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STUDIES ON THE LARVAE OF  
DIGGER WASPS

(Hymenoptera, Sphecidae)

Part III: Philanthinae,

Trypoxyloninae, and

Crabroninae

BY

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**STUDIES ON THE LARVAE OF DIGGER WASPS  
(HYMENOPTERA, SPHECIDAE) PART III:  
PHILANTHINAE, TRYPOXYLONINAE,  
AND CRABRONINAE<sup>1</sup>**

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(Plates IX to XX)

This is a continuation of a series of papers begun by Evans and Lin.<sup>2</sup> The subfamilies Philanthinae, Trypoxyloninae, and Crabroninae are considered together here merely as a matter of convenience. The Philanthinae are most certainly not closely related to the other two, although the Trypoxyloninae and Crabroninae actually have many characters in common and are probably closely related. This problem, along with other matters concerning the classification of the Sphecidae, will be considered in the final paper of this series. The reader is referred to Part I for a discussion of techniques and terminology.

**SUBFAMILY PHILANTHINAE**

I have studied larvae of all Nearctic genera of this subfamily with the exception of *Trachypus*, which is doubtfully recorded from the Southwest. The larvae of Philanthinae are immediately separable from all other Sphecidae by the densely spinulose integument, the slender mandibles, and the conical or tubular anal segment. The tribes and genera of Philanthinae are quite distinct and readily separable.

*Characters of the subfamily.*—Body fusiform, the posterior end conically protuberant, either the supra-anal or the subanal

<sup>1</sup> Acknowledgement is made to the Grace H. Griswold Fund of the Entomology Department of Cornell University for assuming the cost of engraving the plates. Many of the larvae described here were collected in the course of studies on the comparative ethology of digger wasps, a project supported by the National Science Foundation.

<sup>2</sup> Part I: Sphecinae. Trans. Amer. Ent. Soc., 81: 131-153, pls. I-VIII. January 1956. Part II: Nyssoninae. Trans. Amer. Ent. Soc., 82: 35-66, pls. II-XIV. August 1956.

lobe projecting, or the two lobes together forming a tubular projection; integument nearly everywhere with a dense covering of minute, slender spinules; body setae, when present, not abundant and not projecting above these spinules; spiracles with the peritreme not clearly defined, the walls of the atrium divided into hexagons by a network of non-spinose ridges, the opening between the atrium and subatrium simple, circular, unarmed. Head higher than wide; coronal suture strong; parietal bands absent; antennal orbits circular or nearly so, the antennal papilla present, of variable length; head with scattered setigerous punctures, the setae generally very small; epistomal suture weak. Labrum with numerous punctures, from some of which may arise fairly strong setae; margin of labrum with or without conical sensilla and at most weakly spinose or setose; epipharynx variously spinulose and papillose, the sensory areas bare, usually unpigmented; mandibles slender, acuminate, more than twice as long as wide at the base, the apex with two or three teeth (a weak fourth tooth in *Aphilanthops*), the base laterally with one or a few minute setae; maxillary palpi strong, galeae much smaller than the palpi, either very short, hardly longer than broad, or at least very slender and much shorter than the palpi; lacinial area papillose, spinulose, or both; spinnerets paired, either short and blunt or longer, acute, horn-shaped, but in any case not more than 1.5 times the length of the labial palpi; oral surface of the prementum strongly papillose.

#### TABLE OF TRIBAL AND GENERIC CHARACTERS

- A. Mandibles tridentate or weakly quadridentate (figs. 5, 12); epipharynx spinulose or papillose over most of its surface (figs. 4, 14); spinnerets blunt, not longer than the labial palpi (fig. 8)

#### PHILANTHINI

- B. Mandibles weakly quadridentate (fig. 5); lacinial area more or less papillose and with a finger-like process (fig. 9); labrum without conspicuous setae (fig. 4); subanal lobe conically produced (fig. 3) ..... *Aphilanthops* (*frigidus*)

- BB. Mandibles tridentate (fig. 12); lacinial area densely spinulose, without a finger-like process (fig. 11); labrum with numerous strong setae (figs. 14, 16); anal segment tubular, the subanal lobe not protuberant (fig. 13)

*Philanthus* (*gibbosus*, *solivagus*, *bilunatus*, *politus*, [*triangulum*])



- AA. Mandibles bidentate (fig. 29); epipharynx with a considerable area medio-basally which is devoid of spinules or papillae (figs. 30, 31, 34); spinnerets horn-shaped, often surpassing the labial palpi (fig. 26) ..... **CERCERINI**
- B. Head slightly higher than wide, somewhat elliptical in anterior view (fig. 22); anal segment with the supra-anal lobe surpassing the subanal (fig. 23); galeae slender, fairly long, usually about half the length of the maxillary palpi (fig. 21)  
*Cerceris* (*fumipennis*, *nigrescens*, *robertsonii*, *clypeata*, *angularis*, [*rubida julii*, *quinquefasciata*])
- BB. Head very much (about 1.5 times) higher than wide, more or less parallel-sided (fig. 32); anal segment tubular, the supra-anal and subanal lobes about equally prominent (fig. 33); galeae very minute (fig. 35) ..... *Eucerceris* (*flavocincta*)

## Tribe PHILANTHINI

**Aphilanthops frigidus** (Smith)

(Plate IX, figs. 1-10)

*Body*.—Length 12 mm.; maximum width (abdominal segment 5) 3.8 mm. (fig. 3). Strongly fusiform; pleural lobes moderately prominent, rounded; dorsal annulets feebly developed, but each abdominal segment crossed by a narrow, rather inconspicuous transverse elevation about mid-way of its length. Integument everywhere strongly and rather densely spinulose (fig. 7), without setae except for a few small ones intermingled with the spinules and scarcely longer than these; spinules slightly longer and more darkly pigmented along the transverse elevations and down onto the pleural lobes. First thoracic segment impressed medio-dorsally. Supra-anal lobe moderately prominent; subanal lobe strongly, conically produced. Spiracles all about the same size, the second thoracic spiracles somewhat below the line formed by the other spiracles. Spiracular peritremes unpigmented and weakly defined; atria lined with an irregular network of ridges; opening between atria and subatria small, simple, unarmed; subatria constricted and then abruptly expanded to the width of the tracheae (fig. 10).

*Head*.—Slightly higher than wide, measuring .8 mm. wide and .83 mm. high (figs. 1, 2). Pale straw-colored, only the apices of the mandibles conspicuously darker. In lateral view, the front is prominent and the clypeus strongly declivous; there are paired depressions in the middle of the front. Coronal suture strong, short; parietal bands absent. Antennal orbits 80  $\mu$  in diameter; antennae short, about 40  $\mu$  long and 30  $\mu$  wide at the base, capped by three conical sensilla (fig. 6). Head capsule with a few widely scattered, minute, setigerous punctures; clypeus somewhat more densely punctate.

*Mouthparts*.—Labrum strongly bilobed and deeply emarginate; width .36 mm.; maximum height .13 mm. (fig. 4). Surface of labrum with scattered small punctures which grade into sensilla along the apical margin;

margin roughened and rather spinose on the anterior lateral corners. Epipharynx with the sensory areas well defined but unpigmented, each containing about six pores; there are also a few additional pores basad of these among the spinules; greater part of the surface covered with short, stout spinules which grade into papillae basad and laterad. Mandibles .42 mm. long and .20 mm. wide at the base; apex acute and inner margin with two additional teeth and a poorly defined fourth tooth; base with a few minute setae laterally (fig. 5). Maxillae strongly papillose, the lacinial area with a short, finger-like projection; palpi  $75\ \mu$  long and about  $35\ \mu$  wide at the base; galeae about  $18\ \mu$  long and nearly as wide (fig. 9). Labial palpi  $35\ \mu$  long and  $28\ \mu$  wide at the base; spinnerets paired, unpigmented and inconspicuous, slightly shorter than the palpi (fig. 8).

*Material*.—Described from 16 specimens from Ithaca, New York, July 20-Aug. 24, 1955-56 (C. S. Lin, H. E. & M. A. Evans).

*Philanthus gibbosus* (Fabricius)

(Plate X, figs. 11-15)

*Body*.—Length 13 mm.; maximum width 4 mm. (fig. 13). Form similar to *Aphilanthops*, but a little more slender, and without any evidence of the transverse elevations on the dorsum. Integument with rather uniformly distributed spinules much as in *Aphilanthops*. Anal segment in the form of a truncated cone, the supra-anal and subanal lobes about equally developed. First thoracic spiracles slightly larger than the others; second thoracic spiracles slightly below the line formed by the other spiracles. Spiracular atrium lined with ridges forming regular hexagons; opening between atrium and subatrium simple, small, the subatrium gradually enlarged from the opening (fig. 15).

*Head*.—Slightly higher than wide, measuring .75 mm. wide and .85 mm. high. Shape and features very much as described and figured for *Aphilanthops frigidus*; front and clypeus, in lateral view, somewhat less prominent. Antennal orbits  $75\ \mu$  in diameter; antennae short, conical, about  $35\ \mu$  in length.

*Mouthparts*.—Labrum bilobed and with a broad apical emargination; width .39 mm.; maximum height .15 mm. (fig. 14). Surface of labrum with scattered punctures, most of which bear setae, and roughened with small papillae which become more dense anteriorly. Epipharynx spinulose, the sensory areas unpigmented and devoid of spinules, each with about five pores. Mandibles .43 mm. long and .19 mm. in maximum width; apex acute and inner margin with two additional, somewhat rounded teeth; base with one small seta laterally (fig. 12). Maxillae apically strongly papillose, the lacinial area densely spinulose, the spinules set off sharply from the papillae; palpi  $70\ \mu$  long; galeae very small, about  $10\ \mu$  long and about as wide (fig. 11). Labial palpi  $40\ \mu$  long; spinnerets slightly shorter than the palpi but arising from a slight elevation and extending about as far as the palpi; surface of the labium strongly papillose.

*Material*.—Seven specimens from Ithaca, N. Y., Sept. 1954 (C. S. Lin); two specimens from cocoons collected in Woodstock, Maryland (E. G. Reinhard) [U. S. Nat. Mus.].

***Philanthus solivagus* Say**

(Plate X, figs. 16-18)

*Body*.—Length 13 mm.; maximum width 4 mm. In all respects very similar to *P. gibbosus*.

*Head*.—Width .72 mm.; height .82 mm. Antennal orbits  $65\ \mu$  in diameter, the antennae only about  $25\ \mu$  long (fig. 17). In all other respects as described for *gibbosus*.

*Mouthparts*.—Labrum .39 mm. wide, .16 mm. in maximum height (fig. 16); similar to *gibbosus* but with several distinct barrel-shaped sensilla near the outer apical angles. Epipharynx spinulose, the spinules becoming larger laterad and grading into papillae basad; sensory areas each with six pores. Mandibles .45 mm. long and .19 mm. in maximum width; apex tridentate and base with one small seta laterally, as in *gibbosus*. Maxillae about as in *gibbosus*, the spinulose area on the lacinia apparently slightly larger and composed of smaller spinules; palpi  $80\ \mu$  long; galeae  $10\ \mu$  long (fig. 18). Labial palpi only about  $30\ \mu$  long, with several setae near them.

*Material*.—Six specimens from Ithaca, N. Y., Sept. 1954 (C. S. Lin).

***Philanthus bilunatus* Cresson**

(Plate XI, fig. 19)

*Body*.—Length 12 mm.; maximum width 3.6 mm. In all respects very similar to *gibbosus*.

*Head*.—Width .7 mm.; height .8 mm. Antennal orbits  $80\ \mu$  in diameter, the antennae  $35\ \mu$  long. Setigerous punctures somewhat more abundant and conspicuous than in *gibbosus*.

