinules minute. Otherwise similar to the mature larva.

Material Studied.—Eight larvae and semipupae from the Philippine Islands, courtesy of Dr. J. W. Chapman.

Tribe PRENOLEPIDINI Forel

Addition.—Without praesaepium, chiloscleres, or uncinate hairs.

Genus *Paratrechina* Motschoulsky

Paratrechina (Nylanderia) bruesi (Wheeler)

Length (through spiracles) about 1.8 mm. Similar to *P. melanderi,* except in the following details: Head hairs slightly shorter (0.02–0.03 mm long), simple to trifid. Labrum with 2–3 sensilla and 3 small hairs on the anterior surface of each lobe. Mandibles with the apical tooth longer and narrower; anterior and posterior surfaces with minute spinules on the ridges. Anterior surface of labium with numerous minute spinules in short rows.

Young Larva (Fig. 8).—Length (through spiracles) about 1.1 mm. Thorax bent ventrally; head on the anterior end; diameter nearly uniform throughout. Head hairs slightly longer (0.035–0.04 mm long), simple to 4-branched. Otherwise similar to the mature larva.

Very Young Larva.—Length (through spiracles) about 0.05 mm. Head on the anterior end and about as large as the prothorax. Minute isolated spinules on the posterior somites. Body hairs lacking. Head hairs 0.002–0.015 mm long, few, simple. Mandibles rounded, with the teeth short and curved medially. Maxillae appear adnate; palp a cluster of 5 sensilla (4 with a spinule each and 1 with a tall capsule); galea represented by 2 sensilla. Otherwise similar to the mature larva.

Material Studied.—Numerous larvae from Oklahoma.

Paratrechina (Nylanderia) parvula (Mayr)

Length (through spiracles) about 1.9 mm. Similar to *P. melanderi* except in the following details: Body hairs 0.02–0.04 mm long, simple to 4-branched, fewer. Head hairs 0.02–0.05 mm long, simple or bifid. Anterior surface of labrum with 2 hairs and 2 sensilla on each lobe. Mandibles with the apical and subapical teeth longer, the medial teeth in a transverse row. Maxillary palp a peg bearing 5 apical sensilla (1 with a tall capsule, and 4 with a spinule each). Labial palp represented by a cluster of 5 sensilla (1 encapsulated and 4 with a spinule each).

Material Studied.—Ten larvae from North Carolina.

Tribe FORMICINI Forel

Revised Description.—Slender to moderately stout; thorax and first abdominal somite forming a short neck, which is curved ventrally; remainder of abdomen straight; diameter greatest at the fourth abdominal somite; diminishing gradually toward either end. Body hairs short, sparse to moderately numerous. Mandibles robust; with the apical tooth usually sharply marked off, slender, smooth, round-pointed and slightly curved medially; mesal border denticulate near the base of the apical tooth. Maxillae with the apex conoidal or paraboloidal and directed medially. Without praesaepium, chiloscleres or uncinate hairs.

Genus *Lasius* Fabricius

Escherich 1917, p. 95: "ragt der Kopf frei nach vorn vor ('orthognath')." Kannowski 1959, p. 157: Larvae overwinter in incipient colonies. Michener and Michener 1951, Fig. 74 (opposite p. 177): photograph of larvae. Stärcke 1948: "Straight, thin young larva" (p. 28); spinnerets on the labium (p. 47). Wilson 1955, p. 14: "The following larval characters have been established in the present study: relative to *Lasius s.s. (sitkaensis, alienus)* and *Cautolasius (flavus),* the *Chthonolasius* head is more slender and the external mandibular borders more convex (see figures in G. C. Wheeler, 1953, p. 153)."

Lasius flavus (F.)

Glöckner 1956: effect of centrifuging larvae. Michener and Michener 1951, p. 236: Clavigerid beetles *(Claviger testaceus)* "have a habit of eating ant larvae."

Lasius fulignosus (Latreille)

Andrasfalvy 1961, Fig. 3 on p. 308: photograph showing larvae.

Lasius neoniger Emery

Ayre 1962: the eucharitid *Pseudometagea schwarzii* (Ashmead) is parasitoid on the brood.

Lasius niger (L.)

Maneval 1940: The aphid *Myrmecobosca mandibularis* Maneval develops on the larvae (*fide* Biol. Abstr. 16: 1041. 1942) Morley 1953, Fig. 2b on p. 21: a small crude figure of a larva in side view.

Genus MYRMECOCYSTUS Wesmael

Slender. Anus ventral. Antennae small. Head hairs moderately numerous, short and denticulate. Labrum without anterior swellings. Mandibles subtriangular in anterior view; lateral border feebly convex.

Myrmecocystus melliger Forel

(Fig. 9)

Length (through spiracles) about 7 mm. Slender; thorax and first abdominal somite curved ventrally as a neck; remainder of abdomen straight and nearly uniform in diameter; posterior end rounded. Anus ventral, with distinct lips. Leg and wing vestiges present. Body hairs rather sparse and uniformly distributed, 0.07–0.14 mm long, denticulate, straight or slightly curved, stout. Head small. Cranium trans-

