LARVAE OF SOME EUSOCIAL BEES AND WASPS

By George C. Wheeler and Jeanette Wheeler
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LARVAE OF SOME EU SOCIAL BEES AND WASPS

By George C. Wheeler and Jeanette Wheeler

ABSTRACT: The larvae of 17 species of social wasps in the genera Apoica, Belonogaster, Microstigmus, Mischocyrtarus, Polistes, Polybia, Ropalidia, Synoeca and Vespuila are described and many figured; the same for eight species of social bees in the genera Apis, Bombus, Braunsapis, Lasioglossum, Melipona and Trigona. Appended are a list of published descriptions and illustrations of the larvae of eusocial wasps and bees, a list of the published characterizations of the larvae of the higher taxa and a list of published keys to larvae.

When we were invited to write the chapter on the larvae of social Hymenoptera for "Social Insects," H.R. Hermann, ed., Academic Press (1979), we had no misgivings about ant larvae, because we had just finished a monograph about them (1976), based on a leisurely half-century of the study of 692 species in 182 genera representing all 10 of the living subfamilies. But about eusocial bee and wasp larvae we knew nothing and we had less than a year to learn. We sent out appeals for specimens and references. We acknowledge the generous responses with advice and/or specimens from the following: D.R. Davis, National Museum of Natural History, Smithsonian Institution; Howard E. Evans, Colorado State University; Saul I. Frommer, University of California, Riverside; Charles D. Michener, University of Kansas; Jerome G. Rozen, American Museum of Natural History; Robert O. Schuster, University of California, Davis; Roy R. Snelling, Natural History Museum, Los Angeles County; Philip F. Torchio, Utah State University.

We processed representatives of 16 species of eusocial wasps and eight species of eusocial bees by the techniques (1960) we had used for ant larvae and prepared descriptions according to our paradigm (1976; 2–3); drawings were prepared according to the style we had developed for ant larvae. As in all ant larvae papers we used the integuments of the largest larvae which had not defecated. We follow Snodgrass (1960) in considering post-defecation larvae as pharate pupae (= semipupae). Those studies gave us a good acquaintance at first hand with these larvae, but there was no room in our chapter for this material. It seems unfortunate to us that the detailed results of so much labor should not be publicly available; hence we are publishing them herewith.

In our chapter on social Hymenoptera we did not refer to the larvae of the sphexids in the genus Microstigmus, because we were not certain they were eusocial. Since then Roy R. Snelling, Los Angeles County Museum, has assured us that they are indeed eusocial. We follow his advice and a description of the larvae of Microstigmus comes Krombein is included here. This makes a total of 17 species of eusocial wasps we have studied.

We also asked specialists if they kept (or knew of) a catalog of published figures and/or descriptions of the larvae of eusocial bees and wasps. Such a catalog would have saved us considerable time in learning what was already known. No one had (or knew of) such a catalog; but some said that it would be extremely useful.

We therefore append below a list of those species of eusocial wasps and bees whose larvae we have found described and/or illustrated in the literature. The list is incomplete, for we have not had the time to search the literature (as we did for the ants), but it can be used as a starting point for specialists. We hope that they will bring it up to date and keep it so, in order that future students will not be caught in our predicament.

TERMS

We follow Snodgrass in regarding the head of an insect—either larva or adult—as hypognathus. Consequently we consider the face to be anterior and the vertex dorsal, while the mouth parts are directed ventrally.

The praesaeapium is a shallow depression on the ventral surface of certain anterior somites; it resembles somewhat the trophysylax of the pseudomyrmecine ant larva and serves the same function: the workers deposit food in it and the larva eat from it.

We use T1, T2 and T3 as symbols for the thoracic somites and AI to AX for the abdominal somites.

1. REVIEW COMMITTEE FOR THIS CONTRIBUTION:
HOWARD E. EVANS
JEROME G. ROZEN
ROY R. SNELLING

2. Research Associates in Entomology, Natural History Museum of Los Angeles County, and Desert Research Institute, University of Nevada System, Reno, Nevada 89506.

3. "Discovering from the literature what species have been described as larvae is most difficult for obvious reasons. Hence I cannot but feel that a published list of social bees (and presumably other Hymenoptera) might be a significant contribution to the work of others in the future." (Dr. Jerome G. Rozen in a letter of 4 March 1976.)

VESPOIDEA

Body profile straight and fusiform; diameter greatest at AI and AII, gradually attenuated toward posterior end and more rapidly toward anterior end; with temporary trophophylax (= praeaeunium), except in *Mischoctytarus* which has a permanent shelf; transverse wents on dorsum of some somites. Hairs usually lacking or minute and simple. Mandibles highly varied.

VESPIDAE: POLISTINAE

*Apoica pallens* (Fabricius)

**Figure 1**

Length (through spiracles) about 18 mm. Body straight; dorsal profile arcuate; ventral nearly straight, except head and terminal somites curved slightly ventrally; mouth parts directed anteroventrally. Anus terminal; with prominent lips. Leg and gonopod vestiges small knobs; wing rudiments brown lines on unstained integuments. **Spiracles** small; peritreme feebly sclerotized; atrial wall with minute spinules in encircling rows. Entire integument spinulose, the spinules large and isolated anteriorly, becoming smaller and in short rows posteriorly. **Body hairs** moderately abundant on dorsal and lateral surfaces, minute (about 0.09 mm long), fewer ventrally, very fine and flexuous. **Cranium** not sclerotized (= same color as body); large (about 2.34 mm wide and 1.9 mm long); subpentagonal in anterior view, widest immediately behind antennal level; with distinct temporal sulci, the lateral portions appearing sieve-like. Antennae just below midlength of cranium; each mounted on large slightly elevated base; small; with 4 sensilla, each bearing a minute spine. **Head hairs** (and/or minute sensilla) 0.003–0.025 mm long; numerous. **Labrum** bilobed; dorsal border sinuate; each half of anterior surface with about 25 minute (about 0.013 mm long) hairs dorsally and sensilla ventrally; ventral surface with about 25 large projecting sensilla medially and 6 smaller sensilla laterally on each half; posterior surface spinulose, the spinules minute and in short rows ventrally; longer and isolated laterally; posterior surface with about 6 sensilla medially. **Mandible** small (about 0.36 mm wide and 0.64 mm long), moderately sclerotized; falcate; tapering to a very sharp apical tooth with medial blade; a narrowly rounded long tooth projecting anteromedially from blade. **Maxilla** appearing adnate; stripes with about 24 hairs (about 0.025 mm long, simple, slender) on lateral surface; medial and apical surfaces sparsely spinulose, spinules minute; palp a slender peg with 4 apical sensilla; galea stouter than palp and with bifid apex; one branch of apex with 4 sensilla, the other with 1. **Labium** small, surface with fine rugulae; palp a frustum with 4 apical sensilla; an isolated hair (about 0.03 mm long) between each palp and opening of secretorys, the latter wide and feebly projecting. Hypopharynx rugulose. (Material studied: three larvae from Costa Rica, courtesy of Roy R. Snelling.)

*Mischoctytarus flavitas* (Saussure)

**Figure 3**

Length (through spiracles) about 13 mm. Body with thorax narrowed anteriorly; abdomen widest at AII, decreasing to narrowly rounded posterior end, with a pair of small knobs on dorsum of each T2–AIX; praeaeunium floor T1–T3; AI projecting ventrally into 2 spinulose cones. Anus terminal. Head on anterior end; its diameter greater than that of T1 or T2. **Spiracles**: diameter of T2 spiracular atrium twice diameter of remainder; atrial walls with encircling rows of minute spinules. **Integument** of body spinulose, spinules in short rows or isolated on ridges, ridges numerous and transverse or reticulate. **Body hairs** few, stout, 0.025–0.1 mm long, only on ventral projection on AI. **Cranium** moderately sclerotized (= light brown); feebly subcorporate; about 2.4 mm wide and 2.16 mm long; with numerous minute sensilla; temporal sulci present. Antennae small; just below midlength of cranium. **Labrum** bilobed, wide and short (about 1.56 mm wide and 0.48 mm long); anterior surface of each half with a small ventrolateral boss, which bears about 25 minute hairs and/or sensilla; entire anterior surface rugulose; posterior surface of each half with about 20 sensilla, each of which is mounted on a slight projection. **Mandible** falcate; long and slender (about 0.4 mm wide and 0.98 mm long), with very slender apex. **Maxilla** lobose; palp digitiform with 5 (2 apical, 2 subapical and 1 basal) sensilla; galea digitiform, more slender than

FIGURES 1 THROUGH 4.