*Mouthparts*.—Labrum .36 mm. wide, .14 mm. in maximum height; apical margin with about six clearly distinguishable barrel-shaped sensilla on each side of the median line (fig. 19). Epipharynx with two sensilla on each side of the median line at the sides of the emargination, otherwise similar to the preceding two species except in minor details as figured. Mandibles .42 mm. long and .19 mm. in maximum width, tridentate and unisetose, exactly as figured for *gibbosus*. Maxillae broad apically, the lacinial area broadly spinulose as in the preceding species, the spinules set off sharply from the papillae; palpi  $70\ \mu$  long; galeae  $15\ \mu$  long. Apex of the labium strongly papillose; palpi  $40\ \mu$  long and the spinnerets of about the same length.

*Material*.—Four specimens from Ithaca, N. Y., July 24-Aug. 10, 1954 (C. S. Lin).



***Philanthus politus* Say**

(Plate XI, fig. 20)

*Body*.—Length 12 mm.; maximum width 4 mm. No noticeable differences from the preceding three species.

*Head*.—Width .66 mm.; height .75 mm. Antennal orbits circular, 65  $\mu$  in diameter; antennae 35  $\mu$  in length. Head with abundant punctures bearing short setae.

*Mouthparts*.—Labrum .33 mm. wide, the apical margin with the usual emargination and with five clearly distinguishable barrel-shaped sensilla on each side (fig. 20). Epipharynx differing from *bilunatus* in having three sensilla on each side medio-apically and in having the sensory pores more numerous and more widely scattered. Mandibles .37 mm. long and .16 mm. wide, about as figured for *gibbosus* except that the number of setae on the base appears to vary from one to three. Maxillae about as in the preceding species; palpi 70  $\mu$  long; galeae exceedingly small, barely visible above the papillae. Labial palpi about 35  $\mu$  long, the spinnerets protruding to about the same length.

*Material*.—Three specimens from Ithaca, N. Y., June-July 1955 (H. E. Evans).

***Philanthus triangulum* Fabricius**

The larva of this well-known Palaearctic species has been described and figured in detail by Grandi (1931, Boll. Lab. Ent. Bologna, 4: 37-43). In every respect it is very similar to the known North American species. The labrum bears three or four conical sensilla on each side of the median line much as in *politus*; the epipharynx also has a similar series near the apical margin; the sensory areas are small, apparently pigmented, and have about six pores in a small group. The mandibles have a single seta near the base laterally.

## Tribe CERCERINI

***Cerceris fumipennis* Say**

(Plate XI, figs. 21-26)

*Body*.—Length 15 mm.; maximum width (abdominal segment 4) 4.2 mm. (fig. 23). Fusiform; pleural lobes very prominent; anal segment conical, the supra-anal lobe prominent, protruding well beyond the sub-anal lobe. Each body segment with an oval area on each side of the mid-dorsal line and a similar area on each pleural lobe; these areas are smooth and shining, devoid of spinules, and very slightly elevated. Integument elsewhere densely clothed with small spinules as in *Aphilanthops* and *Philanthus*. Spiracles small, virtually unpigmented; atrium lined with ridges forming more or less regular hexagons; opening into the subatrium small, unarmed; subatrium constricted, then abruptly expanded to the width of the trachea (fig. 24).

*Head*.—Considerably higher than wide, measuring 1.2 mm. high and 1.1 mm. wide (fig. 22). Pale straw-colored, the antennae, palpi, and galeae light brown; mandibles light brown at base, the apical half darker; anterior tentorial arms with an elongate brown spot apically and the pleurostomal thickenings with a brown spot just above the mandibular bases. Antennal orbits circular, about  $90\ \mu$  in diameter; antennae moderately long, about  $45\ \mu$  long and  $25\ \mu$  in maximum diameter. Coronal suture rather long, unpigmented; parietal bands absent. Head with numerous small punctures, from a few of which arise minute setae.

*Mouthparts*.—Labrum .5 mm. wide; surface with scattered punctures, many of which bear setae; apical margin with about nine large conical sensilla on each side of the median emargination (fig. 25). Epipharynx apically with dense, small spinules which are directed inward; a large part of the central area of epipharynx is bare; about six sensory pores are present on each side. Mandibles .65 mm. long, .32 mm. in maximum width; base with about eight minute setae laterally; apex slender, the tip subacute and the inner margin with a single tooth somewhat back from the apex (about as illustrated for *nigrescens*, fig. 29). Maxilla with the lacinial area densely clothed with spinules over a broad area, the outer margin only rather weakly papillose; palpus  $110\ \mu$  long,  $40\ \mu$  in maximum thickness; galea slender and moderately long, about  $55\ \mu$  long and  $25\ \mu$  in maximum thickness (fig. 21). Labial palpus  $75\ \mu$  long; spinnerets strongly protruding, horn-like, measuring about  $90\ \mu$ ; oral surface of labium strongly papillose (fig. 26).

*Material*.—One specimen collected by the author on the north bank of the Arkansas River, Arkansas Co., Ark., June 8, 1956.

***Cerceris nigrescens* Smith**

(Plate XII, figs. 27-29)

*Body*.—Length 14 mm.; maximum width 3.5 mm. Very similar to the preceding species; the two pairs of smooth welts on each segment seem to be smaller and less conspicuous.

*Head*.—Width 1.05 mm.; height 1.15 mm. Coloration as in *fumipennis*, the brown spots at the bases of the mandibles and the ends of the anterior tentorial arms conspicuous. Antennal orbits elliptical,  $100\ \mu$  in maximum diameter; antennae  $55\ \mu$  long and  $23\ \mu$  in maximum thickness (fig. 28). Head capsule more sparsely punctate than in *fumipennis*, but with more of the punctures bearing short setae, especially on the clypeus.

*Mouthparts*.—Labrum .48 mm. wide, similar to that of *fumipennis*; epipharynx with a large area medio-basally which is devoid of spinules (fig. 27). Mandibles .7 mm. long, .3 mm. wide at the base; base with four small setae laterally; apex bidentate (fig. 29). Maxillae much as figured for *fumipennis*; palpi  $100\ \mu$  long, galeae much more slender, about  $55\ \mu$  long. Labial palpi  $70\ \mu$  long; spinnerets elongate, horn-shaped, measuring  $80\ \mu$  from the base.



*Material*.—One specimen from Ithaca, N. Y., July 15, 1955 (M. A. Evans).

***Cerceris robertsonii* Fox**

(Plate XII, fig. 30)

*Body*.—Length about 17 mm. Form similar to *fumipennis*, the dorsal and pleural welts unusually large and prominent.

*Head*.—Width 1.05 mm.; height 1.2 mm. Antennal orbits nearly circular, about 100  $\mu$  in diameter; antennae 60  $\mu$  long. In other respects as described for *fumipennis*.

*Mouthparts*.—Labrum .48 mm. wide, differing from the preceding two species in having a somewhat greater number of setae scattered over the surface and in having the margin somewhat more spinulose; epipharynx with three conical sensilla on each side of the median emargination (fig. 30). Mandibles as figured for *nigrescens*, measuring .65 mm. long and .28 mm. wide at the base. Maxillae and labium much as figured for *fumipennis*; maxillary palpi 105  $\mu$  long; galeae 55  $\mu$  long; labial palpi 85  $\mu$  long; spinnerets horn-shaped, about twice as long as the labial palpi.

*Material*.—Four specimens from Kill Devil Hills, Dare Co., N. C., July, 1950, collected by K. V. Krombein in connection with biological studies which have since been published (1952, Wasmann Jour. Biol., 10: 288-294).

***Cerceris clypeata* Dahlbom**

(Plate XII, fig. 31)

*Body*.—Length 13 mm.; maximum width 4.5 mm. Available larvae all in diapause, but agreeing well in most characters with the preceding three species. Smooth welts on each side of the mid-dorsal line and on the pleural lobes very large and prominent. Apex of the abdomen conically elongated, the supra-anal lobe projecting well beyond the subanal.

*Head*.—Width 1.35 mm.; height 1.55 mm. Features as in *fumipennis*, except the antennae more elongate, about 70  $\mu$  in length; antennal orbits nearly circular, 90  $\mu$  in diameter.

*Mouthparts*.—Labrum .68 mm. wide, the apical margin sinuate but not deeply emarginate, the surface provided with numerous setae, the margin provided with a series of small sensilla, about eight on each side (fig. 31). Epipharynx with three sensilla near the apical margin on each side of the median line; lateral apical portions with numerous spinules which are directed basad. Mandibles .9 mm. long, .4 mm. wide at the base, about as figured for *nigrescens*. Maxillary palpi 130  $\mu$  long; galeae slender, about 50  $\mu$  long; labial palpi 100  $\mu$  long; spinnerets horn-shaped, acute, diverging, somewhat shorter than the labial palpi.

*Material*.—Three specimens from cocoons collected at Pittsford, N. Y., July 30, 1955 (H. E. & M. A. Evans).

***Cerceris angularis* Cockerell**

Williams (1919, Hawaiian Sugar Planters' Assoc. Exp. Sta. Bull., Ent. Ser., no. 14, pp. 146-148) has briefly described the larva of this Oriental species. The body form is apparently very similar to that of the North American species, the abdomen terminating conically with the supra-anal lobe more prominent than the subanal. The full-grown larva is said to be 28 mm. in length. Slide mounts of the head capsule and anterior part of the body, prepared by Williams, have been loaned to me by the Sugar Planters' Experiment Station. The integument has the usual dense covering of small spinules, and the spiracles are much as figured for *fumipennis*. A description of the head and mouthparts follows.

*Head*.—Much higher than wide, measuring about 1.2 mm. wide and 1.7 mm. high. Antennal orbits circular, 120  $\mu$  in diameter; antennae rather short, about 60  $\mu$  in length. Small setigerous punctures are present on the head capsule, but they are very sparse and inconspicuous.

*Mouthparts*.—Labrum with numerous setae; labrum and epipharynx with an unusual number of rather strong sensilla toward the apical margin, apparently about 15 on each side. Mandibles bidentate, the inner tooth rather blunt, perhaps from wear. Maxillary palpi 130  $\mu$  long; galeae slender, 60  $\mu$  long; labial palpi 110  $\mu$  long; spinnerets horn-shaped, diverging, about as long as the labial palpi.

*Material*.—Two head capsules and the anterior half of one larva, mounted in balsam, collected at Los Baños, Philippines, in 1917 (F. X. Williams).

***Cerceris rubida julii* Fabre**

The larva of this Palaearctic species has been described briefly by Grandi (1926, Boll. Lab. Zool. Portici, 19: 288-290). The body is densely clothed with minute spinules as in the American species, and the head capsule bears rather numerous short setae. The labrum is not described in detail, but apparently bears numerous setae. The mandibles are bidentate as in the American species, and the maxillary palpi longer and stouter than the galeae. The spinnerets are horn-shaped, diverging, and considerably longer than the labial palpi.

***Cerceris quinquefasciata* Rossi**

Grandi (1928, Boll. Lab. Ent. Bologna, 1: 279-285) has described in great detail the first, second, and final instars of this European species. The mature larva agrees very closely with the North American species in all but a few details. The shape of the head is somewhat unusual, the sides being bulging and the height barely greater than the maximum width. The maxillary palpi are unusually stout and the galeae very short and thick, almost as in *Philanthus*. The details of the labrum and epipharynx are very much as in *Cerceris robertsonii*. The spinnerets are horn-shaped and diverge sharply from the base.

***Eucerceris flavocincta* Cresson**

(Plate XII, figs. 32-35)

*Body*.—Length 18 mm.; maximum width 4.5 mm. Fusiform; pleural lobes fairly prominent; integument wholly clothed with small spinules and without the smooth areas dorsally and laterally characteristic of *Cerceris*. Anal segment conically protuberant, the supra-anal and subanal lobes about equally prominent (fig. 33). Spiracular atria lined with ridges forming small hexagons; all details of the spiracles very much as figured for *Cerceris fumipennis* (fig. 24).