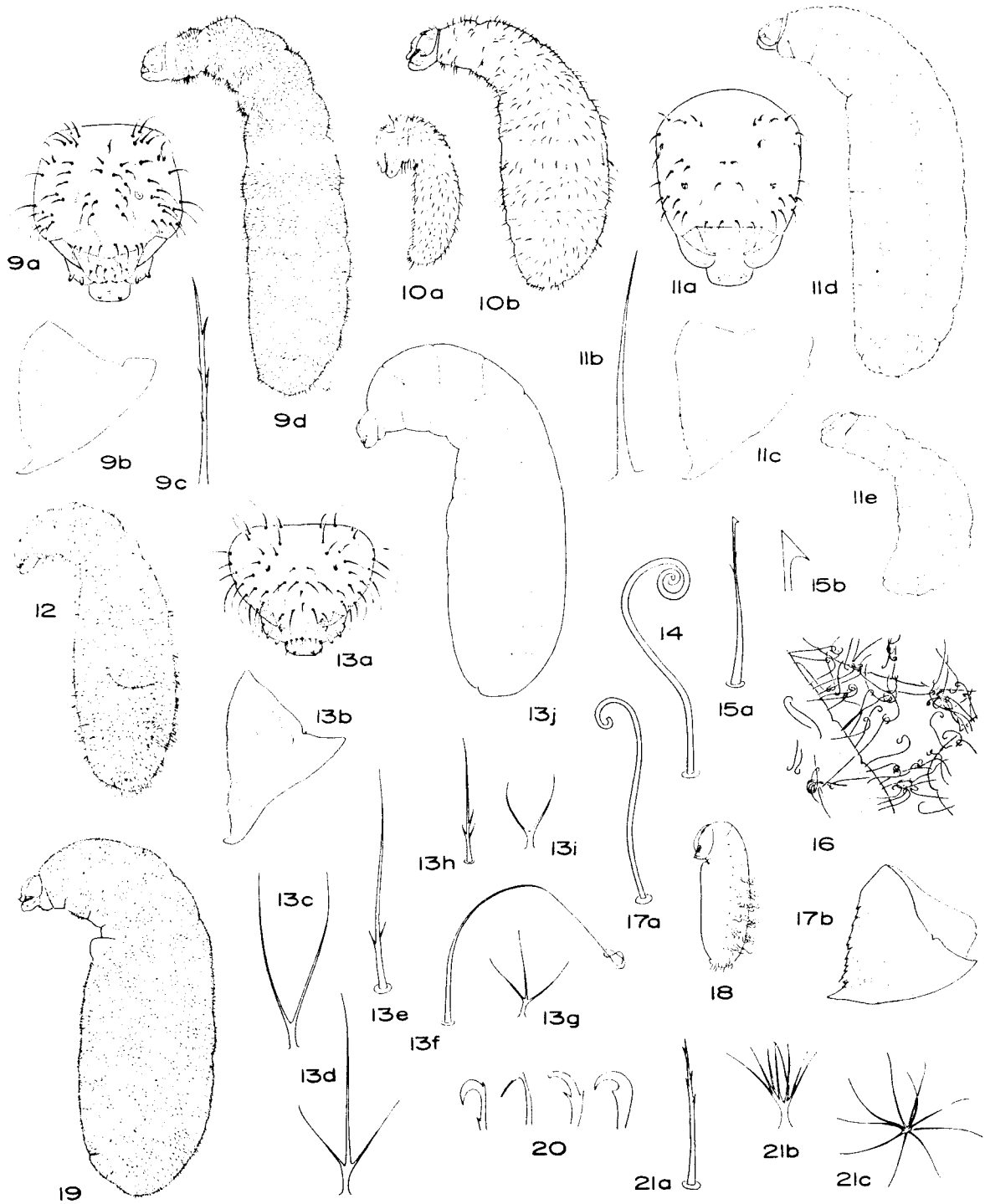

FIG. 9.—*Myrmecocystus melliger:* a, head in anterior view, ×37; b, left mandible in anterior view, ×167; c, body hair, ×167; d, larva in side view, ×11. FIG. 10.—*Myrmecocystus lugubris:* a, very young larva in side view, ×22; b, young larva in side view, ×22. FIG. 11.—*Polyergus rufescens:* a, head in anterior view, ×53; b, body hair, ×423; c, left mandible in anterior view, ×250; d, mature larva in side view, ×10; e, young larva in side view, ×10. FIG. 12.—*Gigantiops destructor:* larva in side view, ×5. FIG. 13.—*Opisthopsis haddoni:* a, head in anterior view, ×53; b, left mandible in anterior view, ×212; c–e, body hairs of mature larva, ×423; f–i, body hairs of young larva, ×423; j, mature larva in side view (hairs omitted), ×13. FIG. 14.—*Camponotus suffusus:* hooked body hair, ×333. FIG. 15.—*C. arcuatus:* a, triangular-tipped hooked hair, ×423; b, enlarged tip, ×1693. FIG. 16.—*C. intrepidus:* portions of the dorsal surface of 3 young larvae showing the entangled hooked hairs, ×42. FIG. 17.—*C. laevigatus:* a, hooked hair of young larva, ×333; b, left mandible of young larva in anterior view, ×212. FIG. 18.—*C. humilior:* young larva in side view, with phantom view of praesaepium (only longest body hairs shown), ×11. FIG. 19.—*Calomyrmex impavidus:* larva in side view, ×10. FIG. 20.—*Polyrhachis* (*Hedomyrma*) sp.: 4 tips of hooked head hairs, ×417. FIG. 21.—*P.* (*Campomyrma*) sp.: a, denticulate body hair, ×333; b, c, 2 views of branched body hairs, ×333.

versely subelliptical in anterior view. Head hairs 0.05–0.08 mm long, stout, straight or slightly curved, denticulate, moderately numerous. Antennae small, each on a low convexity and with 3 sensilla, each of which bears a minute spinule. Labrum bilobed; anterior surface with 4–5 hairs and 3–4 sensilla on each lobe; ventral border of each lobe with 3 sensilla; posterior surface with about 24 sensilla near the middle; posterior surface densely spinulose, the spinules exceedingly minute and in rows which radiate from the dorsolateral angles, the rows continuous near the base but broken distally. Mandibles moderately sclerotized; subtriangular in anterior view, medial border strongly convex; lateral border feebly convex; wedge-shaped, with the edge medial; apical tooth round-pointed and slightly curved medially; medial border denticulate near the base of the apical tooth; anterior and posterior surfaces roughened with numerous longitudinal ridges. Maxillae with the apex conoidal and directed medially, with minute spinules in short arcuate rows; palp a skewed peg with 4 apical and 1 lateral sensilla; galea digitiform, bent and with 2 apical sensilla. Labium with a small patch of minute spinules near the base; palp a low knob with 5 sensilla; opening of sericteries wide and salient. Hypopharynx densely spinulose, the spinules exceedingly minute and in numerous subtransverse rows, the rows grouped in 2 subtriangles which have their bases near the middle.

Material Studied.—Numerous larvae from Texas.

Myrmecocystus lugubris Wheeler

Young Larva (Fig. 10b).—Length (through spiracles) about 2.6 mm. Apparently similar to the mature larva of *M. melliger,* except as follows: Body more swollen. Integument spinulose, the spinules minute, sparse, and usually in subtransverse arcuate rows. Body hairs slightly longer (0.015–0.2 mm long) and with longer and finer denticles. Head hairs about half as numerous. Apical tooth longer and more slender; medial border less convex; lateral border, in part, concave. Labium with minute spinules in short arcuate rows on the anterior and lateral surfaces.

Very Young Larva (Fig. 10a).—Length (through spiracles) about 1.1 mm. Similar to the young larva except in the following details: Head of greater diameter than the first thoracic somite. Body of nearly uniform diameter. Body hairs of 2 types: (1) the more numerous type, 0.015–0.16 mm long, denticulate; (2) about 0.14 mm long, simple, a few on each abdominal somite I–IX.

Material Studied.—A dozen larvae from California, courtesy of R. R. Snelling.

Myrmecocystus mexicanus Wesmael

Length (through spiracles) about 7.5 mm. Similar to *M. melliger,* except in the following details: Body somewhat stouter; thorax more tapered; head smaller. Anus posteroventral, without lips. Integument with isolated spinules. Body hairs slightly longer 0.08–0.2 mm long). Head with the occipital outline broader and flatter. Mandibles shorter and stouter, with the apical tooth round-pointed.

Material Studied.—Eight larvae from New Mexico, courtesy of R. R. Snelling.

Cazier and Mortenson 1965, p. 43: The scarabaeid *Cremastocheilus stathamae* Cazier "appears to be an obligatory predator on the larvae of *Myrmecocystus mexicanus.*"

Myrmecocystus mimicus Wheeler

Length (through spiracles) about 4.8 mm. Similar to *M. melliger,* except in the following details: Body more swollen, but still long and slender. Body hairs about half as numerous and shorter (0.035–0.09 mm long). Head widest at the antennal level. Head hairs about half as numerous. Mandibles with the lateral outline more nearly straight and with the apical tooth slenderer.

Material Studied.—Seventeen larvae from California, courtesy of R. R. Snelling.

Myrmecocystus mojave Wheeler

Length (through spiracles) about 5.3 mm. Very similar to *M. melliger,* except in the following details: Integument with isolated spinules. Mandibles with the medial border less rounded in the basal half. Maxillae with the apex more broadly rounded. Labium with the anterior and lateral surfaces spinulose.

Material Studied.—Ten larvae from California, courtesy of R. R. Snelling.

Myrmecocystus semirufus Emery

Apparently similar to *M. melliger,* except in the following details: Integument with minute spinules in substransverse arcuate rows. Body hairs very sparse, not more than 24/somite, 0.035–0.12 mm long, with numerous denticles. With the widest part of the head above the antennal level. Head hairs about half as numerous. Mandibles with the apical tooth slenderer. Labium with a rather sparse covering of minute spinules in short arcuate rows on the anterior and lateral surfaces.

Material Studied.—Seven immature larvae from California and 6 semipupae from Arizona, courtesy of R. R. Snelling.

Genus *Cataglyphis* Förster

Cataglyphis albicans Roger

Bernard 1951a, p. 94–95: Cette espèce est très curieuse "par la forte taille des larves néonates issues de l'oeuf . . . Il en résulte une croissance totale en volume très faible: les larves au 5e stade sont à peine 7 ou 8 fois plus grosses qu'à leur naissance, tandis que celles des autres Fourmis ont de 21 à 330 pour le même rapport. C'est une adaptation à la sécheresse, une grosse larve néonate ayant une surface plus faible par rapport à son volume, d'où moindre évaporation. Ayant trouvé peu de larves chez les Fourmis strictement désertiques, j'attends de nouveaux résultats pour établir ou non la généralité de ce fait."

Cataglyphis viatica (F.)

Valentini 1951: internal anatomy.

Cataglyphis (Machaeromyrma) bombycina Roger

Bernard 1951a, p. 94: Cette espèce, "remarquable par l'adaptation des ouvrières à l'insolation et au fouissement, possède des larves très banales, avec appareil salivaire très développé, corps gras réduit, intestin non vidable. Ces larves habitent d'ailleurs du sable très humide." Valentini 1951: internal anatomy.

Genus ***Polyergus*** Latreille

Prothorax with a pair of lateral swellings. Anus posteroventral; without prominent lips. Body hairs simple (rarely with bifid or denticulate tip). Head hairs moderately numerous, short, simple. Labrum short, without ventrolateral swellings on the anterior surface. Mandibles small, subtriangular in anterior view; apical tooth short, stout, sharp-pointed, not sharply delimited.