FIGURE 1. Apoica pallens. a, Head in anterior view, X22; b, body hair, X390; c, left mandible in anterior view, X40; d, larva in side view, X7. FIGURE 2. Belonogaster lateritius. a, Larva in side view, X5.5; b, body hair, X600; c, left mandible in anterior view, X21; d, head in anterior view, X13. FIGURE 3. Mischocyttarus flavitarsis. a, Head in anterior view, X14; b, left mandible in anterior view, X94; c, body hair, X1390; d, larva in side view, X14. FIGURE 4. Polistes exclamans lineomotus. a, Larva in side view, X7; b, head in anterior view, X15; c, body hair, X400; d, left mandible in anterior view, X38.

Palp but about as long, with 2 apical sensilla. Labium small and rounded, sparsely spinulose, spinules minute and in short transverse rows; palp a low knob; an isolated sensillum between each palp and opening of sericteries; the latter wide and salient. Hypopharynx densely spinulose, spinules arranged in subtransverse rows, rows so close together that spinules overlap. (Material studied: four larvae from Arizona, courtesy of Roy R. Snelling.)

**Polistes exclamans lineonotus** R. Bohart

*Figure 4*

Length (through spiracles) about 17 mm. Body straight; dorsal profile arcuate, ventral feebly sigmoid; diameter greatest at AII, decreasing slowly to posterior end (which is narrowly rounded) and more rapidly to anterior end; head terminal and slightly smaller than diameter of T1. Anus ventral. A small boss posterior to anus on AX; lateral longitudinal wells well-developed; paired bosses on T2, T3 and AI–AIX; praesaeptic floor formed from depressed ventral surfaces of T1–T3 and AI, ventral wall formed from an anteroveentral extension of AII. Leg vestiges rather large, each with sclerotized ring; wing rudiments present. Spiracles on T2 largest, remainder small and sub-equal. Entire integument spinulose, the spinules coarse and isolated ventrally, grading into minute and in short rows dorsally, on thorax and anterior abdominal somites; posterior spinules finer and less numerous. Body hairs sparse, simple, minute to short (0.005–0.06 mm long), most numerous on venter of T3 and AI. Cranium moderately sclerotized (= light brown); subtrapezoidal in anterior view, widest ventrally (about 2.45 mm wide and 1.68 mm long); temporal sulci long and wide. Antennae just below midlength of cranium; each a low knob with 3 or 4 sensilla. Head hairs numerous (about 200) and minute (about 0.008 mm long). Labrum short and trapezoidal; narrowed ventrally (about 1.27 mm wide and 0.42 mm long); entire anterior surface with about 120 minute hairs (0.005–0.03 mm long) and/or sensilla (each bearing a spinule); ventral border with about 30 sensilla (some heavily sclerotized and elevated) and with numerous minute spinules; posterior surface with about 24 sensilla and with a few minute spinules in short rows. Mandible falcate; about 0.44 mm wide and 0.84 mm long; with a rather long tooth arising from the anterior surface and with a very small tooth between it and apical tooth; anterior surface with a few transverse rugulae; posterior surface with longitudinal rugulae. Maxilla appearing adnate; swollen and lobose laterally; with about 45 minute to short (0.005–0.03 mm long) hairs; with minute isolated spinules medially, in short arcuate rows laterally and posteriorly, palp a tall peg with 5 or 6 apical sensilla; galea an irregular peg with 5 apical sensilla. Labium small and globose, with about 50 minute to short (0.005–0.03 mm long) hairs between palps and opening of sericteries; hairs continued onto posterior surface; each palp a small boss with 5 apical sensilla; opening of sericteries as wide as labium and slightly salient. Hypopharynx with a few minute ridges (rows of spinules?). (Material studied: five larvae from Mexico, courtesy of Roy R. Snelling.)

**Polistes erythrocephalus** Latreille

Length (through spiracles) about 17 mm. Similar to *P. exclamans lineonotus* except as follows: Body stout; dorsal profile J-shaped, ventral profile S-shaped; diameter greatest at AIII; with paired dorsal bosses on T3–AIX; single more prominent boss on AX. Entire integument with large isolated spinules. Body hairs longer (0.012–0.1 mm long). Cranium about 2.7 mm wide and 2 mm long; transversely subelliptical in anterior view; dorsal border feebly impressed. Head hairs twice as numerous (about 400) and longer (0.01–0.1 mm long). Labrum feebly bilobed; about 1.39 mm wide and 0.48 mm long; posterior surface with about 14 sensilla. Mandible about 0.58 mm wide and 0.9 mm long. Maxilla with palp and galea subequal in height. Labium with hairs about 0.05 mm long and simple or about 0.025 mm long and bifid at tip. Hypopharynx with sparse minute spinules. (Material studied: three larvae from California, courtesy of R.O. Schuster.)

**Polistes fuscatus aurifer** Saussure

Length (through spiracles) about 17 mm. Similar to *P. exclamans lineonotus* except as follows: Body stout; dorsal profile J-shaped, ventral profile S-shaped; diameter greatest at AIII; with paired dorsal bosses on T3–AIX; single more prominent boss on AX. Entire integument with large isolated spinules. Body hairs longer (0.012–0.1 mm long). Cranium about 2.7 mm wide and 2 mm long; transversely subelliptical in anterior view; dorsal border feebly impressed. Head hairs twice as numerous (about 400) and longer (0.01–0.1 mm long). Labrum feebly bilobed; about 1.39 mm wide and 0.48 mm long; posterior surface with about 14 sensilla. Mandible about 0.58 mm wide and 0.9 mm long. Maxilla with palp and galea subequal in height. Labium with hairs about 0.05 mm long and simple or about 0.025 mm long and bifid at tip. Hypopharynx with sparse minute spinules. (Material studied: three larvae from California, courtesy of R.O. Schuster.)
Polistes major castaneicolor Bequaert

Length (through spiracles) about 37 mm. Similar to P. exclamans lineonous except as follows. Body with a pair of wefts on dorsum of each AI–AV. Integument with all spines minute. Body hairs 0.01–0.15 mm long, longest and most numerous on venter of AI, the longest flexuous. Cranium heavily sclerotized (= dark brown); about 2.9 mm wide and 1.9 mm long. Antennae above midlength of cranium. Head hairs about 400, 0.06–0.18 mm long, very slender and flexuous. Labrum about 1.6 mm wide and 0.6 mm long; transversely subelliptical in anterior view; anterior surface with about 90 sensilla and minute hairs (about 0.025 mm long). Mandible about 0.52 mm wide and 0.86 mm long. Maxilla with about 20 hairs, 0.01–0.05 mm long; palp stout and digitiform, with 4 apical and 2 lateral sensilla, integument with a few minute spines; galea digitiform, with bifid apex, the larger branch with 5 or 6 apical sensilla, the smaller with 1 apical sensillum. Labium with palp a short peg with 7 or 8 apical and 1–3 lateral sensilla; integument with isolated spines and about 24 short (0.012–0.025 mm long) hairs, the longer with bifid apex. Hypopharynx with a few minute spines in short arcuate rows. (Material studied: two larvae from Arizona, courtesy of Roy R. Snelling.)