*Head*.—Very much higher than wide, measuring 1.3 mm. high and only .83 mm. in maximum width (fig. 32). Pale straw-colored, with considerable brown blotching on the top and sides, especially around the coronal suture; labrum, mandibles, antennae, and pleurostomal thickenings brown; apical portion of the maxillae dark brown. Coronal suture rather long; parietal bands absent. Antennal orbits large and situated rather low; orbits circular, about 100  $\mu$  in diameter; antennae slender, rather long, about 60  $\mu$  in length and reaching the rim of the orbit when appressed. Head capsule with only small, inconspicuous setae.

*Mouthparts*.—Labrum .48 mm. wide; apical margin more or less rounded, with a weak median emargination; disc with numerous short setae and with a series of barrel-shaped sensilla toward the apical margin (fig. 34). Epipharynx similar to *Cerceris*, but the sensory areas somewhat pigmented and with the pores very weak; median apical part spinulose and with two large sensilla on each side. Mandibles in general similar to *Cerceris*, with several weak setae on the sides toward the base, the apex acute and the inner margin with a single additional tooth; length .65 mm., maximum width .25 mm. Maxillae with the palpi very large and prominent, 100  $\mu$  long and about 35  $\mu$  in maximum width; galeae minute, about 20  $\mu$  long and nearly as wide; lacinial area densely spinulose (fig. 35). Labial palpi 90  $\mu$  in length; spinnerets horn-shaped, acute apically, barely surpassing the palpi; oral surface of prementum papillose. In general, the apex of the labium resembles that of *Cerceris fumipennis* (fig. 26) except for slightly shorter spinnerets.



*Material.*—Six specimens from Independence, Sierra Co., Calif., 20 July 1954 (R. M. Bohart and J. A. Powell). These were collected in connection with biological studies which have now been published (1956, Pan-Pac. Ent., 32: 143-144).

#### SUBFAMILY TRYPOXYLONINAE

Larvae of this subfamily are rather commonly collected, as some of the species build mud nests and others nest in hollow twigs and other natural cavities. Larvae of Trypoxyloninae are easily distinguished from other Sphecidae by the ventral, pre-apical anus, the angulate lobe on the inner margin of the maxilla, and the characteristic mandibles. There is relatively little variation in larval form within the subfamily, and the genera and subgenera are separable only on rather minor characters. I have studied material of all three Nearctic genera and subgenera.

*Characters of the subfamily.*—Body somewhat cylindrical; pleural lobes prominent on the thorax and the first nine abdominal segments; posterior annulets more prominent than the anterior annulets; anus situated ventrally well before the apex of the last abdominal segment, which is produced in the form of a rounded or somewhat conical lobe; integument smooth; body with a few small, inconspicuous setae on the thoracic dorsum and often also on the pleural lobes and the last abdominal segment; spiracles with the atrium simple, the walls not lined with strong ridges or other armature; opening between the atrium and subatrium simple, unarmed; subatrium elongate. Head wider than high; parietal bands very weak or absent; epistomal suture distinct; antennal papilla absent, the three sensilla arising from the membrane of the orbit; head with numerous rather prominent setae, most abundant on the lower sides. Labrum with several large setae on the disc and several others on the apical margin medially, the margin sometimes with minute sensilla but never with well-defined barrel-shaped sensilla; epipharynx rather sparsely spinulose, without well-defined sensory areas, with or without a group of small sensory pores or cones on each side; mandibles large and stout, always somewhat less than twice as long as their maximum width, bearing a single large seta near the base, the apex with two large teeth and the inner margin with two or three additional teeth, these teeth surrounding a hol-

lowed-out scoop-like area (teeth may be indistinct due to wear); maxillae with the lacinial area bearing a distinct, angular lobe, but never more than weakly spinulose; galeae slightly to considerably shorter than the maxillary palpi; apical portion of labium on the oral surface with two patches of spinules; spinnerets paired, truncate apically, slightly to considerably exceeding the labial palpi.

#### TABLE OF GENERIC AND SUBGENERIC CHARACTERS

- A. Apex of the maxilla with the surface papillose (fig. 67); maxillary palpi only slightly longer than the galeae; spiracular subatrium elongate, smooth-walled (fig. 66); head strongly roughened on the top and sides and rather strongly setose (fig. 65)  
*Pison (argentatum, [atrum])*
- AA. Apex of maxilla smooth (fig. 42); spiracular subatrium with a series of swellings along its length (figs. 38, 62); head moderately roughened and setose (fig. 36).
- B. Posterior end of the body truncate (fig. 39); spinnerets exceeding the labial palpi only slightly (fig. 43)  
*Trypargilum (clavatum, johannis, arizonense, spinosum, tridentatum, rubro-cinctum, striatum, politum)*
- BB. Posterior end of body somewhat conically produced beyond the anus (fig. 58); spinnerets much exceeding the labial palpi (fig. 60)  
*Trypoxylon (s. str.) (aldrichi, frigidum, adelphae, elongatum, [figulum])*

#### TABLE OF LARVAL CHARACTERS OF SOME SPECIES OF TRYPARGILUM<sup>3</sup>

- A. Epipharynx with the spinules extending to the apical margin medially (figs. 53, 55); antennal orbits elliptical, pigmented (fig. 54); size large, body length over 20 mm., head width 1.5 mm. or over (Groups *politum* and *punctulatum*).
- B. Labrum with about 18-20 setae on the disc (not counting those on the margin) (fig. 53); width of head capsule about 2 mm.  
*politum* Say
- BB. Labrum with about 10 setae on the disc (fig. 55); width of head capsule 1.5-1.8 mm. .... *striatum* Provancher

<sup>3</sup> This table is quite tentative, since the available material varies much in quantity and in state of preservation. It is based on mature, non-diapausing specimens. It includes all the Nearctic species except *californicum* Saussure, *collinum* Smith, and *texense* Saussure, larvae of which were not available for study.

- Trypoxylon (Trypargilum) clavatum** Say (Plate XIII, figs. 36-43)

*Head*.—Considerably broader than high; width 1.16 mm., height .97 mm. (fig. 36). Coronal suture short, weak; parietal bands evident as short, weak lines; epistomal suture strong. Top and sides of the head with numerous small convexities, giving it a roughened appearance. Antennal orbits circular, lightly pigmented, about 50  $\mu$  in diameter, with three small sensilla set in the membrane (fig. 37). Head with small punctures, many of which bear setae often as much as 50  $\mu$  in length; these are especially numerous laterad of the antennal orbits. Clypeus weakly punctate and bearing several setae.

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(fig. 40). Maxillae smooth apically, devoid of papillae and with only a few short, weak spinules on the lacinial area; inner margin somewhat concave, basally with a large, angular lobe; palpi about  $50\ \mu$  in length; galeae about  $25\ \mu$  in length (fig. 42). Labium also rather smooth apically, but with two groups of spines toward the base on the oral surface; palpi about  $50\ \mu$  long; spinnerets strong, diverging, truncate apically, measuring about  $130\ \mu$  from the extreme base, about  $100\ \mu$  from the median point of divergence (fig. 43).

*Material*.—Eleven specimens, one from Ithaca, N. Y., taken from trap nest, Aug. 16, 1955 (H. E. Evans), one from Derby, N. Y., from trap nest, Aug. 1954 (K. V. Krombein), one from Urbana, Ill., Nov. 18, 1919 (T. H. Frison) [Ill. Nat. Hist. Survey], and eight from Plummers Island, Md., July 11-Sept. 5, 1956, from trap nests (K. V. Krombein).

**Trypoxylon (Trypargilum) johannis** Richards (Plate XIV, figs. 44-46)

*Body*.—Length 15 mm.; maximum width 4 mm. Form much as in *clavatum*; posterior annulets prominent, laterally nearly continuous with the pleural lobes; anal segment with the dorso-lateral swellings prominent; anus a transverse slit located ventrally and preapically.

*Head*.—Width 1.4 mm.; height 1.25 mm. Shape and features much as in *clavatum*, the parietal bands slightly longer, the top and sides of the head slightly more roughened. Antennal orbits nearly circular but with a slight extension mesad and with the sensilla somewhat crowded together in the middle; maximum diameter about  $65\ \mu$  (fig. 45).

*Mouthparts*.—Labrum .48 mm. wide and .23 mm. high, very similar to that of *clavatum* but with about ten setae on the disc (fig. 44); epipharynx similar to *clavatum* but apparently with four sensory pores on each side in a small area devoid of spinules. Mandibles .53 mm. long and .32 mm. in maximum width, exactly as in *clavatum*. Maxillae with the lacinial area apparently slightly more strongly spinulose than in *clavatum*; palpi about  $55\ \mu$  long; galeae about  $30\ \mu$  long (fig. 46). Labium as in *clavatum*, the two patches of spinules on the oral surface very prominent.

*Material*.—A single specimen collected from a trap nest, Welaka, Fla., May 11, 1955 (H. E. Evans).

**Trypoxylon (Trypargilum) arizonense** Fox (Plate XIV, figs. 47-48)

*Body*.—Length 9 mm.; maximum width 3 mm. Form as described and figured for *clavatum*. Body setae very inconspicuous and few in number.

*Head*.—Width 1.2 mm.; height 1.12 mm. Shape as in *clavatum*; setae about as in that species; small convexities on the top and sides of the head very noticeable. Coronal suture not visible, the parietal bands barely so. Antennal orbits elliptical, measuring about  $50 \times 60\ \mu$  (fig. 48).

*Mouthparts*.—Labrum .48 mm. wide, .20 mm. high on the median line; anterior margin deeply emarginate; surface with five large setae in more or less of a line on each side of the emargination, and with only one other seta plus one or two punctures on the disc (fig. 47). Epipharynx weakly spinulose and virtually devoid of spinules on the sides. Mandibles .5 mm. long, .31 mm. in maximum width, with a single seta near the base; apex as in *clavatum*, but the teeth reduced, probably as a result of wear. Maxillae somewhat pointed apically, the lacinia with rather conspicuous short spinules, much as figured for *johannis* (fig. 46); palpi about 60  $\mu$  long, the galeae somewhat smaller. Labium with the palpi about 50  $\mu$  long, the spinnerets protruding slightly beyond the palpi; base with two patches of fairly strong spinules, as in other species of the genus.

*Material*.—Two specimens from Davis, Calif., Sept. 3, 1939 (G. E. Bohart).

**Trypoxylon (Trypargilum) spinosum** Cameron (Plate XIV, fig. 49)

*Body*.—Length 13 mm.; maximum width 3.6 mm. Form as described and figured for *clavatum*.

*Head*.—Width 1.28 mm.; height 1.1 mm. Shape and features as in *clavatum*; parietal bands rather long, weakly pigmented; antennal orbits circular, 50  $\mu$  in diameter, the sensilla well separated.

*Mouthparts*.—Labrum .44 mm. wide, .20 mm. high; apical margin concave and disc with about six setae on each side (fig. 49). Mandibles similar in structure to the preceding several species, but in the available specimens much more blunt, the teeth barely evident, probably as a result of wear. Maxillary palpi rather short and broad, only about 40  $\mu$  long; galeae about 30  $\mu$  long; lacinial area with the usual angular lobe and only very weakly spinulose. Apex of labium about as described and figured for *clavatum*.

*Material*.—Three specimens taken from stems at quarantine, Laredo, Texas, Nov. 23, 1942 [U. S. Nat. Mus.].

**Trypoxylon (Trypargilum) tridentatum** Packard

(Plate XIV, figs. 50-52)

*Body*.—Length 15 mm.; maximum width 4 mm. Form much as in *clavatum*; first thoracic spiracles slightly larger than the others; body setae sparse and inconspicuous.