Polyergus rufescens (Latreille)
(Fig. 11)

Length (through spiracles) about 6.2 mm. Rather slender; thorax curved ventrally to form a stout neck; abdomen straight, with the ventral profile flat, the dorsal slightly convex; prothorax with a pair of lateral swellings; posterior end narrowly rounded. Anus posteroventral. Leg and wing vestiges present. Integument spinulose, the spinules minute and in short transverse rows. Body hairs short (0.05–0.1 mm long), sparse, uniformly distributed, simple (rarely denticulate or with bifid tip). Head small. Cranium subpentagonal in anterior view, dorsal outline strongly rounded. Head hairs short (0.035–0.06 mm long), moderately numerous, simple, slightly curved. Antennae small, each with 3 sensilla each of which bears a spinule. Labrum short (breadth 3 times the length), narrowed ventrally, bilobed, with about 10 sensilla and/or minute hairs on the anterior and ventral surfaces; posterior surface of each lobe with 5 sensilla; posterior surface densely spinulose, the spinules minute and in rows which radiate from the dorsolateral angles, the rows continuous near the base but broken distally. Mandibles small, moderately sclerotized, subtriangular in anterior view; apical tooth short, stout, curved medially, tapering rapidly to a sharp point; medial border denticulate near the base of the apical tooth; anterior and posterior surfaces roughened with short longitudinal ridges. Maxillae with the apex a small conoid directed medially, roughened with short transverse ridges, some of which bear minute spinules; palp a low knob with 5 sensilla; galea a short cone with 2 apical sensilla. Labium with the anterior and lateral surfaces sparsely spinulose, the spinules minute and on short transverse ridges; palp a low knob with 5 sensilla (1 encapsulated and 4 with a spinule each); opening of sericteries wide and salient. Hypopharynx densely spinulose, the spinules in numerous subtransverse rows, the rows grouped in 2 subtriangles with their bases near the middle.

Material Studied.—Numerous larvae from Manitoba, North Dakota and Wyoming.

Polyergus lucidus Mayr

Length (through spiracles) about 6.2 mm. Scarcely distinguishable from *P. rufescens:* the mandibles slightly narrower; anterior surface of the labrum with about 15 sensilla.

Material Studied.—Ten larvae from Illinois, courtesy of G. L. Rotramel and J. Marlin.

One great advantage which the student of ant larvae has over the students of solitary Hymenoptera is that he can usually assume that the larvae found in an ant nest belong to the same species as the workers. But this advantage is somewhat diminished by army ants and slave-makers which raid the nests of other ants and carry home larvae as part of the booty. The earliest example of such a complication was demonstrated by Müller in 1886 when he mistook the larvae of *Pachycondyla* (prey) for heteromorphic larvae of *Eciton* (G. C. Wheeler 1943, p. 330.)

Since the obligatory slave-makers of the genus *Polyergus* are notorious for their raids on *Formica* spp., one may not assume that larvae found in a *Polyergus-Formica* nest are the offspring of the *Polyergus* queen. To guard against error we opened *Polyergus* worker cocoons and removed the last larval integument which was packed against 1 end of the cocoon. Although such crumpled integuments are never in good condition, we were able to find conspicuous differences between them and the larvae of *Formica.* If the mature larvae showed the characters detected in the crumpled larval integuments from the *Polyergus* cocoons, then we knew that they were *Polyergus* larvae. The following tabulation can be used to differentiate mature larvae of the 2 genera:

Polyergus	*Formica*
Anus posteroventral; without prominent lips	Anus terminal; with prominent posterior lip
Body hairs simple (rarely with bifid or denticulate tip)	Body hairs mostly with the tip bifid
Head hairs simple	Head hairs mostly with the tip bifid
Labrum without ventrolateral swellings on anterior surface	Labrum with ventrolateral swellings on anterior surface
Mandibles small (length about ⅕ head-width); subtriangular in anterior view; apical tooth short, stout and not sharply delimited	Mandibles moderately large (length about ⅓ head-width); subquadrangular in anterior view; apical tooth long, slender and sharply marked off

Genus ***Formica*** L.

Escherich, 1917, p. 95: "ragt der Kopf frei nach vorn vor ('orthognath')". Michener and Michener, 1951, p. 236–7: The staphylind beetles *Xenodusa cava* and *Lomechusa* feed on ant brood. (See under *Camponotus*). Kannowski, 1959, p. 157: Larvae over-

winter in incipient colonies. Stärcke, 1948: Young larvae are straight and thin (p. 28). The labium bears spinnerets (p. 47).

Formica fusca L.

Wallis (1960) gave an account of spinning movements. Wheeler and Wheeler 1963, Fig. I–3 on p. 14: mature larvae in side view.

Formica polyctena Förster

Schmidt 1964, Fig. 2: drawings of larvae and semipupa in side view.

Formica ulkei Emery

Holmquist 1928, Pl. VI: small photograph of larvae.

Formica (Raptiformica) sanguinea Latreille

Caullery 1952, p. 18: The "larvae of *Lomechusa* are the worst enemies of the ant larvae, which they eat, and yet the ants feed them at the expense of their own larvae."

Tribe GIGANTIOPINI Ashmead

Head with long whiplike denticulate hairs. Without praesaepium, chiloscleres or uncinate hairs.

Genus *Gigantiops* Roger

Gigantiops destructor (F.)

(Fig. 12)

Length (through spiracles) about 8.8 mm. Our previous account was based upon damaged integuments. Since we now have good material we have figured the body in side view.

Tribe OECOPHYLLINI Emery

Genus *Oecophylla* F. Smith

Bernard (1951b, p. 1082–3) described the method of weaving nests with the aid of larvae.

Oecophylla leakeyi Wilson and Taylor

Wilson and Taylor 1964: 197 larvae from the Miocene (p. 96); a photograph of a group of larvae (p. 98). (This is the fourth species of fossil ant larvae; the others are *Iridomyrmex geinitzi* Mayr and *I. goepperti* and *Lasius schiefferdeckeri* in Baltic amber (Oligocene).)

Oecophylla longinoda (Latreille)

Ledoux 1950 (fide Wilson 1953, p. 17): "The threshold for queen-worker divergence is in very early larval life, while the threshold for major-minor divergence is at some time in the second larval stadium."

Oecophylla smaragdina (F.)

Bernard (1951b, fig. 985 on p. 1080) and Goetsch (1957, fig. 23 on p. 56) repeated Doflein's classic figures of the workers using larvae as shuttles. Torre-Bueno 1944, p. 125: In Burma "the adult ants, grubs and larvae are suffocated in an air-tight vessel with smoke; picked clean; made into paste which turns sour, termed Khagyin."

Tribe CAMPONOTINI Forel

Partial Revision.—Mandibles rather small; basal ⅓ broad and thick; distal ⅔ thin, bladelike and slightly curved anteriorly: apical tooth abruptly marked off, short and slightly curved medially; lateral outline saddle-shaped; middle half of mesal border denticulate.

Genus *Opisthopsis* Emery

Praesaepium feebly developed. Uncinate body hairs lacking. Head small. Head hairs long and moderately numerous. Mandibles moderately large. Maxillary palp digitiform.