Polistes poeyi Lepeletier

Length (through spiracles) about 13 mm. Similar to P. exclamans lineonous except as follows. Entire integument spinulose, the spines numerous, isolated and large on thorax and dorsum of AI–AX and venter of AI–AV, less abundant and smaller posteriorly. Body hairs simple; most numerous and longest (0.005–0.1 mm) on venter of AI, fewer and shorter anteriorly and posteriorly. Cranium heavily sclerotized (= dark brown), about 2.4 mm wide and 1.6 mm long. Antennae above midlength of cranium, each with a heavily sclerotized ring, elevated, with 2 or 3 sensilla. Head hairs about 130 and minute (about 0.005 mm long). Labrum about 1.25 mm wide and 0.4 mm long; transversely subelliptical; entire anterior surface with about 8 sensilla and a few isolated spines; ventral border with about 12 sensilla; posterior surface with about 25 sensilla, most numerous dorsally and near midline ventrally; posterior surface with a few minute spines in short arcuate rows. Mandible about 0.36 mm wide and 0.9 mm long; small medial tooth lacking. Maxilla less swollen laterally; anterior surface with about 35 simple, very slender hairs, 0.006–0.025 mm long; medial surface with minute spines, spines isolated or in short rows; palp stout, digitiform, with 4 or 5 apical sensilla; galea approximately same size as palp but with an irregular apex, with 5–7 apical sensilla. Labium small, transversely subelliptical, with a slightly raised, sparsely spinulose, transverse welt dorsally, with about 12 hairs (0.005–0.025 mm long) near each palp; palp a low knob with 4 apical sensilla. Hypopharynx with sparse isolated spines. (Material studied: two larvae from Cuba, courtesy of Roy R. Snelling.)

Polybia occidentalis (Olivier)

Figure 5

Length (through spiracles) about 6 mm. Body straight; stout; diameter greatest at AI and AII, diameter decreasing rapidly anterio-rily and gradually posteriorly. Anus terminal. Head on anterior end, with diameter greater than that of AI; T2, T3 and A1 with paired dorsolateral denticles. Leg, wing and gonopod vestiges distinct. Spiracles small; T2 largest, remainder subequal. Integument spinulose, spines isolated and coarse, decreasing in size and number posteriorly. No body hairs seen. Cranium large, about 1.24 mm wide and 0.74 mm long; transversely subelliptical in anterior view; feebly sclerotized (= yellow); temporal sulci long. Antennae large, at lower third of cranium, each with 3 sensilla. Labrum short (about 0.45 mm wide and 0.1 mm long) and bilobed; each half of anterior surface with about 12 sensilla (each on a small peg), 5 hairs (about 0.125 mm long) and numerous papillae; ventral border with papillae and about 9 sensilla; posterior surface with an isolated sensillum near middle and with a few oblique arcuate rows of minute spines. Mandible small, about 0.2 mm wide and 0.24 mm long, falcate, with irregular apex; a subapical lateral tooth, a crooked apical tooth and a short mediad blade; basal portion with short arcuate ridges, apical portion with a few longitudinal ridges. Maxilla appearing adnate; basal surface with numerous rather coarse spines, apical with about 10 hairs about 0.13 mm long, and numerous short ridges; palp a short rugose irregular peg with 5 apical sensilla; galea an irregular rugose boss with 2 sensilla, each on a slight elevation. Labium transversely subelliptical; with short transverse ridges; palp a cluster of 4–6 slightly elevated sensilla; an isolated sensillum between each palp and opening of sericities; the latter a transverse slit with lips as wide as labium. Hypopharynx sparsely spinulose, the spines minute and in short transverse rows. (Material studied: five larvae from Costa Rica, courtesy of Roy R. Snelling.)

Ropalidia cincta (Lepeletier)

Figure 6

Length (through spiracles) about 18 mm. Body fusiform; head and anus terminal; thorax slender; abdomen abruptly enlarged; venter of T1–T3 forming floor of praesacipum; AI produced ventrally to form its lip; transverse wels meeting on middorsum of T1–AVII, a pair each; diameter of head nearly equal to that of T2. Leg, wing and gonopod vestiges present. Spiracles on T2 about twice diameter of remainder. Integument entirely spinulose, the spines rather large and isolated, largest on AI, abruptly reduced on AIX, lacking on AX. Body hairs 0.005–0.025 mm long, sparse, simple, very fine. Cranium about 2.9 mm wide and 1.6 mm long; semicircular in anterior view; heavily sclerotized (= dark brown) between sulci and to its ventral border, excluding clypeus; sclerotization heaviest along ventral border of cranium and of labrum; temporal sulci long and narrow; clypeus with about 34 sensilla. Antennae at lowest third of cranium; large; each a slightly raised circle with 3 minute sensilla. Labrum trapezoidal in anterior view, narrowed dorsally, very short and wide (about 0.4 mm long and 2.1 mm wide); anterior surface with about 30 sensilla and with minute hairs (about 0.012 mm long); ventral border and adjacent portions of anterior and posterior surfaces with about 66 sensilla, each on a low knob; posterior surface with numerous short rows of minute spines. Mandible large (about 0.4 mm wide and 1.2 mm long); slender; falcate; apical tooth slender and sharp-pointed, with a slender sharp-pointed anterior tooth; mandible with a dark band around basal edge. Maxilla lobose ventrolaterally; anterior

FIGURES 5 THROUGH 8.

FIGURE 5. Polybia occidentalis. a, Larva in side view, X18; b, head in anterior view, X30; c, left mandible in anterior view, X50.

FIGURE 6. Ropalidia cineta. a, Head in anterior view (left maxilla and labium normally hidden behind labrum but drawn here separately), X13; b, left mandible in anterior view, X25; c, larva in side view, X7.

FIGURE 7. Synoeca surinama. a, Body hair, X400; b, left mandible in anterior view, X56; c, head in anterior view, X15; d, larva in side view, X5.5.

FIGURE 8. Vespa maculata. a, Head in anterior view, X17; b, spiracle, X200; c, larva in side view, X3.5; d, left mandible in anterior view, X40; e, body hair, X508.

surface with about 20 hairs (about 0.25 mm long) and minute spinules; appearing adnate; palp digitiform, with 4 apical and 1 lateral sensilla, integument of palp with minute spinules in short transverse rows; galea slightly shorter and slenderer, with 2 apical sensilla. **Labium** short and subtrapezoidal in anterior view, slightly wider basally; with large transverse dorsal welt; palp a peg with 2 apical sensilla and 4 adjacent slightly raised sensilla; area between each palp and opening of seticertes with long slender spinules; an isolated sensillum between each palp and opening of seticertes; the latter wide and transverse, with slightly protruding lips. **Hyopharynx** with numerous minute spinules in short transverse rows. (Material studied: four larvae from Kenya, courtesy of Roy R. Snelling.)