*Head*.—Width 1.2 mm.; height 1.02 mm. Features about as in *clavatum*; coronal suture and parietal bands very weak; antennal orbits ovoid, 70  $\mu$  in maximum diameter, the three sensilla in an oblique row (fig. 51).

*Mouthparts*.—Labrum .5 mm. wide, .2 mm. high on the median line; shape somewhat as in *clavatum*, but the anterior lateral corners more rounded, the anterior margin more concave and without evidence of the

three lobes; disc with six setae on each side in addition to the median marginal group (fig. 50). Epipharynx weakly spinulose, the pores not clearly defined. Mandibles .5 mm. long, .3 mm. in maximum width, features as in *clavatum*. Maxillae somewhat concave apically on the mesal margin, the lacinial area moderately spinulose (fig. 52); palpi about 60  $\mu$  in length, galeae about 30  $\mu$  in length. Labial palpi 50  $\mu$  in length, slightly exceeded by the spinnerets.

*Material*.—Four specimens, 3 from Kill Devil Hills, Dare Co., N. C., Aug. 15 and Sept. 9-10, 1956, and 1 from 4 mi. W. of Cabin John, Md., Aug. 5, 1955, all collected from trap nests by K. V. Krombein.

**Trypoxylon (Trypargilum) rubro-cinctum** Packard

(Plate XV, fig. 63)

*Body*.—Length 13 mm.; maximum width 3.5 mm.; setae very inconspicuous; first thoracic spiracles slightly larger than the others.

*Head*.—Width 1.27 mm.; height 1.1 mm. Shape and features as in *clavatum*. Antennal orbits ovoid, about as in *tridentatum*, measuring 65  $\times$  75  $\mu$ .

*Mouthparts*.—Labrum .44 mm. wide, .19 mm. high on the median line, almost exactly as figured for *tridentatum* (fig. 50). Mandibles .45 mm. long and .26 mm. in maximum width, with five very strong teeth as shown in fig. 63. Maxillae much as in *tridentatum*; palpi about 60  $\mu$  long; galeae very small, about 40  $\mu$  long. Labial palpi 50  $\mu$  in length.

*Material*.—Four specimens, two from Kill Devil Hills, Dare Co., N. C., Aug. 8-Sept. 10, 1956, and two from Plummers Island, Md., July 11-20, 1956, all from trap nests (K. V. Krombein).

**Trypoxylon (Trypargilum) striatum** Provancher (Plate XIV, fig. 55)

*Body*.—Length 20 mm.; maximum width 5.5 mm. Form as described for *clavatum*; setae very inconspicuous, distributed as in that species. Spiracles essentially as figured for *clavatum*, but with some indication of the roughening of the walls of the atrium characteristic of *politum*.

*Head*.—Width 1.5 mm.; height 1.3 mm. Coronal suture weak; parietal bands weak but fairly long. Antennal orbits elliptical, about as figured for *politum* (fig. 54), measuring 60  $\times$  70  $\mu$ .

*Mouthparts*.—Labrum .6 mm. wide, about .3 mm. high; disc with five setae on each side of the median line, and apical margin with a group of setae on the median lobe, which is truncate as in *clavatum*; epipharynx extensively spinulose, the spinules extending practically to the apical margin medially; sensory areas ill-defined, consisting of about six small pores intermingled with the spines plus some very faint larger pores basad of these (fig. 55). Mandibles .56 mm. long, .37 mm. in maximum width, about as figured for *clavatum*. Maxillae rounded apically, very weakly



spinulose on the lacinial area; palpi 70  $\mu$  long; galeae 40  $\mu$  long. Labial palpi 60  $\mu$  long; spinnerets somewhat exceeding the palpi, broad and blunt apically; base of prementum with two patches of setae as in other species of the genus.

*Material*.—Three specimens from trap nests at Plummers Island, Md., July 11-20, 1956; two specimens from trap nests 4 mi. W. of Cabin John, Md., Aug. 8-9, 1955 (all K. V. Krombein).

***Trypoxylon (Trypargilum) politum* Say**

(Plate XIV, figs. 53-54; Plate XV, fig. 62)

*Body*.—Length 20 mm.; maximum width 6 mm. Form as in *clavatum*; body setae nearly absent, represented by a few weak ones on the thoracic dorsum. Spiracles (fig. 62) showing numerous swellings on the walls of the atrium which, on the inside, form weak, irregular ridges; subatrium swollen, abruptly tapered.

*Head*.—Width 2.0 mm.; height 1.75 mm. Shape as in *clavatum*; coronal suture barely evident; parietal bands long but weak; setae relatively short; top and sides of head with many small convexities. Antennal orbits elliptical, darkly pigmented, the sensilla in a more or less straight line; orbit measuring about  $70 \times 80 \mu$  (fig. 54).

*Mouthparts*.—Labrum .83 mm. wide, .37 mm. high on the median line; disc with about nine setae on each side of the median line; apical margin weakly concave, the three lobes weakly defined (fig. 53). Epipharynx strongly spinulose, the spinules extending down to the margin medially. Mandibles similar to other species of the subgenus, but in all the available specimens badly worn, so that the apical teeth are barely evident. Maxillae with the palpi stout, 85  $\mu$  in length; galeae more slender, 65  $\mu$  in length; lacinial area as in *clavatum*, weakly spinulose. Apex of labium as in *clavatum*, the two patches of setae especially prominent.

*Material*.—Described from 26 specimens, all taken from mud nests and in a diapausing state, as follows: 14 from Manhattan, Kansas, Feb. 15, 1950 (H. E. Evans); 2 from Urbana, Ill., Mch. 22, 1920 (T. H. Frison) [Ill. Nat. Hist. Survey]; 5 from Selma, Ala., Oct. 25, 1880 [U. S. Nat. Mus.]; and 5 from E. Falls Church, Va., Sept. 14, 1920 [U. S. Nat. Mus.].

***Trypoxylon (Trypoxylon) aldrichi* Sandhouse** (Plate XV, figs. 56-58)

*Body*.—Length 8 mm.; maximum width 2 mm. (fig. 58). Pleural lobes very prominent, conical, those of the ninth segment especially large, rounded. Anus ventral in position, the anal segment extending well beyond the anus and somewhat conical. Each posterior annulet somewhat swollen on each side of the median line, these swellings indistinctly extending down on the sides to the pleural lobes. Integument smooth; body

with a few weak setae distributed about as in *clavatum*. Spiracles small, circular; structure much as in *clavatum*, but the walls of the atrium with some rather indistinct ridges forming irregular hexagons.

*Head*.—Width .86 mm.; height .80 mm. Form and features much as illustrated for *clavatum*, but more nearly circular in anterior view and the antennal orbits relatively a little larger and lower. Coronal suture very weak; parietal bands not present. Setae distributed about as in *clavatum* and the top and sides of the head similarly roughened. Antennal orbits elliptical, about  $40 \times 50 \mu$  in size, the three sensilla close together in the middle (fig. 57).

*Mouthparts*.—Labrum .31 mm. wide, about .13 mm. high medially (fig. 56); antero-lateral corners slightly produced, anterior margin weakly emarginate; disc with eight setae and the anterior margin with about six setae near the midline. Epipharynx with the spinules small, rather far apart except on the anterior lateral corners, where they are crowded. Mandibles .31 mm. long, 2 mm. in maximum width, exactly as in *clavatum* except that the roughening of the surface is less evident. Maxillae rounded apically, the lacinial area with a distinct but weakly spinulose angular lobe; palpi stout,  $40 \mu$  in length; galeae more slender,  $22 \mu$  in length. Apex of labium very much as figured for *clavatum*; palpi only about  $30 \mu$  in length; spinnerets truncate apically, measuring about  $80 \mu$  from base to apex, surpassing the palpi by about  $40 \mu$ ; oral surface with the usual two patches of spinules, the spinules short and rather sparse.

*Material*.—One specimen from an elderberry stem, Logan, Utah, June 2, 1954 (G. E. Bohart).

***Trypoxylon (Trypoxylon) frigidum* Smith** (Plate XV, figs. 59-60)

*Body*.—Length 7.5 mm.; maximum width 1.6 mm. Features as described and figured for *aldrichi*; tenth abdominal segment well produced beyond the anus, but somewhat more rounded than in *aldrichi*; pleural lobes prominent, especially those on the thorax and on abdominal segment nine.

*Head*.—Width .75 mm.; height .73 mm.; in anterior view nearly circular. Features as in *aldrichi*, including size and shape of the antennal orbits.

*Mouthparts*.—Labrum .27 mm. wide; features as in *aldrichi* but with ten setae on the disc (fig. 59); epipharynx as in *aldrichi*, a few minute sensory pores evident on each side. Mandibles .29 mm. long and .17 mm. in maximum width, of the usual form in the genus but with scarcely any roughening of the upper surface; apical teeth sharp and much as illustrated for *rubro-cinctum* (fig. 63). Maxillae as in *aldrichi*; palpi  $40 \mu$  long; galeae slender,  $30 \mu$  long. Labial palpi  $30 \mu$  long, the spinnerets about  $80 \mu$  long and much exceeding the palpi (fig. 60).

*Material*.—One specimen from Derby, N. Y., June 28, 1956 (L. H. Krombein).

**Trypoxylon (Trypoxylon) adelphiae** Sandhouse (Plate XV, fig. 61)

*Body*.—Length 8 mm.; maximum width 1.7 mm. Features as described and figured for *aldrichi*; anal segment somewhat conical as in that species.

*Head*.—Width .83 mm.; height .75 mm. Form and features as in *aldrichi*, antennal orbits also the same size and shape as in that species.

*Mouthparts*.—Labrum .3 mm. wide; anterior margin somewhat more narrowly emarginate than in the preceding two species; disc with about twelve setae plus a few more on the margin medially (fig. 61). Epipharynx somewhat more heavily spinulose than in *aldrichi*, and with four very small sensory pores on each side. Mandibles .29 mm. long, .18 mm. wide at the base, much as in the preceding two species but with the roughening of the upper surface much stronger, much as in the species of *Trypargilum*. Features of the maxillae and labium as described for *aldrichi*; maxillary palpi 45  $\mu$  long; galeae 30  $\mu$  long; labial palpi 40  $\mu$  long; spinnerets extending well beyond the labial palpi.

*Material*.—One specimen from Plummers Island, Md., July 20, 1956 (K. V. Krombein).

**Trypoxylon (Trypoxylon) elongatum** Ashmead

Williams (1919, Hawaiian Sugar Planters' Assoc. Exp. Sta., Ent. Ser., Bull. no. 14, pp. 143-145) has briefly described the larva of this Philippine species. The full-grown larva is said to be 18.5 mm. long, with well-developed dorsal and lateral protuberances; "the tip of the body is obliquely subtruncate and the thorax is armed with a few bristles." His figure shows a body form identical to that of the North American species of this subgenus. Williams made a balsam mount of the head capsule, which I have examined. The width of the head capsule is 1.35 mm., the height slightly less than this; the coronal suture and parietal bands are not visible; the antennal orbits are obliquely elliptical, about 55  $\mu$  in maximum diameter. The mandibles are of the usual form in the genus, but without any evident roughening on the upper surface. The spinnerets appear to be about twice the length of the labial palpi.

*Material*.—A single head capsule mounted in balsam, from Los Baños, Philippines, 1917 (F. X. Williams).

**Trypoxylon (Trypoxylon) figulum** (Linnaeus)

The larva of this Holarctic species has been described very briefly by Soika (1934, Ann. Soc. Ent. France, 103: 342-343, pl.



probably fairly valid. In general, the larvae of Crabroninae resemble those of the Trypoxyloninae very closely, the most notable difference being the complete absence of an angular lacinial lobe. The arrangement of the genera in the text follows that in the Synoptic Catalog.