Opisthopsis haddoni Emery

(Fig. 13)

Worker Major.—Length (through spiracles) about 6 mm. Body stout; thorax and first abdominal somite curved ventrally, remainder of abdomen straight and subellipsoidal; praesaepium feebly developed. Anus posteroventral. Leg and wing vestiges present. Integument of ventral surface of anterior somites with a few minute spinules in short transverse rows. Body hairs short, numerous and uniformly distributed. Of 3 types: (1) 0.06–0.08 mm long, 2- to 4-branched, without alveolus and articular membrane on all somites, the most numerous type; (2) 0.06–0.09 mm long, with a few moderately long denticles, with alveolus and articular membrane, a few around the middle of each somite except abdominal somite X; (3) 0.03–0.09 mm long, simple, on abdominal somite X. Head small; cranium subhexagonal, breadth 1½ times the length. Head hairs 0.06–0.11 mm long, with a few very fine denticles. Antennae minute, each with 3 small sensilla, each of which bears a minute spinule. Labrum subtrapezoidal, slightly broader than long; the ventral border with 4 projecting sensilla; anterior surface with 6 short hairs and 6 sensilla near the ventral border; posterior surface densely spinulose, the spinules minute and arranged in rows radiating from each dorsolateral corner, the rows becoming sparse and arcuate and the spinules longer distally; posterior surface of each half with 3 large and 3 small sensilla; chiloscleres present. Mandibles heavily sclerotized; subtriangular in anterior view; wedge-shaped with the edge medial; apex forming a short smooth rather stout round-pointed tooth which is curved medially; anterior and posterior surfaces roughened with numerous subparallel ridges. Maxillae with the apex conoidal and roughened medially with a few short transverse rows of minute spinules; palp digitiform and bearing 2 apical and 2 subapical sensilla; galea digitiform with 2 apical sensilla. Labium with the basal portion sparsely spinulose, the spinules rather long and in scattered short transverse rows; palp a skewed peg, with 1 apical, 2 subapical, and 1 lateral sensilla; opening of sericteries wide and salient. Hypopharynx densely spinulose, the spinules minute and arranged

in subparallel rows, the rows grouped in 2 subtriangles which have their bases near the middle.

Worker Media.—Length (through spiracles) about 4.1 mm. Very similar to the major worker except in the following details: Body relatively shorter and stouter. Body hairs with fewer branches per hair, denticulate and simple hairs more numerous.

Young Larva.—Length (through spiracles) about 2.4 mm. Resembling the mature larva, except in the following particulars: Slenderer, thorax more curved. Body hairs fewer. Body hairs (1) 0.03–0.05 mm long, 2- to 4-branched, decreasing in number of branches posteriorly; (2) about 0.05 mm long, denticulate, on thorax and first 2 abdominal somites, few on each somite. Head hairs simple or with a few denticles.

Very Young Larva.—Length (through spiracles) about 1.4 mm. Short and stout; head very large. Body hairs very few, becoming sparser posteriorly: (1) on thorax and abdominal somites I–IV, 0.03–0.06 mm long, 2- and 3-branched; (2) 0.06–0.09 mm long, with moderately long denticles, few, on the thorax; (3) 0.005–0.1 mm long, the longest with a very fine flexible tip, a few on each somite. Head hairs 0.025–0.11 mm long, simple or with a few fine denticles. Maxillary palp a short frustum with 4 apical sensilla; galea a short frustum with 2 apical sensilla. Labium with the anterior surface sparsely spinulose, the spinules minute and in short rows; palp a cluster of 4 sensilla. Otherwise resembling the mature larva.

Material Studied.—Numerous larva from Australia, courtesy of Dr. W. L. Brown.

Opisthopis rufoniger Forel

Length (through spiracles) about 4 mm. Very similar to *O. haddoni,* except as follows: Head relatively larger and neck stouter. Body hairs of 2 types: (1) 0.03–0.17 mm long, 2- to 4-branched, without alveolus and articular membrane, on all somites; (2) 0.03–0.08 mm long, denticulate, a few on each somite, the longest with alveolus and articular membrane. Mandibles with the apex slenderer and less curved. Maxillary and labial palps with 5 sensilla each.

Material Studied.—Numerous larvae from Australia, courtesy of Dr. W. L. Brown.

Genus *Camponotus* Mayr

Partial Revision.—Head hairs short to moderately long.

Michener and Michener 1951: photograph in color, Fig. 76 (opposite p. 181). The staphylinid beetle *Xenodusa cava* Lec. "devours ant brood in addition to cheating it of some of its rightful nourishment" (p. 237). Stärcke (1948) described the young larva as straight and thin (p. 28). "With some species the *labrum* also bears a pair of sensilla turrets" (p. 34). Wheeler and Bailey 1920, p. 270–1: "In a study undertaken by the senior author and Mr. George C. Wheeler of the larvae of a large number of other ant genera, no structure comparable to the Pseudomyrmine trophothylax has been found, except in certain species of *Camponotus* of the subgenus *Colobopsis.* In all the species of the latter subgenus examined the larva is very hypocephalic and the ventral portion of the first abdominal segment projects considerably beyond the thoracic segments and presents a pronounced concavity or basin in the mid-ventral region precisely in the position of the trophothylax of the Pseudomyrminae. A feeble vestige of the same structure occurs in many *Camponotus* larvae belonging to other subgenera. No solid pellet is deposited in the basin of *Colobopsis* but it may, perhaps, be used to hold a supply of the liquid food regurgitated by the workers or of the saliva secreted by the larva itself for the benefit of its attendants."

In all the following descriptions of species we have compared the larvae with the larva of *C. noveboracensis* (Wheeler and Wheeler 1953, p. 183) unless otherwise indicated; only differences are given here.

Camponotus americanus Mayr

Length (through spiracles) about 8.7 mm. No uncinate body hairs found. Naked area on head not conspicuous. Mandibles with the apical tooth narrower and straighter, with a small subapical denticle.

Material Studied.—Four larvae from Michigan.

Camponotus herculeanus (L.)

Klots and Klots 1959, p. 290: Photograph of a queen with larvae. Stärcke 1948: Fig. 41 (p. 53) antenna and maxillary palp in section. Fig. 26 (p. 40) antenna in profile.

Camponotus laevigatus (F. Smith)
(Fig. 17)

Length (through spiracles) about 10 mm. Body hairs (1) 0.07–0.12 mm long, the longest with alveolus and articular membrane; no uncinate hairs found. Head hairs more numerous and shorter (0.075–0.125 mm long). Anterior and ventral surfaces of the labrum with 17 sensilla; spinules on posterior surface much longer. Mandibles with the apical tooth straighter and slenderer; spinules long and comblike; median surface rougher. Maxillae with the apex shorter, the spinules longer and more numerous. Labium and hypopharynx with longer spinules.

Young Larva.—Length (through spiracles) about 2.4 mm. Thoracic somites curved ventrally; abdomen straight and elongate-ovoidal. Body hairs of 2 types: (1) 0.05–0.1 mm long, simple to trifid; (2) 0.07–0.13 mm long, with the tip curled, several on the dorsal and lateral surfaces of each somite. Cranium subpentagonal, widest at the level of the mandibles. Head hairs 0.015–0.1 mm long, simple or denticulate or bifid or with curled tip. Spinules on posterior surface of labrum minute. Mandibles subtriangular, slightly broader than long; lateral outline convex; apical tooth short and acute; medial surface not as rough nor spinules as long as in mature larva. Maxillary spinules minute.

Material Studied. — Numerous larvae from California.

Camponotus ligniperdus (Latreille)

Bernard (1951b, Fig. 938 on p. 1030) and Goetsch (1957, Fig. 4b on p. 21) repeated Eidmann's figure (1926, fig. 5 on p. 794) of a colony-founding queen with brood. Hoelldobler 1961: There are 2 egg-laying periods: spring and late summer. The larvae from the latter overwinter in a resting larval stage and are very resistant to cold. The strongly curved resting larvae apparently receive no food during the winter. When feeding is resumed in the spring some larvae grow very rapidly and in 12 days one can note an astonishing difference in size between the fed larvae and those still in the resting condition (Fig. 3 on p. 20). The resting stage persists even at higher temperatures. These observations refute Eidmann's claim that the large larvae observed in the spring have overwintered at that size, while the small larvae have resulted from eggs laid early in the spring.

Camponotus noveboracensis (Fitch)

Kannowski (1959, p. 135), referring to colony-founding, stated that "the first eggs are laid and the first larvae hatch in June and early July; the larvae grow during July with pupae forming late in July and in early August; additional eggs are laid in early August; these develop into larvae before the onset of hibernating conditions."

Camponotus pennsylvanicus (DeGeer)

Fielde (1905): photograph on p. 240 = Wheeler 1910, Fig. 45 on p. 79, but is clearer; Wheeler's figure was lettered. McCook 1876: "Of the larvae three sizes were found. The most numerous were evidently those of the dwarfs, soft, small white grubs. The others were nearly of the same length, and differed mainly in size, one form having more plumpness than the other. These grubs were of faint straw color, or livid" (p. 289). Pl. IV, Fig. 11 is a crude representation of a "larva of a large form, probably of queen or worker major." Michener and Michener 1951, p. 136: "Artificially fed larvae . . . do not develop on a vitamin-free diet, but if yeast is added develop normally."