**Synoeca surinama** (Fabricius)

Figure 7

Length (through spiracles) about 24 mm. Body fusiform; nearly straight; diameter greatest at AIII, attenuated gradually toward each end; lateral longitudinal welts on sides of abdomen; a pair of transverse welts meeting at midline on dorso of each AII–AVII; AIX with digitiform middorsal projection. No suggestion of a praesaeipium. Leg, wing and gonopod vestiges dark brown. **Spiracles** with minute spinules in transverse rows on atrial wall. Entire integument spinulose, spinules longer and isolated anteriorly, minute and in rows posteriorly. **Body hairs** 0.025–0.05 mm long; simple spines; most numerous on venter of thorax and anterior abdominal somites, sparse elsewhere. **Craniun** feebly sclerotized (= yellow); feebly bilobed due to median impression of dorsal border; about 2.6 mm wide and 1.8 mm long; temporal sulci long and slender. Antennae at midlength of cranium; each with a sclerotized border and with 3 minute sensilla. Head hairs short (0.019–0.037 mm long), spike-like and numerous (about 220). **Labrum** short (about 1.4 mm wide and 0.4 mm long), transversely subelliptical; anterior surface with about 24 hairs (about 0.03 mm long) dorsally and numerous sensilla (each mounted on a small papilla); ventral border thick and feebly sclerotized, with sensilla on small papillae; posterior surface with small papillae and with minute spinules in short arcuate rows. **Mandible** small about 0.45 mm wide and 0.55 mm long; subpentagonal in anterior view, distal end blunt; apex sclerotized, with a small boss directed anteromedially and bearing a few rows of minute spinules; subapical portion with about 36 minute sensilla; medial portion with minute spinules in short transverse rows; basal portion reticulorugose and with minute spinules in short transverse rows. **Maxilla** appearing adnate; cardo swollen ventrolaterally, with about 6 hairs (about 0.05 mm long); stipe rather slender and with about 18 hairs (about 0.25 mm long); palp sclerotized, an irregular peg with 5 sensilla, subequal to galea; galea with 2 apical sensilla. **Labium** small, transversely subelliptical in anterior view, dorsal portion densely spinulose, the spinules long and slender; palp sclerotized, a small peg with 3 apical sensilla; an isolated sensillum between each palp and opening of seticertes; the latter a transverse slit, with lips as wide as labium. **Hyopharynx** with numerous short transverse ridges bearing minute spinules. (Material studied: three larvae from Mexico, courtesy of Roy R. Snelling.)

**VESPINAE**

**Vespula maculata** (Linnaeus)

Figure 8

Length (through spiracles) about 19 mm. Body stout and slightly curved ventrally; head moderately large and anteroventral; anus terminal; AX with 2 stout posterior dorsal cones; lateral longitudinal welts well developed; praesaeipium floor formed by depressed venter of T1–T3 and AI; pII strongly projecting ventrally to form lip; AII–AIV with lateral bosses; AII–AVII with a pair of transverse welts meeting at middorsum, one pair per somite. Leg, wing and gonopod vestiges present. **Spiracles** of thorax small; abdominal large, with rather wide peritreme; atrial walls with minute spinules, varying to hair-like with minute denticles. **Integument** entirely and densely spinulose, spinules large and isolated or minute and in short rows. **Body hairs** minute (about 0.03 mm long), simple, sparse. **Craniun** feebly sclerotized (= yellow); about 2.6 mm wide and 1.7 mm long; subhexagonal or transversely subelliptical in anterior view, with feebly medial impression of occipital border; temporal sulci distinct; ventral border of clypeus straight. Antennae at midlength of cranium, each mounted on a small boss, with 3 sensilla, each bearing a small spine. Head hairs numerous (about 170), minute (about 0.008 mm long), concentrated on clypeus. **Labrum** small (about 0.8 mm wide and 0.4 mm long), short and bilobed; anterior surface of each half with about 30 minute hairs and/or sensilla, each bearing a spine; each half of ventral border with about 6 large projecting sensilla and numerous minute spinules; posterior surface with about 8 large sensilla on a sclerotized base. **Mandible** subquadrangular in anterior view; about 0.4 mm wide and 0.77 mm long; medioventral border sclerotized; with a thin subapical blade adjacent to thicker medial blade, both distal to swollen base; numerous papillae at junction of thicker blade and base; a few minute spinules on anterior surface. **Maxilla** with cardo and stipes feebly separated; cardo with about 7 sensilla; integument of stipes spinulose, spinules minute and isolated; palp a short peg with short transverse rugae on integument, apex with 4 sensilla and a denticle; galea a low knob with 2 apical sensilla. **Labium** small; with several lateral sensilla, each bearing a spine; anteromediaal surface with long slender spinules; palp a low boss with 4 apical sensilla and a denticle; an isolated sensillum between each palp and opening of seticertes; the latter wide, transverse and slightly protruding, with numerous minute spinules on lips. **Hyopharynx** spinulose ventrally, spinules minute and isolated; with heavy pigmented ridges dorsally. (Material studied: numerous larvae from Colorado, courtesy of H.E. Evans, and from New Hampshire, collected by G.C. Wheeler.)

**Vespula atropilosa** (Sladen)

Length (through spiracles) about 21 mm. Similar to *V. maculata* except as follows. Body nearly straight; T1 very short and hidden dorsally; T2 entire and swollen dorsally; T3 feebly divided into anterior and posterior annuli, AI–AIX distinctly divided by middorsal impression; AX with a pair of lateral bosses; anus terminal and with anterior and posterior lips. **Spiracles** with long isolated spinules on atrial wall; atrial opening with numer-
ous spines bearing denticles at opening of trachea. Integument with isolated spines. **Body hairs** 0.06—0.25 mm long. **Cranium** about 2.4 mm wide and 1.8 mm long; temporal sulci long and narrow. Head hairs about 0.004 mm long. **Labrum** about 1 mm wide and 0.36 mm long; deeply bilobed; ventral border of each half with about 12 sensilla and a few rather long spines in arcuate rows; posterior surface of each half with a cluster of about 6 sensilla dorsally and 9 ventrally and with isolated patches of spines laterally and medially. **Mandible** about 0.42 mm wide and 0.79 mm long; apical tooth nearly uniformly slender, subapical tooth stouter, basal stoutest; blade bearing minute denticles basally and rows of minute spines ventrally. **Maxilla** with about 25 hairs (about 0.005 mm long); palp with 3—4 apical sensilla. **Labium** with palp a short stout peg bearing 5 apical sensilla. (Material studied: six larvae from Colorado, courtesy of H.E. Evans.)

**Vespula maculifrons** (Buysson)

Length (through spiracles) about 19 mm. Similar to **V. maculata** except as follows. Body with prominent ventralateral bosses on AI—AV; AX long and turned ventrally and with a single large dorsal boss. **Spiracles** of metathorax smaller than remainder, which are subequal. Body hairs more numerous on venter of AI. **Cranium** not sclerotized (= same color as body); about 2.2 mm wide and 1.66 mm long; temporal sulci more heavily sclerotized. Antennae at lower third of cranium. Head hairs about 200 and shorter (about 0.003 mm long). **Labrum** about 0.78 mm wide and 0.24 mm long; hairs on anterior surface 0.006—0.012 mm long; ventral border with about 12 sensilla and with minute spines in short rows medially; posterior surface with 30—36 sensilla. **Mandible** about 0.3 mm wide and 0.7 mm long; anterior surface of teeth roughened with minute isolated denticles; posterior surface roughened with numerous minute bosses near base of blade. **Maxilla** with cardo sclerotized (= pigmented); anterior surface with about 20 minute hairs (about 0.006 mm long) hairs and/or sensilla; stipes rugulose; palp a stout peg with 5 apical sensilla; galea with 2—4 apical sensilla. **Labium** with palp a small boss bearing 3 apical sensilla. (Material studied: four larvae from Michigan, courtesy of R.O. Schuster.)

**Vespula pennsylvania** (Saussure)⁴

Length (through spiracles) about 14 mm. Similar to **V. maculata** except as follows. Body with paired dorsal bosses on AI—AV only. **Body hairs** 0.005—0.025 mm long. **Cranium** about 2 mm wide and 1.6 mm long. **Labrum** with short rows of minute spines near entire ventral border of anterior surface; posterior surface with spines in short arcuate rows, except those near middle sulcus coarse and isolated. **Mandible** about 0.3 mm wide and 0.69 mm long; with medial and apical teeth covered on all surfaces with small bosses; posterior surface of proximal portion with minute spines in short transverse rows. **Maxilla** with about 24 minute hairs (about 0.005 mm long); palp with about 5 apical sensilla; galea a slender tall cone. **Labium** with short rows of minute spines on anterior surface. **Hyppopharynx** with short transverse rows of minute spines. (Material studied: 13 larvae from California, courtesy of R.O. Schuster.)