*Characters of the subfamily.*—Body rather stout, somewhat grub-like; pleural lobes strongly developed; anus situated ventrally and preapically, the tenth segment either truncate or slightly produced beyond the anus; integument sometimes completely smooth, but more often with very small spinules which are irregularly distributed and generally separated from one another by more than their own length; body setae present on parts of the dorsum and pleura, but always very small and sparse; spiracles with the atrium smooth-walled or lined with a network of fine ridges; opening into the subatrium simple, unarmed; subatrium elongate. Head wider than high; parietal bands weak or absent; antennal papilla absent, the three sensilla arising from the membrane of the orbit, which may be slightly elevated; head always with numerous fairly long setae. Labrum of simple structure, the disc with numerous strong setae, the apical margin fringed with small spines, but without noticeable sensory cones or stout setae set in the margin; epipharynx strongly spinulose, at least in part, the sensory pores or cones set in smooth areas well back from the anterior margin; mandibles of variable structure, usually about twice as long as their maximum width, with one or rarely two stout setae on the side near the base; maxillae simple, the lacinia without a lobe, but with dense, rather long spinules; maxillary palpi always longer and stouter than the galeae; labium with at least part of the oral surface clothed with spinules; spinnerets paired, long and slender, always exceeding the labial palpi and sometimes up to as much as three times the length of the palpi; spinnerets usually truncate apically.

TABLE OF TRIBAL AND GENERIC CHARACTERS <sup>4</sup>

- A. Epipharynx with the spinules extending to the apical margin medially, or nearly so (figs. 69, 79); lacinial area spinulose, without papillae intermingled with the spinules (figs. 83, 92)

## CRABRONINI

- B. Mandibles simple, with only the apical tooth; labrum rather deeply emarginate ..... *Tracheliodes* [*δ-notatus*]  
 BB. Mandibles with from three to five teeth.

- C. Mandibles with three or four teeth (figs. 72, 100), in lateral view without a tooth visible part way out on the hind margin (figs. 96, 97, 101).

- D. Mandibles with three teeth, the penultimate tooth of the other genera apparently absent; galeae very small ..... *Lindenius* [*pygmaeus*]

- DD. Mandibles with four teeth (figs. 72, 100).

- E. Integument smooth, entirely without spinules; teeth of mandibles in nearly the same plane, in lateral view the penultimate tooth only slightly evident (fig. 101)

*Euphikis* (*arapaho*, *pedicellatus*, [*coarctatus*, *clavipes*])

- EE. Integument with small spinules evident under high magnification (at least on some parts of the body); apex of mandibles, in lateral view, usually more evidently bifid (figs. 96, 97).

- F. Lacinial area with short spinules; oral surface of labium wholly covered with short spinules ..... *Entomognathus* [*brevis*]

- FF. Lacinial area with longer and more flexible spinules (fig. 73); labium with longer spinules in a more circumscribed area.

*Crabro* (*advenus*), *Crossocerus* (*ambiguus*, *fergusoni*, [*cinxius*, *capitosus*, *pubescens*, *walkeri*, *varus*, *quadrimalatus*, *podagricus*])

- CC. Mandibles with five teeth, the fifth tooth located on the ventral side and not readily visible from above (figs. 82, 87, 88), in lateral view the fifth tooth visible on the hind margin part way out (figs. 80, 89).

<sup>4</sup> This table will doubtless require much modification when the larvae of more genera are known (at present 9 out of 15, with 3 of the 9 known only from descriptions by European writers). I have been unable to separate the larvae of *Crabro* and *Crossocerus* on the basis of available material. The characters given for the separation of the tribes Crabronini and Oxybelini are of a rather minor nature and may not hold for all genera of both tribes.

- D. Apex of mandibles not hollowed out ventrally, the base of the mandibles with two setae (fig. 82); labium with two patches of very long spines (fig. 84) ..... *Anacrabro (ocellatus)*
- DD. Apex of mandibles hollowed out on the ventral side, the base with only one seta (figs. 87, 88); labium with much shorter spinules (fig. 93).  
*Ectemnius (stirpicolus, atriceps, tumidoventris, zonatus, cavifrons, guttatus)*
- AA. Epipharynx with the spinules mostly on the base and sides, leaving a large area medio-apically bare or bearing papillae (figs. 105, 111); lacinial area both papillose and spinulose, some of the papillae commonly intermingled with the spinules (fig. 113); mandibles with five teeth (fig. 114)  
*OXYBELINI, Oxybelus (bipunctatus, quadrinotatus, [melacholicus, argentatus])*

#### Tribe CRABRONINI

##### *Anacrabro ocellatus* Packard (Plate XVII, figs. 75-84)

*Body*.—Length 7.5 mm.; maximum width (abdominal segment 5) 2.3 mm. (fig. 78). Grub-like, somewhat curved; pleural lobes prominent, rounded, those on the thorax somewhat lower than those on the abdomen; anus situated ventrally on the tenth abdominal segment, which is blunt. Integument smooth except for irregularly distributed short spinules, visible only under high magnification; these spinules are generally separated from each other by more than their length (fig. 81). Body also with a few small setae dorsally and on the pleural lobes. Spiracles small, lightly pigmented; atrium with a meshwork of weak ridges lining the walls; opening into the subatrium unarmed; subatrium elongate (fig. 76).

*Head*.—Width 1.15 mm.; height .96 mm. (fig. 75). Coronal suture short, unpigmented; parietal bands absent; epistomal suture indistinct. Top and sides with numerous small convexities, giving the head a roughened appearance. Antennal orbits circular, 45  $\mu$  in diameter (fig. 77). Head with numerous strong setae, many of them as much as 300  $\mu$  in length, especially abundant on the lower sides. Clypeus with several strong setae in a row.

*Mouthparts*.—Labrum .43 mm. wide, its apical margin rounded, with a very weak median emargination; margin spinose; surface with numerous large setae (fig. 79). Epipharynx spinulose, the spinules grading into papillae latero-basally, with about four sensory cones in an unpigmented area on each side well back from the margin. Mandibles .52 mm. long, .28 mm. wide near the base; base with two strong setae laterally; inner margin with four teeth in about the same plane, plus a fifth tooth which is in a different plane and beneath the others (fig. 82); in lateral view this fifth tooth is prominent on the posterior margin of the mandible (fig. 80). Maxillae with the palpi about 80  $\mu$  long, the galeae much smaller, about



40  $\mu$  long; lacinial area densely clothed with long, flexible setiform spines (fig. 83). Labium with the palpi 70  $\mu$  long, only about 50  $\mu$  actually extending beyond the apex of the labium; spinnerets elongate, truncate apically, extending beyond the apex of the labium for about 100  $\mu$ ; oral surface of labium with two patches of very long, flexible spines (fig. 84).

*Material*.—Three specimens from Ithaca, N. Y., July 1953 (M. A. Evans).

**Entomognathus brevis** (Van der Linden)

Grandi (1927, Redia, 16: 74-77) has described the larva of this Palaearctic species in some detail. The body is grub-like, shaped much as in *Anacrabro*, but the position of the anus is not indicated. The integument is sparsely clothed with short spines and bears a few setae, as in *Anacrabro*. The head shape is about as in that genus, but the setae appear to be somewhat shorter and more regularly arranged on the sides of the head. The labrum does not differ noticeably from that of *Anacrabro*. The mandibles have four teeth, subequal in size and all in about the same plane (about as figured for *Euphlilis*, fig. 100). Both the lacinial area and the oral surface of the labium are extensively covered with close-set, short spinules. The spinnerets extend beyond the margin of the labium to about twice the length of the palpi.

**Lindenius pygmaeus** (Rossi)

Grandi has also described the larva of this Palaearctic species (1928, Boll. Lab. Ent. Bologna, 1: 310-312). The body form is much as in *Anacrabro*, but a bit more slender; the tenth abdominal segment is rounded, lobe-like, the position of the anus not indicated. The features of the head and of the labrum are very much as in *Anacrabro*. The mandibles have but a single seta near the base, and the inner margin has but three teeth, the penultimate tooth of the other genera apparently being absent. The maxilla is papillose apically and the lacinial area bears long, flexible spines; the palpi are very large and the galeae unusually small. The spinnerets are about twice the length of the labial palpi.

**Tracheliodes 5-notatus** (Jurine)

The larva of this Palaearctic species has also been described by Grandi (1927, Boll. Lab. Ent. Bologna, 1: 25-26). The body

form is similar to that of *Anacrabro*, but more slender; the tenth abdominal segment is somewhat pointed, the anus distinctly pre-apical in position. The features of the head are much as described for *Anacrabro*; the labrum is setose as in that genus, but the apical margin is more deeply emarginate and apparently not fringed with spines. The mandibles are said to be simple and edentate, tapering gradually to an acute apex. The maxillary galeae are much shorter than the palpi and the lacinial area is spinulose. The labium possesses rather long palpi, and the spinnerets exceed the palpi only slightly; the oral surface has two patches of spinules which are very much shorter than in *Anacrabro*.

***Crabro advenus* Smith**

(Plate XIX, figs. 95-96)

*Body*.—The body of the single available specimen is not well preserved. The integument appears to be covered with small, widely separated spinules as in *Anacrabro*.

*Head*.—Width 1.15 mm.; height .95 mm. Coronal suture indistinct, but the parietal bands apparently present as weak lines of slightly darker pigmentation. Top and sides of head capsule only very weakly roughened; head setae very small, the longest ones only about 25  $\mu$  in length. Antennal orbits circular, about 45  $\mu$  in diameter, the three sensilla located on top of a somewhat dome-like elevation.

*Mouthparts*.—Labrum .35 mm. wide, the apical margin rounded and with only a very weak median emargination; apical margin fringed with long setae, especially laterally; disc with numerous strong setae (fig. 95). Epipharynx with abundant strong spinules medially, grading into smaller spinules and papillae laterally; sensory areas consisting of five very small cones in a group and some weaker pores basad of these. Mandibles much as figured for *Euplilis arapaho* (fig. 100), with four teeth which are in nearly the same plane and nearly equal in size; in lateral view (fig. 96) only the penultimate tooth is prominent, the apex thus somewhat bifid; base with one seta. Maxillae much as in *Anacrabro*; lacinial area with dense, long, flexible spinules; palpi conical, 70  $\mu$  in length; galeae small and slender, 35  $\mu$  in length. Apex of labium with dense, fairly long spines on the upper surface (shorter than in *Anacrabro*); palpi 60  $\mu$  long; spinnerets much exceeding the palpi.

*Material*.—One specimen from Snow Hill, Md., 29 May 1952 (W. H. Anderson) [U. S. Nat. Mus.].

***Euplilis arapaho* Pate**

(Plate XIX, figs. 99-103)

*Body*.—Length about 4 mm. The body of the single available specimen is not well preserved, but it appears to resemble closely that of *Anacrabro*.

*ocellatus* except that it is more slender. The pleural lobes are very strong, and each posterior annulet bears a strong transverse elevation which is interrupted medially. The posterior end of the body is rounded and the anus situated preapically. The integument is completely smooth and without any spinules whatsoever; a few minute setae are present on the thoracic dorsum. The spiracles are simple, the atrium without sculpturing, the subatrium somewhat more elongate than in *Anacrabro*.

*Head*.—Width .58 mm.; height .54 mm. Shape much as in *Anacrabro*; parietal bands absent; coronal suture weak but fairly long. Top and sides of head rather strongly roughened by many small convexities. Setae confined largely to the periphery of the head, as seen in anterior view, considerably fewer in number than in *Anacrabro*, the longest ones about  $30\ \mu$  in length. Antennal orbits ovoid, about  $40\ \mu$  in greatest diameter, the three sensilla located on a dome-like elevation of the membrane of the orbit. Epistomal suture distinct; clypeus with a very few setae.