Subgenus *Colobopsis* Mayr

Partial Revision.—Body hairs sparse and uniformly distributed; mostly simple or branched; a few very long and whiplike; none with hooked tip.

Wheeler and Bailey 1920, p. 270–1: See under the genus *Camponotus.*

Camponotus (Colobopsis) fictor Forel

Length (through spiracles) about 4.3 mm. Similar to *C. (Colobopsis) mississippiensis,* except in the following details: Body hairs: (1) simple, becoming denticulate posteriorly; (2) 2- to 6-branched, 0.015–0.065 mm long; (3) about 0.3 mm long, simple, whiplike, with the base sinuous or kinked. Head hairs moderately numerous, simple or finely denticulate. Antennae larger. Maxillae with palp and galea slenderer.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Dinomyrmex) famelica Emery

Length (through spiracles) about 1.5 mm. Body hairs (1) 0.006–0.025 mm long, with 2–5 branches, longest ventrally on thorax and abdominal somites I and II; (2) 0.15–0.25 mm long, whiplike, a few on the dorsal and lateral surfaces of pro- and mesothorax and on the ventral surfaces of the thorax and abdominal somites I and II. Head hairs more numerous, shorter (0.075–0.2 mm long), mostly simple, a few bifid. Mandibles straighter and slenderer.

Material Studied.—Seven larvae from New South Wales, courtesy of Rev. B. B. Lowerey.

Camponotus (Myrmaphaenus) fastigatus verae Forel

Length (through spiracles) about 3.9 mm. Body hairs shorter: (1) 0.04–0.08 mm long, mostly trifid; (2) 0.065–0.09 mm long, with a triangular hook at the tip, with alveolus and articular membrane. Cranium twice as broad as long. Head hairs more numerous, shorter (0.025–0.05 mm long). Labrum lacking the ventral lobe. Mandibles with the apical tooth slenderer and the medial surface rougher.

Material Studied.—Eight larvae from Brazil, courtesy of Karol Lenko.

Camponotus (Myrmophyma) adami Forel

Length (through spiracles) about 4 mm. Stouter. Body hairs of 1 type: 0.05–0.14 mm long; simple, bifid or trifid, some with alveolus and articular membrane. Head rounder in anterior view. Head hairs shorter (0.08–0.1 mm long), simple or bifid. Mandibles with the apical tooth straighter and more slender.

Very Young Larva.—Length (through spiracles) about 1.7 mm. Stouter than young of *C. noveboracensis.* Body hairs of 2 types: (1) 0.03–0.075 mm long, simple to trifid, on all somites; (2) 0.065–0.11 mm long, with a single hook at the tip, a few on all surfaces of each somite except the ventral surface of the prothorax. Head hairs simple to 4-branched. Mandibles subtriangular, slightly broader than long, lateral outline convex; apical tooth short and acute; medial surface not so rough nor spinules so long as in mature larva. Maxillary palp and galea shorter and stouter than in mature larva.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmophyma) arcuatus Mayr

Immature Larva (Fig. 15).—Length (through spiracles) about 1.6 mm. Apparently very similar to *C. noveboracensis,* except in the following details: Body hairs of 2 types: (1) simple to 3-branched, 0.05–0.07 mm long, on all somites; (2) about 0.07 mm long, a few on each somite, with a triangular-hooked tip and with a few denticles on the shaft. Labrum lacking the ventral projection. Mandibles with the apical tooth slenderer.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmophyma) ephippium (F. Smith)

Length (through spiracles) about 7.6 mm. Body hairs of 2 types: (1) 0.025–0.075 mm long, 2- to 3-branched; (2) 0.05–0.175 mm long, simple, some on ventral surface of thorax and abdominal somites I–VI and dorsal surface of abdominal somite X. Head hairs twice as numerous, shorter (0.1–0.15 mm long), simple. Anterior surface of labrum with 9 hairs and 19 sensilla. Mandibles slenderer. Maxillae stouter; palp a cone with 4 sensilla, galea digitiform, with 2 sensilla. Labium with a few minute spinules in short rows on the anterior surface.

Material Studied.—Seven larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmophyma) evae Forel

Length (through spiracles) about 7 mm. Ventral surface of abdomen flatter; dorsal surface more curved; with longitudinal ventrolateral welts. Anus posteroventral. Body hairs of 1 type: 0.55–0.9 mm long, 2- to 6-branched, on all somites, numerous. Head hairs twice as numerous, shorter (0.045–0.1 mm long), simple to trifid. Posterior surface of labrum with about 25 sensilla.

Young Larva.—Length (through spiracles) about 2 mm. Thorax stout and bent ventrally, abdomen somewhat stouter, straight, tapering slightly toward either end. Praesaepium lacking. Integument of posterior somites with minute spinules in short rows. Body hairs of 2 types: (1) 0.02–0.07 mm long, simple to 5-branched, some on every somite, becoming fewer posteriorly; (2) 0.035–0.1 mm long, with a single hook at the tip, slightly curled posteriorly, a few on each somite. Head hairs shorter, of 2 types: (1) 0.035–0.065 mm long, with a single hook at the tip, about 80; (2) 0.03–0.06 mm long, simple to trifid, about 18.

Very Young Larva.—Length (through spiracles) about 1.7 mm. Similar to the young larva (above) except the body hairs of type 1 are simple or bifid and are on the thorax and first three abdominal somites.

Material Studied.—Numerous larvae from Queensland, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmophyma) froggatti Forel

Length (through spiracles) about 6.4 mm. Stouter. Body hairs of 3 types: (1) 0.04–0.06 mm long, 2- to 4-branched, on all somites; (2) about 0.2 mm long, single-hooked tip, a few on abdominal somites II–IV; (3) 0.1–0.175 mm long, simple, on the ventrolateral surfaces of abdominal somites V and VI and on the dorsolateral surfaces of abdominal somites VI and VII. Head hairs shorter (0.04–0.06 mm long), simple to trifid. Labrum lacking the median ventral projection; anterior surface of labrum with 7 hairs; posterior surface with 16 sensilla. Mandibles with the apical tooth shorter and slenderer and with a distinct subapical tooth.

Very Yong Larva.—Length (though spiracles) about 1.6 mm. Body hairs of 2 types: (1) 0.015–0.05 mm long, simple to 4-branched, on thorax and abdominal somites I–III; (2) 0.06–0.14 mm long, with single-hooked tip, a few on each somite. Head hairs 2- to 4-branched.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmophyma) innexus Forel

Length (through spiracles) about 8 mm. Body hairs of 3 types: (1) 0.075–0.175 mm long, 2- to 4-branched, on all somites; (2) 0.14–0.25 mm long, with single hook at the tip, a few on the lateral and dorsal surfaces of each abdominal somite I–VI; (3) 0.09–0.16 mm long, with denticulate tip, a few on the dorsal and lateral surfaces of abdominal somites VII–X. Head hairs twice as numerous, shorter (0.07–0.13 mm long), simple to trifid. Labrum without the median projection; anterior surface with 14 sensilla. Mandibles with the apical tooth slenderer and straighter.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmosaulus) intrepidus (Kirby)

Length (through spiracles) about 9.4 mm. Body hairs of first type 0.1–0.3 mm long, simple to 4-branched, longest on the ventral surface of the thorax. Genae bulging. Head hairs twice as numerous, shorter (0.1–0.175 mm long), simple or bifid. Labrum without a median projection; anterior surface with about 20 sensilla. Mandibles with the apical tooth slenderer. Maxillae with more of the integument spinulose; palp and galea longer. Labium with longer spinules.