**SPHECOIDEA**

**SPHECIFORMES**

**SPHECIDAE: PEPHIPREDONINAE**

*Microstigmus comtes* Krombein

Figure 16

Length (through spiracles) about 4 mm. Slender, fusiform and slightly sigmoid; widest at AI, tapering slightly toward anterior end and more toward posterior end; AX with prominent posterodorsal cone; anus terminal; head large. [Material inadequate to show leg, wing and gonopod vestiges.] Thirteen differentiated somites. **Spiracles** simple, small and decreasing in diameter posteriorly, on T2, T3 and AI—AV. Entire integument with minute isolated spines; minutely rugose, rugae closely spaced and longitudinal on ventral surface, irregular elsewhere—but always fine. **Body hairs** very few, widely scattered, minute (about 0.012 mm long) and simple. **Cranium** transversely subelliptical (about 0.45 mm wide and 0.038 mm long); no temporal sulci; clypeus projecting anteriorly and overhanging labrum. Each antenna a slender peg with 2 or 3 sensilla, mounted on a large circular disc, at lower third of cranium. No head hairs. **Labrum** crescentic; anterior surface with a few scattered sensilla, each bearing a spine; spines few and isolated anteriorly, minute and in short rows laterally and posteriorly. **Mandible** subtriangular in anterior view; with an apical and 2 subapical teeth, all heavily sclerotized; width increasing abruptly dorsal to basal tooth, wider portion bearing about 6 slender sharp-pointed spines which are directed ventrally. **Maxilla** large and swollen; entire integument sparsely spinulose, spines all minute, some isolated and others in short rows, rows longitudinal medially and transverse anteriorly; palp a small slender frustum with 2 apical and 2 subapical sensilla; galea represented by an isolated sensillum. **Labium** with minute isolated spines; palp similar to maxillary palp in size, shape and sensilla; an isolated sensillum, between each palp and opening of sericisternae; the latter a narrow transverse slit on anterior surface of labium. **Hyppopharynx** with numerous subparallel transverse fine ridges (rows of spines?) [Material studied: two torn integuments and a slightly shriveled semipupa (?) from Costa Rica (see Evans and Matthews, Psyche 75:132—134); material loaned by National Museum of Natural History, Smithsonian Institution, courtesy of Dr. D.R. Davis.]

It does not seem worth while revising our Key to the Larvae of Social Hymenoptera to accommodate one species. If one wishes to add it before more social sphaeinds are known, we suggest: 1c. Larvae reared in separate cells; hairs few and minute; temporal sulci absent; antennae at lower third of cranium .............................................. *Microstigmus comtes*

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⁴We cannot understand why entomologists persist in using the misspelling *pennsylvania* for the name of this species. Obviously it is the Latinized adjective for the name of the state of Pennsylvania. We have found the names of 15 other species of Hymenoptera that were correctly spelled *pennsylvanicus* (<a, -um>). Why embalm an error in the literature?
APIFORMES
(exclusive of allodapoids)

Body profile stout and crescentic; diameter greatest at AIV and AV, gradually attenuated toward either end. Hairs none or sparse and simple. Mandibles small and usually bearing small denticles.

HALICTIDAE: HALICTINAE
Lasioglossum imitatum (Smith)

Figure 9

Length (through spiracles) about 7.5 mm. Body subcrescentic; diameter greatest at AI; anterior and posterior ends almost meeting; head and anus terminal; anus without lips; head large; lateral longitudinal wrinkles well developed; T2--AVIII each with a pair of transverse wrinkles extending from the longitudinal wrinkles to mid-dorsum, smaller on AIX and AX, reduced to low bosses on dorsum of T1. Wing and leg vestiges present. Spiracles rather large; peritreme very narrow and feebly sclerotized; atrium with rows of encircling spinules. Integument on dorsal and ventral surfaces with minute spinules isolated or in short rows. No body hairs seen. Cranium feebly sclerotized (= light yellow); feebly cor- date in anterior view; about 0.86 mm wide and 0.63 mm long; temporal sulci short. Each antenna a small boss with 2 or 3 sensilla, each sensillum mounted on an elevated disc. No head hairs seen. Labrum small; about 0.28 mm wide and 0.13 mm long; feebly bilobed; anterior surface with a few short transverse rows of minute spinules; anterolateral surfaces with a few ridges; lat- eral and ventral surfaces spinulose; posterior surface densely spinulose, spinules long and in short rows medi ally, larger and isolated laterally. Mandible small and stout; about 0.15 mm wide and 0.24 mm long; apex heavily sclerotized; basal half sub- rectangular, apical half subtriangular, sharp-pointed, with a med- ial blade bearing a few medial denticles. Maxilla paraboloidal, anterior and medial surfaces of cardo with reticulate ridges and with rather large isolated spinules; apex with short transverse rows of minute spinules; palp represented by 5 isolated sensilla; galea represented by 2 apical sensilla. Labium small; palp repre- sented by a few scattered sensilla; an isolated sensillum between each palp and opening of sericiteries; the latter a short transverse slit. Hypopharynx with coarse isolated spinules. (Material studied: five larvae from Kansas, courtesy of C.D. Michener.)

Lasioglossum sp.

Figure 10

Length (through spiracles) about 14.7 mm. Similar to L. im- itatum except as follows. Body with wrinkles on dorsal and lateral surfaces and venter of AIX more distinct. Integument with nu- merous rugulae in varied patterns; spinulose, spinules coarse and isolated or finer and in short transverse rows. Cranium about 1.4 mm wide and 0.78 mm long; feebly cordate. Labrum about 4.9 mm wide and 0.25 mm long; subtrapezoidal in anterior view, widest dorsally; posterior surface spinulose, the spinules minute and in short arcuate rows and with about 12 sensilla. Mandible about 0.25 mm wide and 0.46 mm long. (Material studied: four larvae from "Wellsville res., Cache Co., Utah, June 1971," coll. P.F. Torchio, courtesy of P.F. Torchio.)

ANTHOPHORIDAE: XYLOCOPINAE

Social allodapoids. Body profile usually J-shaped; anterior end (thorax and first 3 or 4 abdominal somites) stout and strongly curved ventrally; remainder straight and elongate-subconical; tapering to a pointed posterior end; with one or a pair of projec- tions on dorsum of thorax and a few abdominal somites. Body hairs short to long and sparse to abundant; head hairs, when present, sparse but remarkably long. Mandibles small.

Braunsapis facialis (Gerstaecker)

Figure 11

Length (through spiracles) about 5.4 mm. Body subcrescentic; diameter greatest at AIV, attenuating toward either end; dorsal profile long and C-shaped, ventral profile angulate; ventral surface flat to concave; lateral longitudinal wrinkles well developed, forming small cones on T2, T3 and AI; a middorsal boss on AI; praesaepeum with permanent bosses projecting ventrally from each lateral surface of T2, T3, and AI; AI forming ventral wall. Anus terminal, with a long subconical ventral lip and a short conical dorsal lip. Leg and gonopodal vestiges present. Spiracles with peritreme narrow and lightly sclerotized, atrial wall with a few encircling rugulae. Entire integument rugulose and with papillae or spinules; rugulae on venter of thorax transverse and bearing minute spinules; integument around spiracles with nu- merous large granules. Body hairs few, simple, 0.025–0.15 mm long, short and spine-like to long with flexuous tip. Cranium not sclerotized (= same color as body); about 0.96 mm wide and 0.54 mm long; subcordate, sharply narrowed ventrally; temporal sulci conspicuous, rather wide and vertical. Antennae at lower third of cranium; each mounted on a small base, a slight elevation with 3 sensilla. Head hairs few (about 40), about 0.008 mm long on clypeus near labrum, long (0.125–0.6 mm) elsewhere and with fine flexuous tip. Labrum transversely subelliptical, about 0.35 mm wide and 0.12 mm long; with raised transversely elliptical and feebly sclerotized (= yellow) portion ventrally; an- terior surface with about 20 hairs and with minute spines dor- sally; ventral surface with minute spinules in short transverse rows; posterior surface with about 4 sensilla and rows of minute spinules. Mandible small (about 0.1 mm wide and 0.18 mm long); feebly sclerotized; subtriangular in anterior view; apex nar- rowly round-pointed and directed medially; apical half with med- ial blade bearing a few minute denticles near apex. Maxilla small and appearing adnate, apex broadly round-pointed; with a few transverse rows of minute spinules on medial and posterior surfaces; palp represented by a cluster of 5 or 6 sensilla; galea apparently lacking. Labium small; with a basal transverse spinu- lose welt; anterior surface with a few transverse rows of minute spinules; palp represented by a cluster of 5 sensilla; an isolated sensillum between each palp and opening of sericiteries; the latter an inconspicuous transverse slit. (Material studied: five larvae from Natal, courtesy of C.D. Michener.)