*Mouthparts*.—Labrum .2 mm. wide, .09 mm. high on the median line; apex subtruncate; disc with a few setae and apical margin strongly spinose; epipharynx strongly spinulose, the sensory areas consisting of a small group of sensilla above which are several large pores (fig. 99). Mandibles .27 mm. long, .13 mm. in maximum width; base with a single seta; inner margin with four teeth, all about equally developed, but the penultimate somewhat the most prominent (figs. 100, 101). Maxillae with the palpi about  $40\ \mu$  in length, the galeae about  $30\ \mu$  in length; lacinial area with dense long spinules which are directed outward (fig. 102). Apex of labium with numerous strong spines on the oral surface; palpi about  $35\ \mu$  in length; spinnerets measuring about  $50\ \mu$  from base to apex, only slightly exceeding the palpi (fig. 103).

*Material*.—One specimen from *Sambucus* stem, Logan, Utah, 1948 (G. E. Bohart).

***Euplilis pedicellatus* (Packard)**

(Plate XIX, fig. 104)

Packard (1896, Jour. N. Y. Ent. Soc., 4: 161-163) presented a brief description and sketch of the larva of this species. According to him, the body terminates in "a small knob-like portion" and the body is sparsely clothed with rather long setae. The only material of this species available to me is a single cast skin taken from a cocoon.

*Body*.—With a few small, widely scattered setae. Integument smooth, without any evidence of spinules. Spiracles as described for *arapaho*.

*Head*.—Essentially as described for *arapaho*. Antennal orbits circular,  $40\ \mu$  in diameter.

*Mouthparts*.—Labrum .18 mm. wide, .09 mm. high, much as in *arapaho* but with the setae more spread out over the disc; epipharynx with long



spinules more confined to the apical margin than in *arapaho* (fig. 104). Mandibles with a single seta basally, with four strong teeth along the inner margin, the antepenultimate the weakest. Maxillae about as figured for *arapaho*; palpi and galeae about the same length. Labium with the palpi about 30  $\mu$  long, the spinnerets much exceeding the palpi, about 65  $\mu$  long.

*Material*.—A single cast larval skin from a cocoon in a rose stem, sent to the author from Dayton, Ohio, May 5, 1956.

***Eupililis coarctatus* (Scopoli)**

The larva of this Palaearctic species has been described by Micheli (1929, Boll. Soc. Ent. Italiana, 61: 34-35). Nothing is said about the nature of the integument or the body setae. The labrum bears a somewhat larger number of setae than in the known American species, but otherwise the labrum and epipharynx are very similar. The mandibles have four subequal teeth along the inner margin. The maxillae and labium are much as in *arapaho* except that the spinnerets protrude far beyond the labial palpi.

***Eupililis clavipes* (Linnaeus)**

Maréchal (1929, Ann. Soc. Ent. France, 98: 115-116) has described the larva of this species. The body form is much as figured for *Crossocerus ambiguus* (fig. 71); setae are said to be present on the body, also a few on the head capsule. The head is subcircular in anterior view, the labrum shaped much as in *arapaho*. The mandibles have four sharp teeth along the inner margin. The maxillary palpi considerably exceed the galeae and the spinnerets much exceed the labial palpi.

***Crossocerus* (*Coelocrabro*) *ambiguus* (Dahlbom)**

(Plate XVI, figs. 69-74)

*Body*.—Length 6 mm.; maximum width 2 mm. (fig. 71). Form similar to *Anacrabro ocellatus*, but more slender; pleural lobes very prominent; anal segment roundly protuberant, the anus ventral and preapical. Integument clothed sparsely and irregularly with minute spinules, much as in *Anacrabro*. Body without setae except for a few inconspicuous ones on the thoracic dorsum. Spiracles with the atria lined with a few weak ridges which tend to form large hexagons.

*Head*.—Width .7 mm.; height .66 mm.; subcircular in anterior view; coronal suture weak; parietal bands absent; epistomal suture distinct. Top and sides of the head weakly roughened, provided with numerous

setae, the longest setae about  $40\ \mu$  in length. Antennal orbits transversely ovoid,  $50\ \mu$  in greatest diameter, the membrane of each orbit elevated and bearing three sensilla (fig. 74).

*Mouthparts*.—Labrum .21 mm. wide, .10 mm. high; disc with numerous setae and apical margin bristly; epipharynx strongly spinulose, the sensory areas each consisting of several small sensilla plus a few pores basad of these (fig. 69). Mandibles .32 mm. long and .17 mm. wide at the base, with a single seta near the base; inner margin somewhat crenulate, with four rather poorly defined teeth (fig. 72). Maxillae rounded apically, the surface weakly papillose, the lacinial area with dense, erect spinules; palpi about  $55\ \mu$  long, galeae about  $25\ \mu$  long (fig. 73). Labium strongly spinulose on the oral surface; palpi about  $35\ \mu$  long; spinnerets about  $70\ \mu$  long (fig. 70).

*Material*.—Four specimens from Ithaca, N. Y., August 27, 1954 (C. S. Lin).

**Crossocerus (Coelocrabro) fergusonii** Pate (Plate XIX, figs. 97-98)

*Body*.—Length 6 mm.; maximum width 2 mm. Form similar to *ambiguus*; posterior annulets very prominent, especially anteriorly; pleural lobes also very prominent, especially on the thorax. Integument sparsely and irregularly clothed with minute spinules. Spiracles with the atrium lined with irregular hexagons, the subatrium very long, slender, and smooth (fig. 98).

*Head*.—Width .86 mm.; height .76 mm. Parietal bands apparently represented by weakly pigmented streaks. Antennal orbits shaped as in *ambiguus*,  $50\ \mu$  in maximum diameter. Head with relatively few setae, the longest setae only about  $25\ \mu$  in length, the setae situated mostly on the sides of the head.

*Mouthparts*.—Labrum .28 mm. wide, .14 mm. high on the median line; shaped as in *ambiguus* and very similar to that species; epipharynx also much as in *ambiguus* but somewhat more coarsely spinulose medially and anteriorly. Mandibles with a single seta near the base; inner margin with four very strong, subequal teeth, the penultimate tooth very strong and projecting in a slightly different plane from the others, such that in lateral view the mandibles appear bifid at the apex (fig. 97). Maxillae as figured for *ambiguus* but with the galeae relatively shorter, only about  $15\ \mu$  long, scarcely longer than thick. Labium with the palpi about  $40\ \mu$  in length, the spinnerets about  $90\ \mu$  in length.

*Material*.—Three specimens from cocoons in elderberry stem, Logan, Utah, June 1948 (G. E. Bohart).

- Crossocerus (Coelocrabro) cinxius** (Dahlbom)  
**Crossocerus (Coelocrabro) capitosus** (Shuckard)  
**Crossocerus (Coelocrabro) pubescens** (Shuckard)  
**Crossocerus (Coelocrabro) walkeri** (Shuckard)

The larvae of these four species of the subgenus *Coelocrabro* have been described by various European workers. All seem to resemble closely the two American species described above. In all of them the mandibles have four strong teeth, with the apical two juxtaposed so that the apex is strongly bifid in lateral view (as in *fergusoni*). The parietal bands appear to be distinct in *pubescens*, absent in the others. In all of them the spinnerets much exceed the labial palpi. References to the descriptions are as follows: *cinxius*, Micheli, 1930, Mem. Soc. Ent. Italiana, 9: 55-56; *capitosus*, Maréchal, 1927, Ann. Soc. Ent. France, 96: 105-106; *pubescens*, Baudot, 1934, Ann. Soc. Ent. France, 103: 383; *walkeri*, Baudot, 1929, Bull. Zool. Soc. France, 54: 498-500.

**Crossocerus (Ablepharipus) podagricus** (Van der Linden)

Goidanich (1928, Boll. Lab. Ent. Bologna, 1: 103-106) has provided a detailed and well-illustrated description of this species. The head is sparsely setose; the labrum is truncate apically and otherwise much as in *ambiguus*. The mandibles have four strong teeth and a single seta near the base. The spinnerets taper strongly from a rather broad base and are only about twice the length of the labial palpi. All in all, the resemblance to the two American species described above is very great, and there are no obvious differences which might be considered of sub-generic value.

**Crossocerus (Stenocrabro) varus** Lepeletier

Maneval (1939, Ann. Soc. Ent. France, 108: 82-83) has supplied a short description of this species. The mandibles are rather weakly quadridentate and, in lateral view, weakly bifid apically, much more as in *ambiguus* than as in *fergusoni* and the five Palaearctic species discussed above. The spinnerets are exceedingly long and slender. The galeae also agree with *ambiguus* in being rather slender and elongate. The head has abundant setae.

**Crossocerus (Hoplocrabro) quadrimaculatus** (Fabricius)

Maneval (1939, op. cit., pp. 85-86) has also described the larva of this species. The mandibles have three strong teeth and a weak fourth tooth basad of these; the apical two teeth are juxtaposed so that the apex is bifid in lateral view. The head



has many small setae and the labrum an unusual number of setae. The galeae are very slender and fairly long, the spinnerets very long and spiniform.

**Ectemnius (Hypocrabro) stirpicolus** (Packard)

(Plate XVIII, figs. 85-90)

*Body*.—Length 7 mm.; width 2.2 mm. Very much as figured for *Crossocerus ambiguus*; last abdominal segment rounded, extending well beyond the anus. Integument smooth, but with a few widely scattered minute spinules visible under high power on certain parts of the body; body setae very sparse, short, and inconspicuous. Spiracles (fig. 86) much as in *Crossocerus*, but the subatrium with a bulbous expansion close beneath the atrium.

*Head*.—Width .8 mm.; height .73 mm. (fig. 85). Orbits lightly pigmented; anterior tentorial arms and pleurostomal and hypostomal thickenings heavily pigmented; mandibles brown; palpi and galeae light brown; posterior aspect of head with paired pigment spots beneath the foramen and the maxilla with a pigmented bar as illustrated. Coronal suture very weak; parietal bands represented by weak pigmented lines. Setae sparse and rather short, the longest ones about 30  $\mu$  long. Antennal orbits unusually small, transversely ovoid but approaching circular, about 40  $\mu$  in diameter.

*Mouthparts*.—Labrum .24 mm. wide, .12 mm. high; apical margin weakly rounded, bristly; disc with a few setae (fig. 90). Epipharynx strongly spinulose, especially medially and anteriorly. Mandibles with five teeth, one of the teeth ventral in position and not visible from above; apical two teeth juxtaposed in such a way that in lateral view the apex is strongly bifid; ventral surface hollowed out apically, much as in *Trypoxylon*; base with a single seta; length .34 mm., maximum width .18 mm. (figs. 87-89). Maxillae much as figured for *Crossocerus*, rounded and smooth apically, the lacinial area with dense, rather long, flexible setae which are directed outward; palpi 60  $\mu$  long, galeae slender, 40  $\mu$  long. Labial palpi 30  $\mu$  long, considerably exceeded by the spinnerets; oral surface of labium with a large patch of rather long, flexible setae.

*Material*.—Two whole specimens plus several cast skins, all taken from cocoons in rose stems sent to the writer from Dayton, Ohio, May 1956.

**Ectemnius (Ectemnius) atriceps** (Cresson) (Plate XVIII, figs. 91-94)

*Body*.—Not well preserved in the available material. Integument with very minute, unevenly distributed spinules and with a few small setae in certain areas. Spiracles as figured for *stirpicolus*.

*Head*.—Width .96 mm.; height .83 mm. Features much as in *stirpicolus*, but the parietal bands considerably stronger, about .25 mm. in length.

Antennal orbits small, ovoid,  $50\ \mu$  in greatest diameter, with a central, circular pigmented area bearing only two sensilla (at least on both sides of the single available specimen) (fig. 94). Longest setae of the head about  $30\ \mu$  in length.