Young Larva (Fig. 16).—Length (through spiracles) about 3 mm. Body hairs of 2 types: (1) 0.08–0.16 mm long, simple to trifid, numerous, on all somites; (2) 0.1–0.2 mm long, with the tip hooked and slightly curled, a few on the dorsal surfaces of thorax and abdominal somites I–III, and on all surfaces of abdominal somites IV–X. Labrum with the median projection; posterior surface with about 22 sensilla, spinules extremely long and overlapping. Mandibles with the apical tooth bent abruptly and sharp-pointed; base broad. Otherwise similar to the mature larva.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmosaulus) molossus Forel

Length (through spiracles) about 8 mm. Integument of ventral surface of thorax and first 2 abdominal somites with spinules in short transverse rows. Body hairs of 1 type: 0.1–0.15 mm long, 2- to 8-branched (mostly 3- or 4-branched). Head very small. Head hairs twice as numerous, shorter (0.075–0.125 mm long), 2- to 5-branched. Labrum lacking the median ventral projection. Mandibles with the apical tooth slenderer and straighter. Maxillae blunter; palp digitiform with 2 apical sensilla. Labium with large isolated spinules and smaller spinules in short transverse rows.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Myrmosaulus) suffusus (F. Smith) (Fig. 14)

Length (through spiracles) about 9.8 mm. Body hairs of 1 type: 0.1–0.15 mm long, simple to 4-branched, a few with alveolus and articular membrane. Genae slightly bulging. Head hairs shorter (0.08–0.15 mm long), simple to trifid. Labrum without median projection. Mandibles with the apical tooth straighter and slenderer. Maxillae blunter; medial and anterior surfaces spinulose. Labial palp a slightly raised cluster of five sensilla.

Very Young Larva.—Length (through spiracles) about 2.8 mm. Integument with minute spinules in short rows, increasing in number ventrally and posteriorly. Body hairs of 2 types: (1) 0.08–0.15 mm long, simple to trifid, the longest with alveolus and articular membrane, generally distributed; (2) 0.08–0.16 mm long, the tip with a single hook and curled, a few on the metathorax and abdomen. Genae slightly bulging. Head hairs 0.08–0.1 mm long, simple to trifid. Labrum without median projection. Mandibles with the apical tooth very short, curved abruptly and acute. Maxillae with the apical cone shorter; medial and anterior surfaces spinulose; palp a low knob bearing 5 sensilla; galea a short cone with 2 apical sensilla. Labial palp a cluster of 5 sensilla.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Orthonotomyrmex) sp.

Length (through spiracles) about 7 mm. Body hairs 0.05–0.12 mm long, 2- to 5-branched, generally distributed. Head hairs more numerous and shorter (0.07–0.12 mm long), 2- to 3-branched. Labrum without the midventral projection. Mandibles with the apical tooth slenderer and longer, the tip more hook-like.

Very Young Larva.—Length (through spiracles) about 2.5 mm. Body hairs of 2 types: (1) 0.03–0.15 mm long, simple to trifid, on all somites (the longest with alveolus and articular membrane); (2) 0.13–0.15 mm long, tip with a single hook and curled, a few on meso- and metathorax and each abdominal somite. Head hairs 0.05–0.1 mm long, simple to trifid. Antennae relatively smaller. Labrum without the midventral projection. Mandibles subtriangular in anterior view, the lateral outline convex, the apical tooth short, acute and curved medially. Maxillary palp a low knob with 5 sensilla; galea a low knob with 2 sensilla; labial palp a slightly raised cluster of 5 sensilla; opening of sericteries not salient.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Pseudocolobopsis) alboannulatus Mayr

Length (through spiracles) about 4.6 mm. Body hairs of 3 types: (1) 0.04–0.07 mm long, 2- to 5-branched, the most numerous type, on all somites; (2) 0.06–0.13 mm long, denticulate, a few on each thoracic somite and abdominal somites IX and X; (3) 0.12–0.13 mm long, with a triangular hook at the tip, on abdominal somites I–VIII (a few on each). Head hairs shorter, of 2 types: (1) 0.045–0.07 mm long, 2- to 3-branched, about 12; (2) 0.04–0.1 mm long, with small denticles, about 80. Labrum without midventral projection; anterior surface with 6 hairs and 14 sensilla. Mandibles with the apical tooth straighter.

Material Studied.—Two larvae from Brazil, courtesy of Karol Lenko.

Camponotus (Pseudocolobopsis) claviscapus Forel

Length (through spiracles) about 4.4 mm. Body hairs of 3 types: (1) 0.02–0.05 mm long, 2- to 4-branched, on all somites; (2) about 0.1 mm long, with hooked tip, a few on the dorsal surface of each abdominal somite I–VII; (3) 0.04–0.1 mm long, denticulate, on the ventrolateral surfaces of abdominal somites IV–VIII and on all surfaces of IX and X. Head hairs more numerous and much shorter (0.04–0.06 mm long), simple to trifid. Labrum without median projection; anterior surface with 8 hairs and 12 sensilla. Mandibles with the apical tooth slenderer and the spinules longer. Maxillary palp and galea longer.

Young Larva.—Length (through spiracles) about 2 mm. Integument with spinules on the ventral surface of the thorax and all surfaces of the abdomen. Body hairs of 2 types: (1) 0.035–0.055 mm long, 2- to 4-branched, on all somites; (2) 0.07–0.09 mm long, denticulate, with or without a single hook at the tip, a few on each somite. Head hairs short (0.05–0.08 mm long), bifid or trifid.

Material Studied.—Numerous larvae from Brazil, courtesy of Karol Lenko.

Camponotus (Pseudocolobopsis) pallescens Mayr

Length (through spiracles) about 4.7 mm. Body hairs of 3 types: (1) 0.04–0.06 mm long, simple to 5-branched, on all somites; (2) 0.04–0.08 mm long, denticulate, a few on each somite of thorax and abdominal somites VIII–X; (3) 0.08–0.14 mm long, with single-hooked tip, a few on dorsal and lateral surfaces of abdominal somites I–VII. Head hairs shorter (0.04–0.09 mm long), denticulate. Labrum with 7 hairs and 13 sensilla on the anterior surface and 16 sensilla on the posterior surface. Mandibles with the apical tooth slenderer.

Very Young Larva.—Length (through spiracles) about 0.8 mm. Head on the anterior end and of about the same diameter as the body, the latter nearly uniform in diameter. Body hairs of 2 types: (1) 0.035–0.07 mm long, the tip hooked, a few on each thoracic somite; (2) 0.005–0.02 mm long, simple, a few on the dorsal and lateral surfaces of pro- and mesothorax and on the ventral surfaces of abdominal somites I and II. Head hairs short (0.03–0.06 mm long), simple or with the tip hooked.

Material Studied.—Numerous larvae from Brazil, courtesy of Karol Lenko.

Camponotus (Tanaemyrmex) atlantis Forel
C. (T.) sylvaticus barbaricus Emery

Valentini 1951: internal anatomy.

Camponotus (Tanaemyrmex) humilior Forel
(Fig. 18)

Length (through spiracles) about 6.5 mm. Body hairs of 3 types: (1) 0.05–0.09 mm long, 2- to 4-branched, on all somites, numerous; (2) 0.07–0.14 mm long, denticulate, a few on each thoracic somite and abdominal somites I–III and VII–X; (3) 0.05–0.08 mm long, with a triangular hook at the tip, a few on the dorsal and lateral surfaces of abdominal somites I–VI. Head hairs shorter (0.07–0.1 mm long), mostly denticulate, a few bifid or trifid. Labrum without the midventral projection; anterior surface with 5 hairs and 12 sensilla; posterior surface with 20 sensilla. Mandibles with the apex straighter and narrower; spinules on anterior surface longer.

Young Larva.—Length (through spiracles) about 2.6 mm. Body hairs of 3 types: (1) 0.03–0.06 mm long, simple or bifid, on all somites; (2) 0.025–0.065 mm long, denticulate, a few on abdominal somites VIII–X; (3) about 0.35 mm long, very slender and flexuous, a few on each abdominal somite II–VII. Head hairs 0.025–0.045 mm long.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Camponotus (Tanaemyrmex) santosi Forel

Length (through spiracles) about 6.3 mm. Body hairs of 3 types: (1) 0.05–0.1 mm long, 2- to 5-branched, numerous, on all somites; (2) 0.05–0.08 mm long, denticulate, a few on the thorax and abdominal somites VIII–X; (3) 0.05–0.08 mm long, with a triangular hook at the tip, a few on the dorsal and lateral surfaces of abdominal somites I–VII. Head hairs twice as numerous, shorter (0.05–0.07 mm long), mostly denticulate, a few trifid. Labrum without midventral projection, anterior surface with 8 hairs and 14 sensilla; posterior surface with 18 sensilla and longer spinules.