APIDAE: BOMBINAE
Bombus bimaculatus Cresson

Figure 12

Length (through spiracles) about 19 mm. Body subcrescentic;
FIGURES 9 THROUGH 11.

**FIGURE 9.** Lasiosglossum imitatum. a, Head in anterior view, X42; b, larva in side view, X24. **FIGURE 10.** Lasiosglossum sp. a, Left mandible in anterior view, X98; b, left mandible in posterior view, X98; c, larva in side view, X10. **FIGURE 11.** Braunsapis facilis. a, Two body hairs, X135; b, larva in side view, X25; c, left mandible in anterior view, X88; d, head in anterior view, X35.

dorsal profile long and C-shaped; ventral profile shorter and J-shaped; lateral longitudinal welts well developed; thoracic somites each with a pair of mammiform bosses on the dorsum, their tips acute and sclerotized; posterior portion of each abdominal somite with a transverse welt from spiracle to middorsum. Transitory praesaeipium floor formed from the ventral depression of thoracic somites and A1; venter of A1 forms cover. Leg and gonopod vestiges present. Area around each spiracle depressed; peritreme narrow and feebly sclerotized; atrial wall lined with rings of long spinules, some simple and some denticulate. Entire integument with large isolated spinules grading into minute spinules posteriorly; integument roughened with numerous rugulae. Body hairs sparse, about 0.038 mm long, varying from slender and slightly curved to stout and hooked. Cranium not sclerotized (= same color as body); subcordonate in anterior view, about 1.68 mm wide and 1.13 mm long; temporal sulci conspicu-
Bomhus occidentalis nigroscutatus Franklin

Length (through spiracles) about 15.4 mm. Similar to B. bimaculatus except as follows. Body forming a nearly complete circle; dorsal profile very long and C-shaped, ventral V-shaped; middle portion of T1-T3 with a pair of transverse wels meeting at middorsum, one pair per somite. Integument of dorsal and lateral surfaces with numerous large isolated spinules, ventral with numerous subparallel ridges bearing minute spinules; no spinules around spiracles. Body hairs shorter (about 0.005 mm long). Cranium feebly sclerotized (= yellow) and transversely sub-elliptical; about 1.68 mm wide and 1.2 mm long. Labrum about 0.45 mm wide and 0.115 mm long; each half of anterior surface with about 30 hairs about 0.006 mm long. Mandible about 0.3 mm wide and 0.45 mm long; apex broadly and heavily sclerotized; no blade seen. Maxilla with basal portion ventral and apex directed dorsomedially; hairs all about 0.013 mm long; palp with 5 apical sensilla; galea represented by a single hair about 0.19 mm long. Labium with minute spinules in short arcuate rows on anterior surface, rows transverse; palp with 5 apical sensilla; 2 hairs about 0.013 mm long medial to each palp. Hypopharynx with minute spinules in transverse rows dorsally, laterally with ends curved ventrally. (Material studied: two larvae from California, courtesy of R.O. Schuster.)

APIDAE: APINAE
Apis mellifera Linnaeus

Figure 13

Length (through spiracles) about 14 mm. Body subcrescentic; diameter greatest at AVIII; posterior end narrowly round-pointed; anterior end nearly sharp-pointed; lateral longitudinal wels on T2-AX and a pair of transverse wels on each somite T2-AVII, meeting at middorsum, one pair per somite. Leg, wing and gonopod vestiges present. Somites indistinguishable. Spiracles with narrow peritreme and a simple atrial wall. Integument densely spinulose, spinules minute and in short rows or large and isolated. Body hairs few, about 0.013 mm long; simple. Cranium subpentagonal; about 1.6 mm wide and 1.2 mm long; no portion sclerotized (= same color as body); temporal sulci conspicuous (wide); integument with numerous denticles or papillae. Antennae very large; on lower third of cranium; each with 3 sensilla. Head hairs few (about 24); 0.006-0.013 mm long; simple. Labrum about 0.49 mm wide and 0.24 mm long; integument roughened as on cranium; each half of anterior surface with about 12 sensilla, each with a minute spine; with spinules on and near ventral and lateral surfaces, spinules long and slender; posterior surface spinulous, spinules longer and in rows ventrally and laterally. Mandible about 0.19 mm wide and 0.9 mm long; elongate-lobose and slightly curved medially in anterior view; apex with blunt denticles directed medially. Maxilla with apex narrowly round-pointed; entire integument with short transverse rows of minute spinules and a few sensilla each with a long spine; palp a short subcone with 5 (2 apical, 2 subapical and 1 lateral) sensilla; galea a rounded knob with 2 sensilla, each bearing a spine. Labium subcircular; anterior surface sparsely spinulose, spinules in rows, rows longer ventrally; palp a short peg with 2 apical sensilla, each with a small rounded medial protuberance; an isolated sensillum between each palp and opening of sericerties, the latter wide and salient, lips with ridges radiat-
ing to free border. **Hypopharynx** with a few minute spines in short arcuate rows, rows arranged into longer transverse subparallel rows. (Material studied: numerous larvae from California, courtesy of S.I. Frommer.)

**APIDAE: MELIPONINAE**

*Melipona fasciata trinitatis* Cockerell

**Figure 14**

Length (through spiracles) about 13 mm. Body subcrescentic; posterior end more rounded than anterior; lateral longitudinal wells well developed; ventral swellings on AI–AIX; a pair of transverse wells from spiracle to middorsum on T1–AVIII, one pair per somite; AIX with welt across dorsum. Anus terminal and with ventral lip. No praescaepium. **Spiracles** with minute spinules on free edge of peritreme; walls of atrium with minute spinules in transverse rows. **Integument** largely spinulose, spinules isolated and rather large or in short rows and smaller. **Body hairs** minute (about 0.006 mm long), simple and very slender. **Cranium** feebly sclerotized (≈ yellow); about 1.44 mm wide and 0.88 mm long; feebly subcordate; temporal sulci distinct; integument rugulose; some rugae with minute spinules; clypeus with about 18 hairs near labrum. Antennae small; at lower third of cranium; each on a slightly raised boss; each with 3–5 sensilla, each of which bears a minute spine. **Labrum** about 0.34 mm wide and 0.29 mm long; feebly bilobed; anterior surface of each half with numerous long isolated spinules and 12 sensilla; ventral and lateral surfaces with numerous spinules in short rows, more numerous ventrally; middle of ventral border of each half with prominent projecting sensilla; entire posterior surface spinulose, spinules minute and in transverse arcuate rows; posterior surface with sensilla. **Mandible** small, about 0.2 mm wide and 0.4 mm long; feebly sclerotized; subtriangular in anterior view, with apex round-pointed and curved medially; apical half with medial blade and numerous denticles; base with minute isolated spinules on anterior surface. **Maxilla** with numerous rather large isolated spinules on cardo; stipes narrowly round-pointed and spinulose, spinules rather long and in arcuate rows arranged longitudinally; palp and galea subequal; palp a low knob with 4 apical sensilla, each bearing a spine; galea a low knob with 2 apical sensilla. **Labium** with long subparallel transverse ridges bearing spinules; palp a low knob with 4 or 5 sensilla; an isolated sensillum between each palp and opening of sericteries; the latter wide and salient. (Material studied: one larvae and three semiupae from Trinidad, courtesy of J.G. Rozen.)