*Mouthparts.*—Labrum .28 mm. wide, .14 mm. high; apical margin bristly, very weakly emarginate medially, the disc with about 10 setae on each side (fig. 91). Epipharynx strongly spinulose medially and apically, papillose toward the base. Mandibles .42 mm. long, .21 mm. in maximum width, exactly as figured for *stirpicolus*. Maxillae rounded apically, the lacinial area with rather long, slender spines; palpi  $70\ \mu$  in length; galeae  $40\ \mu$  in length (fig. 92). Labium with moderately long spines on the oral surface; palpi  $40\ \mu$  long; spinnerets prominent, about  $80\ \mu$  long (fig. 93).

*Material.*—A single specimen from a cocoon in a *Sambucus* stem, Logan, Utah, April 1948 (G. E. Bohart).

**Ectemnius (*Ectemnius*) *guttatus*** (Van der Linden)

The larva of this species has been described briefly and figured rather crudely by Minkiewicz (1932, Polskie Pismo Ent., 10: 214-215, under the name *spinicollis*). The apical two teeth of the mandibles appear to be juxtaposed in the manner of *stirpicolus* and *atriceps*, but the mandibles are otherwise not described adequately. The apex of the maxilla and of the labium agree fairly closely with the American species. The antennal orbits are not described or figured.

**Ectemnius (*Oreocrabro*) *tumidoventris*** (Perkins)

Williams (1927, Proc. Haw. Ent. Soc., 6: 448) has sketched the larva of this Hawaiian species, and the slides which he made of the head capsule have been loaned to me by the Hawaiian Sugar Planters' Experiment Station.

*Body.*—As figured by Williams, somewhat fusiform and with very prominent posterior annulets and pleural lobes; anal segment protruding as a rounded lobe; thorax with a few weak setae.

*Head.*—Width 1 mm.; height .95 mm. Coronal suture and parietal bands not visible in the available preparations; setae small, few in number, about as in *stirpicolus*. Antennal orbits small, circular, about  $40\ \mu$  in diameter.

*Mouthparts.*—Labrum .32 mm. wide, the apical margin subtruncate; disc with a large number of setae (about as in *atriceps*); margin strongly spinose. Mandibles with five teeth and exactly as figured for *stirpicolus*. Maxillae smooth and rounded apically; palpi  $80\ \mu$  long; galeae  $50\ \mu$  long;

lacinial area with dense, flexible spines. Labial palpi 50  $\mu$  long; spinnerets 70  $\mu$  long, exceeding the palpi only slightly.

*Material*.—Described from two head capsules mounted in balsam by F. X. Williams, specimens from Kilauea, Hawaii, Nov. 1919.

**Ectemnius (Clytochrysus) zonatus** (Panzer)

Maneval (1937, Rev. Franc. Ent., 4: 167-169) has provided a rather full description of this species. The head is subcircular in anterior view, slightly wider than high, with the parietal bands absent and the antennal orbits unusually small, each with three sensilla. The mandibles are bifid apically and possess a single additional rounded tooth on the inner margin. The spinnerets and the labial palpi are both unusually long and slender. The mandibles appear to differ considerably not only from those of *stirpicolus*, *atriceps*, and *tumidoventris*, but also from those of another species of *Clytochrysus*, *cavifrons*, as described by Leclercq (see below). It is possible that the mandibles of Maneval's specimens were badly worn.

**Ectemnius (Clytochrysus) cavifrons** (Thomson)

Leclercq (1954, Monographie systematique . . . des Hyménoptères Crabroniens, p. 25) presents an excellent figure of the head capsule of this species. The resemblance to the American species *stirpicolus* and *atriceps* is very striking. The parietal bands are fairly strong and the antennal orbits small. The mandibles are exactly as figured for *stirpicolus*. The labrum, maxillae, and labium are not sketched in detail, but as far as can be seen they do not differ notably from the American species.

Tribe OXYBELINI

**Oxybelus bipunctatus** Olivier (Plate XX, figs. 107-115)

*Body*.—Length 7.5 mm.; maximum width 2.5 mm.; fusiform, slightly thicker posteriorly; pleural lobes rounded, very prominent on the thorax but less so on the abdomen; anus ventral and preapical, the apex of the abdomen forming a distinct rounded lobe (fig. 109). Integument smooth, sparsely clothed with minute spinules which vary in size and shape and are rather irregularly distributed (fig. 110). Body with a few small setae dorsally. Spiracles with the atrium rather broad and shallow, lined with a few weak ridges; subatrium elongate (fig. 108).

*Head*.—Width .83 mm.; height .7 mm.; subcircular in anterior view (fig. 107). Coronal suture and parietal bands not visible. Epicranium very weakly roughened by small convexities; setae sparse but fairly long, the longest measuring about 50  $\mu$ . Antennal orbits small, circular, 30  $\mu$  in diameter.

*Mouthparts*.—Labrum .32 mm. wide, about .14 mm. high on the median line; apical margin weakly emarginate medially; surface with a few large setae (fig. 111). Epipharynx mostly bare medio-apically, but with dense spines basally and laterally; sensory areas unpigmented, each with about six small pores. Mandibles .40 mm. long, .19 mm. wide at the base; base with a single seta; apex with five teeth surrounding a ventral excavation, much as in *Ectemnius* (fig. 114); in lateral view, apex bifid and two other teeth visible below the apex (fig. 115). Maxillae rounded apically, densely papillose, the lacinial area with strong spinules among the papillae; palpi 50  $\mu$  long; galeae 25  $\mu$  long, ending in two distinct sensilla (fig. 113). Labium with the palpi 45  $\mu$  long, one of the apical sensilla unusually large; spinnerets long and pointed, measuring 80  $\mu$  from the base; oral surface papillose and with a group of very long, slender spines on each side below the palpus (fig. 112).

*Material*.—Fifteen specimens from Ithaca, N. Y., June-Sept., 1954-56 (H. E. Evans, C. S. Lin).

***Oxybelus quadrinotatus* Say**

(Plate XIX, figs. 105-106)

*Body*.—Length 8 mm.; maximum width 3 mm. Form as described and figured for *bipunctatus*.

*Head*.—Width .93 mm.; height .83 mm. Considerably more roughened by small convexities than in *bipunctatus*. Antennal orbits very small, circular, about 40  $\mu$  in diameter. Setae slightly more abundant than in *bipunctatus*, the longest ones about 60  $\mu$  in length.

*Mouthparts*.—Labrum .36 mm. wide, the apical margin prominently emarginate, the disc with about 20 strong setae (fig. 105). Epipharynx essentially as in *bipunctatus*, the spinules toward the base medially not quite as strong. Mandibles .41 mm. long, .22 mm. wide at the base, as described and figured for *bipunctatus*. Maxillae somewhat more broadly rounded and less strongly papillose than in *bipunctatus*, but otherwise very similar; palpi 50  $\mu$  long; galeae very short, only about 20  $\mu$  long. Labium with the palpi 55  $\mu$  long, the spinnerets 100  $\mu$  long, very slender and narrowly truncate apically; oral surface papillose and with paired patches of long spines (fig. 106).

*Material*.—Three specimens from Ithaca, N. Y., June-July 1955 (H. E. Evans).



***Oxybelus melancholicus* Chevrier**

The larva of this European species has been described by Grandi (1929, Boll. Lab. Ent. Bologna, 2: 279-282). The head capsule, clypeus, and labrum appear to have many more setae than in the American forms. The labrum is weakly emarginate apically; the epipharynx is spinulose, with a large area medio-apically covered with papillae. The mandibles have five teeth and are essentially as described for *bipunctatus*. The lacinial area and the oral surface of the labium are not described in detail. The spinnerets are stout and blunt.

***Oxybelus argentatus* Curtis**

Grandi (1954, Boll. Lab. Ent. Bologna, 20: 193-196) has recently provided a description and an excellent series of figures of this species. The body form is much as in the American species, with the anal segment forming a rounded lobe. The head is slightly wider than high and bears numerous setae. The mandibles are bidentate apically and have several small, blunt teeth on the inner margin. The lacinial area bears both papillae and spinules. The spinnerets considerably exceed the labial palpi and are blunt apically.

**EXPLANATION OF FIGURES**

In the drawings of the head, the anterior aspect is shown on the left side, the posterior aspect on the right side. In drawings of the labrum, the upper surface is shown on the left side, the under surface (epipharynx) on the right side. Drawings of the mandibles are of the dorsal (anterior) aspect unless otherwise stated; in drawings of the lateral aspect of the mandibles, the left mandible is always shown.

## PLATE IX

- Fig. 1.—*Aphilanthops frigidus* (Smith), head.  
Fig. 2.—Same, head and prothorax (lateral view).  
Fig. 3.—Same, body (lateral view).  
Fig. 4.—Same, labrum and epipharynx.  
Fig. 5.—Same, mandible.  
Fig. 6.—Same, antenna.  
Fig. 7.—Same, portion of integument of prothorax, highly magnified.  
Fig. 8.—Same, apex of labium (upper or oral surface, right half).  
Fig. 9.—Same, apex of maxilla.  
Fig. 10.—Same, spiracle.

## PLATE X

- Fig. 11.—*Philanthus gibbosus* (Fabricius), apex of maxilla.  
Fig. 12.—Same, mandible.  
Fig. 13.—Same, body.  
Fig. 14.—Same, labrum and epipharynx.  
Fig. 15.—Same, spiracle.  
Fig. 16.—*Philanthus solivagus* Say, labrum and epipharynx.  
Fig. 17.—Same, antenna.  
Fig. 18.—Same, apex of maxilla.

## PLATE XI

- Fig. 19.—*Philanthus bilunatus* Cresson, labrum and epipharynx.  
Fig. 20.—*Philanthus politus* Say, labrum and epipharynx.  
Fig. 21.—*Cerceris fumipennis* Say, apex of maxilla.  
Fig. 22.—Same, head.  
Fig. 23.—Same, body.  
Fig. 24.—Same, spiracle.  
Fig. 25.—Same, labrum and epipharynx.  
Fig. 26.—Same, apex of labium (oral surface, right half).

## PLATE XII

- Fig. 27.—*Cerceris nigrescens* Smith, labrum and epipharynx.  
Fig. 28.—Same, antenna.  
Fig. 29.—Same, mandible.  
Fig. 30.—*Cerceris robertsonii* Fox, labrum and epipharynx.  
Fig. 31.—*Cerceris clypeata* Dahlbom, labrum and epipharynx.  
Fig. 32.—*Eucerceris flavocincta* Cresson, head.  
Fig. 33.—Same, last two segments of abdomen (lateral view).  
Fig. 34.—Same, labrum and epipharynx.  
Fig. 35.—Same, apex of maxilla.

## PLATE XIII

- Fig. 36.—*Trypoxylon clavatum* Say, head.  
Fig. 37.—Same, antenna.  
Fig. 38.—Same, spiracle.  
Fig. 39.—Same, body.  
Fig. 40.—Same, mandible.  
Fig. 41.—Same, labrum and epipharynx.  
Fig. 42.—Same, apex of maxilla.  
Fig. 43.—Same, apex of labium (oral surface).

## PLATE XIV

- Fig. 44.—*Trypoxylon johannis* Richards, labrum and epipharynx.  
Fig. 45.—Same, antenna.  
Fig. 46.—Same, apex of maxilla.  
Fig. 47.—*Trypoxylon arizonense* Fox, labrum and epipharynx.  
Fig. 48.—Same, antenna.  
Fig. 49.—*Trypoxylon spinosum* Cameron, labrum and epipharynx.  
Fig. 50.—*Trypoxylon tridentatum* Packard, labrum and epipharynx.  
Fig. 51.—Same, antenna.  
Fig. 52.—Same, apex of maxilla.  
Fig. 53.—*Trypoxylon politum* Say, labrum and epipharynx.  
Fig. 54.—Same, antenna.  
Fig. 55.—*Trypoxylon striatum* Provancher, labrum and epipharynx.