Young Larva.—Length (through spiracles) about 3 mm. Body hairs of 2 types: (1) 0.05–0.07 mm long, 2- to 4-branched, numerous on all somites; (2) 0.035–0.07 mm long, with a triangular hook at the tip, a few on the dorsal and lateral surfaces of each somite. Head hairs 0.04–0.06 mm long, 2- to 4-branched.

Material Studied.—Four larvae from Cuba, courtesy of Dr. W. L. Brown.

Camponotus (Tanaemyrmex) vicinus Mayr

Length (through spiracles) about 13 mm. Body hairs of 2 types: (1) 0.05–0.15 mm long, 2- to 4-branched, numerous, on all somites; (2) 0.06–0.13 mm long, denticulate, few, on abdominal somites VI–X. Head hairs twice as numerous and shorter (0.06–0.14 mm long), simple to 4-branched. Labrum without midventral projection; anterior surface with 10 hairs and 14 sensilla; posterior surface with 22 sensilla.

Very Young Larva.—Length (through spiracles) about 2 mm. Body hairs of 2 types: (1) 0.04–0.08 mm long, simple to 4-branched, numerous on all somites; (2) 0.1–0.16 mm long, with the tip hooked, on the dorsal and lateral surfaces of the anterior somites and on all surfaces of the posterior somites. Head hairs 0.05–0.09 mm long, simple to 4-branched.

Material Studied.—Numerous larvae from North Dakota and Wyoming.

Genus CALOMYRMEX Emery

Calomyrmex impavidus (Forel)
(Fig. 19)

Length (through spiracles) about 7.8 mm. Thorax and first abdominal somite forming a short stout neck, which is sharply marked off from the remainder of the abdomen and which is strongly curved ventrally; remainder of abdomen subellipsoidal and rather stout. Praesaepium well developed and apparently permanent; the posterior half of abdominal somite II raised to form a transverse welt and, on either side, ridges extend forward from this welt to form the sides of the praesaepium. Integument spinulose on the dorsal surfaces of abdominal somites VI–X and on the ventral surfaces of the thorax and abdominal somites I–III. Similar to our previous description of *C. albopilosus* with the following exceptions: Body hairs (1) 2- to 4-branched, on all somites, 0.175–0.275 mm long; (2) simple, few, on abdominal somites VIII–IX, about 0.2 mm long. Mandibles with the apex straighter and more round-pointed; lateral outline concave but not saddle-shaped. Maxillae spinulose on all surfaces.

Very Young Larva.—Length (through spiracles) about 2 mm. Plump and chunky, slightly curved ventrally; diameter nearly uniform but somewhat constricted at the first abdominal somite; ends rounded. Integument with spinules on the ventral surface of the thorax and abdominal somites I–III and the dorsal surface of abdominal somites IV–X. Body hairs of 2 types: (1) simple, on all somites, 0.05–0.14 mm long, the tip becoming recurved posteriorly; (2) 0.01–0.05 mm long, simple or bifid, on the thorax and first abdominal somite. Head hairs about a third as numerous as on the mature larva. Of 2 types: (1) 0.08–0.11 mm long, simple or with the tip hooked; (2) 0.01–0.04 mm long, simple to 3-branched. Chiloscleres represented by sclerotized fragments. Mandibles subtriangular, slightly broader than long, laterial outline convex; apical tooth short and acute; medial surface not so rough and spinules not so long as in mature larva. Maxillary palp an irregular knob with 4 apical and 1 lateral sensilla; galea a cone with 2 apical sensilla. Labial palp a raised cluster of 5 sensilla; opening of sericteries a narrow slit. Otherwise similar to the mature larva.

Material Studied.—Sixteen larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Genus ***Polyrhachis*** F. Smith

Polyrhachis (Chariomyrma) hookeri Lowne

Young Larva.—Length (through spiracles) about 1.8 mm. Thorax stout and bent ventrally; abdomen

somewhat stouter, straight, tapering slightly toward either end. Anus subterminal. The prothorax bears a pair of lateral swellings. Praesaepium lacking. Body hairs of 2 types: (1) 0.03–0.07 mm long, simple to trifid, on all somites, the more numerous type; (2) 0.06–0.08 mm long, with a single hook at the tip, several on every somite, increasing in number posteriorly. Integument with minute spinules in short transverse rows on the ventral surface of the thorax and first 3 abdominal somites and all surfaces of abdominal somites VIII–X. Head hairs 0.06–0.08 mm long, numerous, simple to trifid. Labrum with 11 simple hairs on the anterior surface; no sensilla. Mandibles subtriangular in anterior view, lateral outline convex, apical tooth short and acute. Otherwise similar to the mature larva.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Polyrhachis (Campomyrma) sp.
(Fig. 21)

Length (through spiracles) about 7.6 mm. Similar to *P. hookeri,* except in the following details: Slenderer. Integument furnished with minute spinules in short transverse rows on the ventral surface of the thorax and first 3 abdominal somites. Body hairs of 2 types: (1) 0.045–0.25 mm long, simple to 11-branched, longest and with the fewest branches on the ventral surface of the thorax; (2) about 0.075 mm long, denticulate, a few on the dorsal and lateral surfaces of all somites (except prothorax), abundance increasing posteriorly. Head hairs about 0.08 mm long, 2- to 8-branched. Anterior surface of labrum with 10 hairs and 8 sensilla. Mandibles wider.

Material Studied.—Six larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Polyrhachis (Hagiomyrma) schencki Forel

Length (through spiracles) about 4.8 mm. Similar to *P. hookeri,* except in the following details: Body hairs of 2 types: (1) 0.08–0.19 mm long, simple to 6-branched, all branches in the same plane, the more numerous type, on all somites, longest on the ventral surface of the thorax and abdominal somites I–III; (2) 0.05–0.11 mm long, denticulate, on all somites. Posterior surface of the labrum with only 24 sensilla. Mandibles with the apical tooth stouter. Maxillary and labial palps digitiform.

Young Larva.—Length (through spiracles) about 1.9 mm. Thorax stout and bent ventrally; abdomen somewhat stouter, straight, tapering slightly toward either end. Anus subterminal. Prothorax with a pair of lateral swellings. Body hairs of 2 types: (1) 0.03–0.06 mm long, simple to 6-branched, all branches in the same plane, on all somites; (2) 0.04–0.06 mm long, with the tip hooked and curled, few, on each somite, increasing posteriorly in number, size, and curl. Integument with minute spinules in short transverse rows on the ventral surface of the thorax and first 3 abdominal somites and the dorsal surface of abdominal somites VIII–X. Head hairs 0.04–0.06 mm long, 2- to 6-branched, all branches in the same plane. Labrum with about 20 sensilla on the posterior surface. Mandibles with the apical tooth vestigial. Otherwise similar to the mature larva.

Material Studied.—Several larvae from New South Wales, courtesy of Rev. B. B. Lowery.

Polyrhachis (Hedomyrma) sp.
(Fig. 20)

Length (through spiracles) about 5.2 mm. Similar to *P. hookeri,* except in the following details: Body hairs of 3 types: (1) 0.05–0.08 mm long, 2- to 6-branched, the most numerous type, on all somites; (2) 0.06–0.1 mm long, denticulate, on all somites; (3) about 0.6 mm long, on abdominal somites III–VII, long and whiplike. Spinules on the ventral surface of the thorax and abdominal somites I, II, III, and X. Head hairs 0.04–0.07 mm long, moderately numerous, denticulate. Anterior surface of labrum with 8 hairs and 6 sensilla; posterior surface with 24 sensilla.

Young Larva.—Length (through spiracles) about 1.8 mm. Body shape similar to the young larva of *P. hookeri.* Integument spinulose. Body hairs of 3 types: (1) 0.02–0.04 mm long, on dorsal and lateral surfaces of all somites, simple to trifid; (2) 0.03–0.11 mm long, with the tip hooked, on all surfaces of the thorax and abdominal somites I, II, VIII, IX, and X; (3) about 0.3 mm long, whiplike, a few on the dorsal surface of each abdominal somite IV–VIII. Head hairs of 2 types: (1) 0.05–0.12 mm long, simple to trifid; (2) 0.03–0.05 mm long, shaft denticulate and tip hooked but highly variable. Anterior surface of labrum with 11 hairs and 4 sensilla. Mandibles similar to those of *P. hookeri.* Otherwise similar to the mature larva.