**Trigona jaty** Smith

**Figure 15**

Length (through spiracles) about 5.5 mm. Body subcrescentic; head and anus terminal; lateral longitudinal wells well developed; AI and AIII with a pair of bosses each, which meet at middorsum; smaller structures on AIV and AV. Venter flattened. Head large. Leg, wing and gonopod vestiges present. **Spiracles** with wide, feebly sclerotized peritreme; atrial wall with a few simple ridges. **Integument** entirely spinulose, spinules large and isolated on dorsal ridges above spiracles, elsewhere minute and in rows. **Body hairs** few, simple and minute (about 0.12 mm long). **Cranium** not sclerotized (≈ same color as body); about 0.9 mm wide and 0.6 mm long; subcordate in anterior view; temporal sulci short and narrow. Antennae at lower third of cranium; each set on a raised base; a small elevation with 3 sensilla, each bearing a minute spine. Head hairs few (about 10), about 0.012 mm long, simple and slender. **Labrum** semicircular in anterior view, about 0.29 mm wide and 0.15 mm long; entire anterior surface spinulose, spinules short and in transverse rows; anterior surface with about 25 raised sensilla; rather long isolated spinules on ventral and lateral surfaces; posterior surface with minute spinules in short transverse rows. **Mandible** small and stout (about 0.14 mm wide and 0.2 mm long); feebly sclerotized; subtriangular in anterior view; apex round-pointed and curved medially, with spinulose margin; a few minute spinules on anterior surface near base. **Maxilla** slightly inflated; apex bluntly rounded; spinulose, spinules longer and isolated apically, shorter and in rows basally; palp a short knob with 3 apical sensilla; galea represented by 2 sensilla, each bearing a rather long spine. **Labium** small; sparsely spinulose, spinules minute and isolated; palp a short knob; an isolated sensillum between each palp and opening of sericteries, the latter wide and salient. **Hypopharynx** with minute spinules in long subparallel transverse rows. (Material studied: numerous larvae from Panamá, courtesy of P.F. Torchio.)
LIST OF SPECIES WHOSE LARVAE ARE DESCRIBED
AND/OR ILLUSTRATED IN THE LITERATURE\(^5\)

SUPERFAMILY VESPOIDEA

FAMILY VESPIDAE

SUBFAMILY POLISTINAE

Apoica
flavissima van der Vecht. Dias 1975: 3, fig. 16–23.
pallens (Fabricius). Dias 1975: 3, fig. 9–15; this paper.

Belonogaster
lateritus Gerstaecker. Wheeler and Wheeler 1979: 313, fig. 13h; this paper.

Brachygaster
augusti (Saussure). Dias 1975: 9, fig. 175–180.
scutellaris (Fabricius). Reid 1942: 314, fig. 99–103.

Metapolybia
cingulata (Fabricius). Reid 1942: 317, fig. 109–113.

Mixochyrttus
araujoi Zikán. Dias 1975: 6, fig. 68–73, 85.
carbonarius (Saussure). Reid 1942: 323, fig. 118–119.
cerebrous acheron Richards. Reid 1942: 322, fig. 124–126, 129.
collaredi Richards. Reid 1942: 324, fig. 131.
drewsenii Saussure. Dias 1975: 4, fig. 24–33, 55, 56.
flavitarsis (Saussure). This paper.
injunclus (Saussure). Reid 1942: 326, fig. 133, 134.
latior (Fox). Dias 1975: 6, fig. 74–84.
lecotis (Ducke). Reid 1942: 320, fig. 115, 123, 128.
metoces Richards. Reid 1942: 321, fig. 117, 122.
oecotrich Richards. Reid 1942: 323, fig. 114, 121.
rotundicollis (Cameron). Dias 1975: 4, fig. 34–44.
superus Richards. Reid 1942: 325, fig. 132.
surinamensis (Saussure). Reid 1942: 325, fig. 127.
syneocius Richards. Reid 1942: 323.
sp. Reid 1942: 325, fig. 135–137.

Parachartergus
fraternus (Gribodo). Dias 1975: 7, fig. 98–104.
pseudoapicalis (Fabricius). Dias 1975: 6, fig. 90–97.

Polistes
biguous (Linnaeus). Yamane 1976: 10, fig. 8–11.
canadensis (Linnaeus). Dias 1975: 11, fig. 228–238.
carnifex (Fabricius). Reid 1942: 300, fig. 43–51; Nelson 1969: 88.
cinctus (Lepeltier). Packard 1897: 77–79, fig. 6; Reid 1942: 304.
crinitus multicolor (Olivier). Reid 1942: 303, fig. 52–62.
erthrocephalus Latreille. Nelson 1969: 92; this paper.
exclamans Vierek. Nelson 1969: 47; this paper.
e. lineonous R. Bohart. This paper.
foederatus Kohl. Grandi 1934a: 74–78, pl. 1, II; Grandi 1934b:
19–26, fig. V–X; Reid 1942: 304–305, fig. 63–66.
fascatus (Fabricius). This paper.
f. aurifer Saussure. Nelson 1969: 56; this paper.
gallicus (Linnaeus). Parker 1943: 619–620, fig. 1–5; Reid 1942:
305–306, fig. 67–68; Sokta 1934: 340, fig. 10.
kohli Dalla Torre. Grandi 1934a: 74–78, pl. 1.
major castaneicolor Bequaert. This paper.
poei Lepeltier. This paper.
rothnei iwatai van der Vecht. Yamane 1976: 10, fig. 12.

Polybia
bistriata (Fabricius). Reid 1942: 310, fig. 86–89.
catillex Moebius. Reid 1942: 310, fig. 82–85.
chrysanthus (Weber). Dias 1975: 8, fig. 145–151.
dimidiata (Olivier). Dias 1975: 8, fig. 152–157.
fastidiosuscula Saussure. Dias 1975: 8, fig. 131–137.
ignobilis (Haliday). Dias 1975: 8, fig. 138–144.
micas Ducke. Reid 1942: 308, fig. 69–77.
occidentalis (Olivier). Dias 1975: 7, fig. 105–112; this paper.
paulista (von Ihering). Dias 1975: 7, fig. 113–120.
rejuncta (Fabricius). Reid 1942: 309, fig. 78–81.

Protonectarina
sylveirae (Saussure). Dias 1975: 8, fig. 158–164.

Protopolybia
exigua (Saussure). Dias 1975: 9, fig. 181–187.
minutissima (Spinola). Reid 1942: 312, fig. 90–93.
pumila (Saussure). Dias 1975: 9, fig. 188–194.
sedula (Saussure). Reid 1942: 312, fig. 94–98.

Ropalidia
cincta (Lepeltier). This paper.

Stelopolybia
infernalis (Saussure). Reid 1942: 316, fig. 104–108.
pallipes (Olivier). Dias 1975: 10, fig. 202–210

Synoeca
surinama (Fabricius). Wheeler and Wheeler 1979: 313, fig. 13i; this paper.
s. cyanella (Fabricius). Dias 1975: 6, fig. 86–89.

\(^5\) Social parasites are included.

SUBFAMILY VESPINAE

*Vespa*

*affinis* Linnaeus. Yamane 1976: fig. 29, 37, 41.

*analis insularis* Dalla Torre. Yamane 1976: fig. 28, 42, 49, 54b, 59.


*crabro* Linnaeus. Reid 1942: 296, fig. 37–41.

*c. flavofasciata* Cameron. Yamane 1976: fig. 44, 54a, 58.

*mandarina latilineata* Cameron. Yamane 1976: fig. 53.

*m. nobilis* Sonan. Yamane 1976: fig. 14–16, 18–21, 53.

*simillima* Smith. Yamane 1976: fig. 45.