Very Young Larva.—Length (through spiracles) about 1.1 mm. Similar to the young larva of *P. hookeri,* except in the following details: Integument spinulose. Body hairs of 2 types: (1) long (0.14–0.18 mm) and whiplike, on dorsal and lateral surfaces of thorax and abdominal somites I–VII, not numerous; (2) 0.05 –0.07 mm long, with the tip hooked, on dorsal and lateral surfaces of abdominal somites VIII–X, few. Head hairs 0.06–0.14 mm long, few, simple, long and whiplike to short and slightly curved. Anterior surface of labrum with 10 hairs.

Material Studied.—Numerous larvae from New South Wales, courtesy of Rev. B. B. Lowery.

REFERENCES CITED

Andrasfalvy, A. 1961. Mitteilungen über Daten des Hochzeitsfluges verschiedener Ameisenarten in Ungarn und Ergebnisse von Versuchen der Koloniegründung im Formicar dieser Arten. Insectes Sociaux 8: 299–310.

Ayre, G. L. 1962. *Pseudometaeca schwarzii* (Ashm.) Eucharitidae: Hymenoptera), a parasite of *Lasius neoniger* Emery. Can. J. Zool. 40: 158–64, 5 fig.

Bernard, F. 1951a. Adaptations au milieu chez les fourmis sahariennes. Bull. Soc. Hist. Nat. Toulouse 86: 88–96.

1951b. Super-famille des Formicoidea, p. 997–1104. *In* P. P. Grassé [ed.] Traité de Zoologie, Tome X, Fasc. II. Masson et Cie., Paris.

1953. Les fourmis du Tassili des Ajjer (Sahara

Central). Inst. Rech. Sahariennes Univ. d'Algérie. 132 p., 6 pl.
Brown, W. L. 1955. A revision of the Australian ant genus *Notoncus* Emery, with notes on other genera of Melophorini. Bull. Mus. Comp. Zool. Harvard Coll. 113: 471–94.
Caullery, M. 1952. Parasitism and Symbiosis. Sidgwick & Jackson, Ltd., London. 340 p.
Cazier, M. A., and M. A. Mortenson. 1965. Bionomical observations on myrmecophilous beetles of the genus *Cremastocheilus* (Coleoptera: Scarabaeidae). J. Kans. Entomol. Soc. 38: 19–44.
Eidmann, H. 1926. Die Koloniegründung der einheimischen Ameisen. Z. Vergl. Physiol. 3: 776–826.
Escherich, K. 1917. Die Ameise. Schilderung ihrer Lebensweise. 2d ed. Friedr. Vieweg und Sohn, Braunschweig. 384 p.
Fielde, A. M. 1905. The communal life of ants. Nature-Study Rev. 1: 239–51.
Glöckner, W. E. 1956. Über Zentrifugierversuche an Formiciden. Insectes Sociaux 3: 403–15.
Goetsch, W. 1957. The Ants. Univ. Michigan Press, Ann Arbor. 169 p.
Hoelldobler, B. 1961. Temperaturunabhaengige rhythmische Erscheinungen bei Rossameisenkolonien (*Camponotus ligniperda* Latr. und *Camponotus herculeanus* L.). Insectes Sociaux 8: 13–22.
Holmquist, A. M. 1928. Notes on the life history and habits of the mound-building ant, *Formica ulkei* Emery. Ecology 9: 70–87.
Kannowski, P. B. 1959. The flight activities and colony-founding behavior of bog ants in southeastern Michigan. Insectes Sociaux 6: 115–62.
Klots, A. B., and E. B. Klots. 1959. Living Insects of the World. Doubleday & Co., Garden City, N.Y. 304 p.
Ledoux, A. 1950. Recherche sur la biologie de la fourmi fileuse (*Oecophylla longinoda* Latr.). Ann. Sci. Nat. (Zool.) 12: 312–461.
Maneval, H. 1940. Observations sur un aphidiide (Hym.) myrmécophile. Description du genre et de l'espèce. Bull. Mens. Soc. Linn. Lyon 9: 9–14. [Fide Biol. Abstr.]
McCook, H. C. 1876. Notes on the architecture and habits of *Formica pennsylvanica*, the Pennsylvania carpenter ant. Trans. Amer. Entomol. Soc. 5: 277–89.
Michener, C. D., and M. B. Michener. 1951. American Social Insects. D. Van Nostrand Co., Inc., New York. 267 p.
Morley, D. W. 1953. Ants. Collins, London. 179 p.
Schmidt, G. H. 1964. Aktivitätsphasen bekannter Hormondrüsen während der Metamorphose von *Formica polyctena* Foerst. Insectes Sociaux 11: 41–57.
Stärcke, A. 1948. (1949). Contribution to the biology of *Myrmica schencki* Em. Tijdschr. Entomol. 91: 25–71.
Torre-Bueno, J. R. de la. 1944. Why not eat insects? Bull. Brooklyn Entomol. Soc. 39: 122–31.
Valentini, S. 1951. Sur l'adaptation des larves de Formicoidea. Ann. Sci. Nat. (Zool.) 11: 249–76.
Wallis, D. I. 1960. Spinning movements in the larvae of the ant *Formica fusca*. Insectes Sociaux 7: 187–99.
Wheeler, G. C. 1943. The larvae of the army ants. Ann. Entomol. Soc. Amer. 36: 319–32.
Wheeler, W. M. 1910. Ants, Their Structure, Development and Behavior. Columbia Univ. Press, New York. 663 p.
Wheeler, G. C., and I. W. Bailey. 1920. The feeding habits of pseudomyrmine and other ants. Trans. Amer. Phil. Soc. (Art. 4): 235–79, 5 pl.
Wheeler, G. C., and J. Wheeler. 1953. The ant larvae of the subfamily Formicinae. Ann. Entomol. Soc. Amer. 46: 126–71, 175–217.
1960. The ant larvae of the subfamily Myrmicinae. Ann. Entomol. Soc. Amer. 53: 98–110.
1963. The Ants of North Dakota. Univ. North Dakota Press, Grand Forks. 326 p.
Wilson, E. O. 1953. On Flander's hypothesis of caste determination in ants. Psyche 60: 15–20.
1955. A monographic revision of the ant genus *Lasius*. Bull. Mus. Comp. Zool. Harvard Coll. 113: 1–205.
Wilson, E. O., and R. W. Taylor. 1964. A fossil ant colony: new evidence of social antiquity. Psyche 71: 93–103.

Comparative Studies of the Labellar Sensitivity of Female Tabanids (Diptera) to Sucrose and Sodium Chloride[1]

SURESH B. LALL[2] AND D. M. DAVIES
Department of Biology, McMaster University, Hamilton, Ontario, Canada

ABSTRACT

Contact chemoreceptive sensilla on the aboral margins of the labella are sensitive to water, sucrose, and sodium chloride in the 3 female tabanids studied. The labellar receptors play a major role in "triggering" sucking action, following detection of acceptable substrates by the fore tarsi. Labellar acceptance thresholds for sucrose were 0.0025M–0.005M, 0.015M–0.031M, and 0.0125M–0.0625M in *Chrysops vittatus* Wiedemann, *Hybomitra lasiophthalma* (Macquart), and *Tabanus lineola* F., respectively; the labellar rejection thresholds for NaCl in 0.5M sucrose were 0.50M, 0.70M, and 0.60M–0.70M, respectively. The labellar contact chemoreceptors had lower acceptance and rejection thresholds than those of tarsal sensilla.

The tarsal sensitivity of female tabanids to sucrose and sodium chloride was described by the authors in a previous paper (Lall and Davies 1967). The aboral margins of the labella, as well as the tarsi, possess contact chemoreceptive sensilla that are sensitive to a variety of chemicals (Lall and Davies, unpublished notes).

The only other study made thus far of contact chemoreception in Tabanidae is that of Frings and O'Neal (1946) on the female of a horse fly, *Tabanus sulcifrons* Macquart, but sensory physiology of con-

[1] From a thesis to be prepared by the first author for presentation to the Department of Biology of McMaster University, Hamilton, Ontario, Canada, in partial fulfillment of the requirements of the Ph.D. degree. The first author was the recipient of a scholarship from the Biology Department of McMaster University, and the research was supported in part by a grant to the second author from the National Research Council of Canada. Accepted for publication March 13, 1967.
[2] Permanent address: Department of Zoology, University of Udaipur, Udaipur (Rajasthan), India.