*tropica pseudosoror* van der Vecht. Yamane 1976: fig. 44, 60.

*velutina flavitaris* Sonan. Yamane 1976: fig. 17.

*xanthoptera* Cameron. Yamane 1976.

*Vespuila*

*arenaria* (Fabricius). Packard 1897: 80.

*atropilosa* (Sladen). Wheeler and Wheeler 1979: 313, fig. 13g; this paper.

*germanica* (Fabricius). Grandi 1935: 31; Reid 1942: 296, fig. 32–35; Soika 1934: 340, 11 fig.

*karenkona* Sonan. Yamane 1976: fig. 63.

*lewisi* Cameron. Yamane 1976.

*media* (DeGeer). Reid 1942: fig. 30–35; Yamane 1976: fig. 25, 38, 47, 52, 57.

*maculata* (Linnaeus). Wheeler and Wheeler 1979: 306, fig. 10b, 313, 13f; this paper.

*maculifrons* (Buysson). This paper.

*norvegica* (Fabricius). Grandi 1934a: 74–78, pl. 1–II; Grandi 1934b: 17–23, fig. XI–XVI; Reid 1942: 296, fig. 32–35.

*pennsylvanica* (Saussure). This paper.


*r. schrenckii* Radoszkowsky. Yamane 1976: fig. 56, 64.


*silvestris* Scopoli. Grandi 1934a: 74–78, pl. I.


SUPERFAMILY SPHECOIDEA

FAMILY SPHECIDAE

SUBFAMILY PEMPHREDONINAE

*Microstigmus*

*comes* Krombein. Evans and Matthews 1968: 132–134; this paper.

FAMILY HALICITIDAE

SUBFAMILY HALICITINAE

TRIBE HALICITINI

*Lasiosglossum*

*imitatum* (Smith). This paper.

sp. This paper.

FAMILY ANTHOPHORIDAE

SUBFAMILY XYLOCOPINAE

TRIBE ALLODAPINI

*Allolapula*

*acutigera* Cockerell. Michener 1975: 246, fig. 2–4, 14, 15.


*hesset* Michener 1975: 248, fig. 1, 12, 13.

*melanopus* (Cameron). Michener 1975: 249, fig. 5, 6, 18, 19.

*ornaticeps* Michener. Michener 1975: 249, fig. 8, 9, 20, 21.

*Brionapsis*


*elizabethana* (Strand). Michener 1975: 237, fig. 66, 82–90.

*facialis* (Gerstaecker). Michener 1975: 229, fig. 1–8, 27–30;

Wheeler and Wheeler 1979: 299, fig. 6, 306, fig. 10c, 313, fig. 13c; this paper.


*ghanae* Michener. Michener 1975: 236, fig. 79–81.


*trochantera* (Gerstaecker). Michener 1975: 240, fig. 69, 70, 114–118.


Exondylops

*konowi* Brauns. Michener 1975: 249, fig. 10, 11, 22, 23.

Exoneura


*hamulata* Cockerell. Syed 1963: 268–269, fig. 20–32.


*subbaculifera* Rayment. Syed 1963: 273, fig. 50–52.


Inquilina

*excavata* (Cockerell). Syed 1963: 273, 274, fig. 38–43.

Nasutapis


FAMILY APIIDAE

SUBFAMILY BOMBINAE

*Bombus*

*agrorum pascuorum* Scopoli. Grandi 1937: 316–320, fig. XXXI–XXXIV.
americanorum Fabricius. Michener 1953: 1087, fig. 248–253; Ritcher 1933: 59, fig. 32, 33.
auricomus Robertson. Ritcher 1933: 59, fig. 1, 4, 10, 14, 15.
bimaculatus Cresson. Ritcher 1933: 59, fig. 2, 5, 7–9, 11, 18, 19. Wheeler and Wheeler 1979: 313, fig. 13d; this paper.
fervidus (Fabricius). Packard 1897: 115; Ritcher 1933: 59, fig. 28, 29.
griseocollis (DeGeer) (= separatus). Ritcher 1933: 59, fig. 22.
impatiens Cresson. Ritcher 1933: 59, fig. 16, 17.
melanopygus Nylander. This paper.
occurrentis nigroscutatus Franklin. This paper.
perplexus Cresson. Ritcher 1933: 59, fig. 20, 21.
silvarum (Linnaeus). Grandi 1934b: 112–117, fig. LXXVI–LXXX.
terricola Kirby. Ritcher 1933: 59, fig. 24, 25.
vagans Smith. Packard 1897: 117; Ritcher 1933: 59, fig. 26, 27.
vosnesenskii Radoszkowski. Michener 1953: 1089, fig. 254.

Posthyrus
variabilis (Cresson). Ritcher 1933: 59, fig. 3, 6, 30, 31; Michener 1953: 1090.

SUBFAMILY APINAE

Apis

cerana Fabricius (= indica). Torchio and Torchio 1975: 8, 9; fig. 3, 4, 10, 14, 24–26, 35, 42, 46, 51, 55, 61, 71, 76.
dorsata Fabricius. Torchio and Torchio 1975: 10, 11, fig. 7, 8, 12, 16, 29–33, 36, 39, 40, 44, 48, 49, 53, 56, 62, 70, 74, 78.
florea Fabricius. Torchio and Torchio 1975: 9, 10, fig. 5, 6, 11, 15, 27, 28, 37, 43, 47, 52, 57, 63–65, 67, 68, 72, 75.
mellifera Linnaeus. Grandi 1934a: 78, pl. II; Grandi 1934b: 110–112, fig. LXXIV–LXXV; Michener 1953: 1094, fig. 275–280; Nelson 1924: 1167–1170, 5 fig.; Packard 1897: 120; Torchio and Torchio 1975: 4–8, fig. 1, 2, 9, 13, 17–23, 34, 38, 41, 45, 50, 54, 58–60, 66, 69, 73, 77; Wheeler and Wheeler 1979: 306, fig. 10a; 313, fig. 13a; this paper.

SUBFAMILY MELIPONINAE

Lestrimelitta
ehrhardti Friese. Oliveira 1968: 9, fig. 1–3.
limao (Smith). Oliveira 1968: 2–6, fig. 1–3.

Melipona
fasciata trinitatis Cockerell. Wheeler and Wheeler 1979: 313, 13b; this paper.

Trigona
corvina Cockerell. Michener 1953: 1094, fig. 271, 272, 274.
droryana (Friese). Oliveira 1965 (jide 1968).
juty Smith. Wheeler and Wheeler 1979: 313, 13c; this paper.

CHARACTERIZATIONS OF LARVAE OF HIGHER TAXA

VESPOIDEA

Vespidae:—Dias 1975: 2, fig. 1–8; Reid 1942: 287–289.
Vespinae:— Reid 1942: 294; Yamane 1976: 4–9, fig. 1–3.

VESPOIDEA

Subfamilies of Vespidae:—Reid 1942: 289; Soika 1934: 341.
Species of Vespa and Vespula of Japan and Taiwan, Yamane

SPHECOIDEA

APIFORMES GROUP

Bombinae:—Ritcher 1933: 54–56.

KEYS TO LARVAE


VESPOIDEA

Subfamilies of Vespidae:—Reid 1942: 289; Soika 1934: 341.
Species of Vespa and Vespula of Japan and Taiwan, Yamane

Certain species of Polistes Reid 1942: 299–300.
Certain genera of Polistinae:—Reid 1942: 307.
Certain species of Polybia Reid 1942: 308.
Two species of Protopolybia Reid 1942: 312.
Eleven species of Mischocyttarus Reid 1942: 318–319.

Wheeler & Wheeler: Eusocial Bee & Wasp Larvae

SPHECOIDEA
APIFORMES GROUP


Certain species of *Bombus* and *Psithyrus* Ritcher 1933: 59.


LITERATURE CITED


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It is almost impossible to determine the dates of Grandi’s publications. We have tried to follow Michener 1953.