## PLATE XV

- Fig. 56.—*Trypoxylon aldrichi* Sandhouse, labrum and epipharynx.  
Fig. 57.—Same, antenna.  
Fig. 58.—Same, body.  
Fig. 59.—*Trypoxylon frigidum* Smith, labrum and epipharynx.  
Fig. 60.—Same, apex of labium.  
Fig. 61.—*Trypoxylon adelphiae* Sandh., labrum and epipharynx.  
Fig. 62.—*Trypoxylon politum* Say, spiracle.  
Fig. 63.—*Trypoxylon rubro-cinctum* Packard, mandible.  
Fig. 64.—*Pison* sp., labrum and epipharynx.

## PLATE XVI

- Fig. 65.—*Pison argentatum* Shuckard, head.  
Fig. 66.—Same, spiracle.  
Fig. 67.—Same, apex of maxilla.  
Fig. 68.—Same, labrum and epipharynx.  
Fig. 69.—*Crossocerus ambiguus* (Dahlbom), labrum and epipharynx.  
Fig. 70.—Same, apex of labium.  
Fig. 71.—Same, body.  
Fig. 72.—Same, mandible.  
Fig. 73.—Same, apex of maxilla.  
Fig. 74.—Same, antenna.

## PLATE XVII

- Fig. 75.—*Anacrabro ocellatus* Packard, head.  
Fig. 76.—Same, spiracle.  
Fig. 77.—Same, antenna.  
Fig. 78.—Same, body.  
Fig. 79.—Same, labrum and epipharynx.  
Fig. 80.—Same, mandible (lateral view, posterior margin to left).  
Fig. 81.—Same, portion of integument of prothorax, highly magnified.  
Fig. 82.—Same, mandible (anterior view).  
Fig. 83.—Same, apex of maxilla.  
Fig. 84.—Same, apex of labium (oral surface).

## PLATE XVIII

- Fig. 85.—*Ectemnius stirpicolus* (Packard), head.  
Fig. 86.—Same, spiracle.  
Fig. 87.—Same, mandible (anterior view).  
Fig. 88.—Same, mandible (posterior or ventral view).  
Fig. 89.—Same, mandible (lateral view, posterior margin to right).  
Fig. 90.—Same, labrum and epipharynx.  
Fig. 91.—*Ectemnius atriceps* (Cresson), labrum and epipharynx.  
Fig. 92.—Same, apex of maxilla.  
Fig. 93.—Same, apex of labium.  
Fig. 94.—Same, antenna.

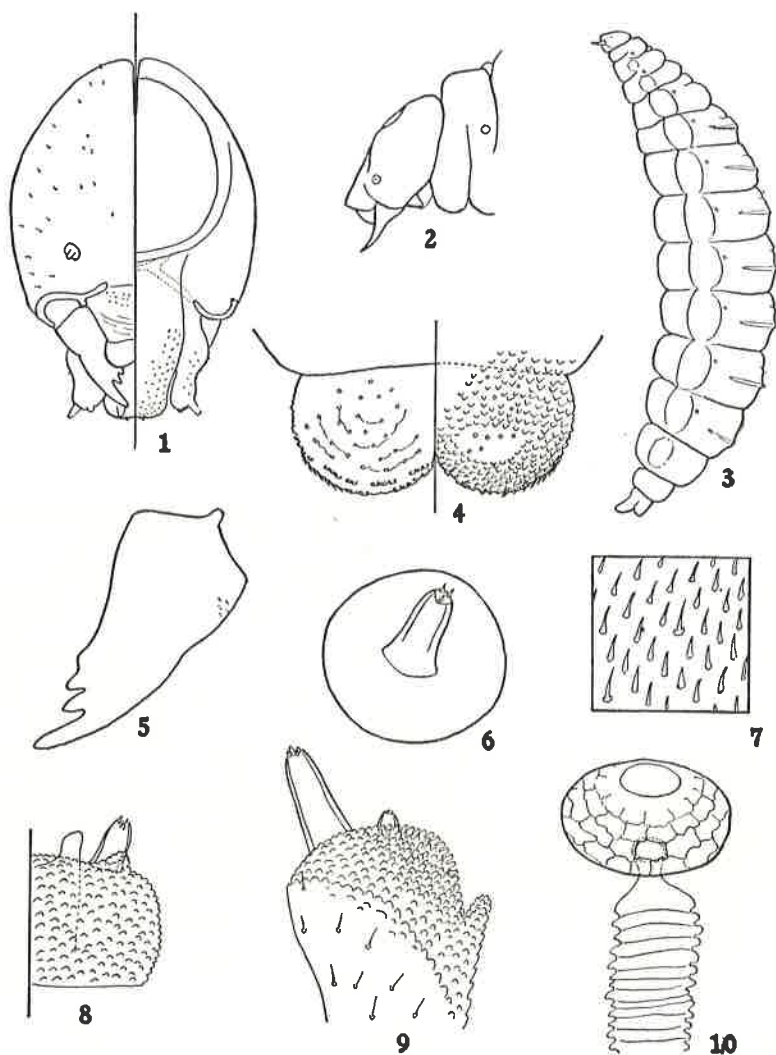
## PLATE XIX

- Fig. 95.—*Crabro advenus* Smith, labrum and epipharynx.  
Fig. 96.—Same, mandible (lateral view, posterior margin to left).  
Fig. 97.—*Crossocerus fergusonii* Pate, mandible (lateral view).  
Fig. 98.—Same, spiracle.  
Fig. 99.—*Euphilis arapaho* Pate, labrum and epipharynx.  
Fig. 100.—Same, mandible (anterior view).  
Fig. 101.—Same, mandible (lateral view).  
Fig. 102.—Same, apex of maxilla.  
Fig. 103.—Same, apex of labium (oral surface).  
Fig. 104.—*Euphilis pedicellatus* (Packard), labrum and epipharynx.  
Fig. 105.—*Oxybelus quadrinotatus* Say, labrum and epipharynx.  
Fig. 106.—Same, apex of labium (upper or oral surface on right, lower on left).



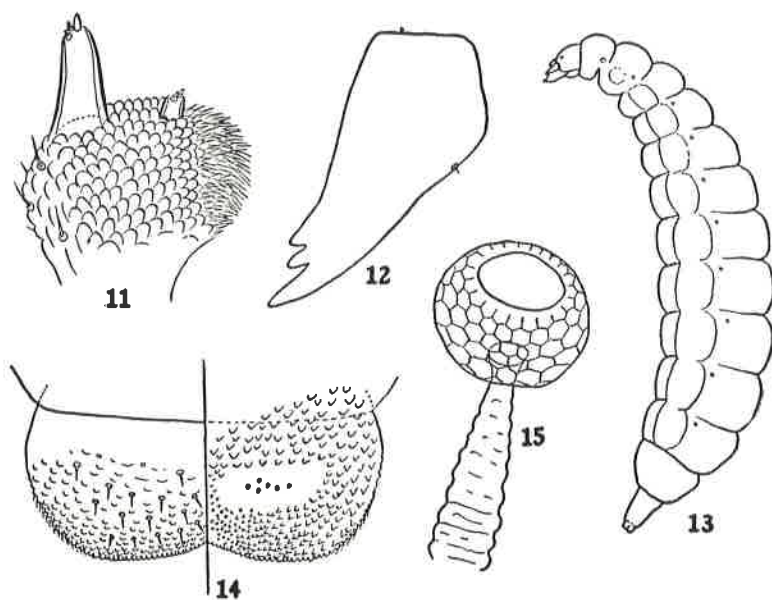
## PLATE XX

- Fig. 107.—*Oxybelus bipunctatus* Olivier, head.  
Fig. 108.—Same, spiracle.  
Fig. 109.—Same, body.  
Fig. 110.—Same, portion of integument of prothorax, highly magnified.  
Fig. 111.—Same, labrum and epipharynx.  
Fig. 112.—Same, apex of labium (upper or oral surface on right, lower on left).  
Fig. 113.—Same, apex of maxilla.  
Fig. 114.—Same, mandible (anterior view).  
Fig. 115.—Same, mandible (lateral view, posterior margin to left).

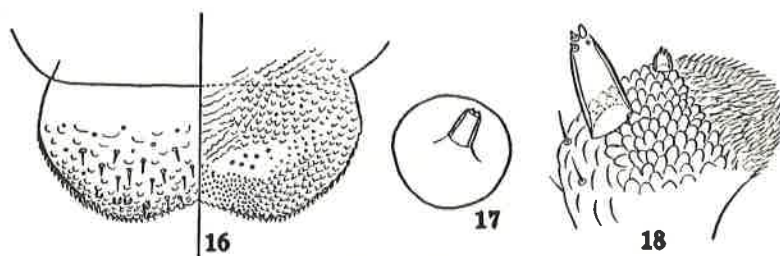


*Aphilanthops frigidus* (Smith)

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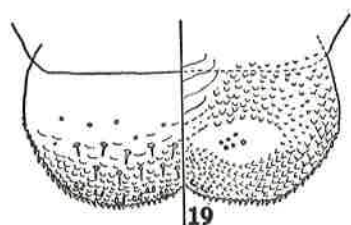


*Philanthus gibbosus* (Fabricius)

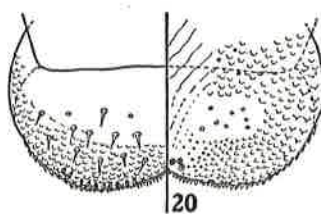


*Philanthus solivagus* Say

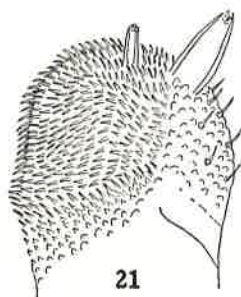
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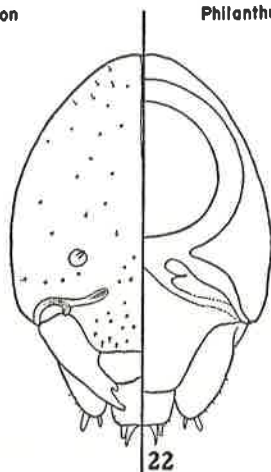
*Philanthus bilunatus* Cresson



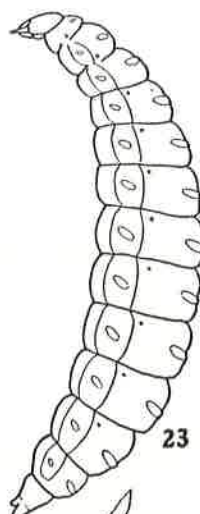
*Philanthus politus* Say



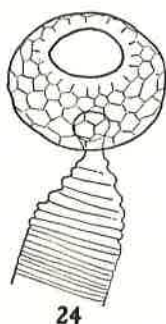
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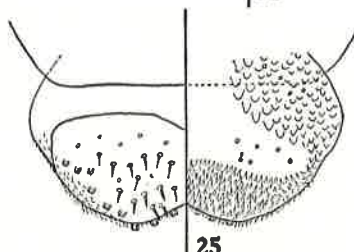
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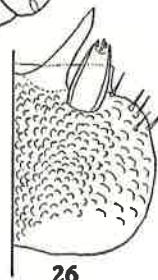
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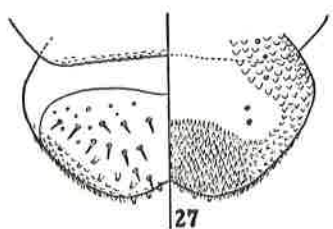


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*Cerceris fumipennis* Say

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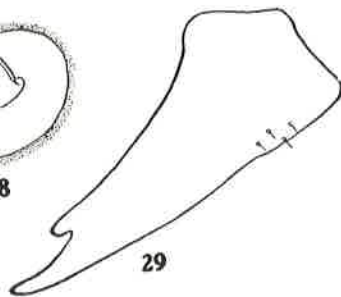




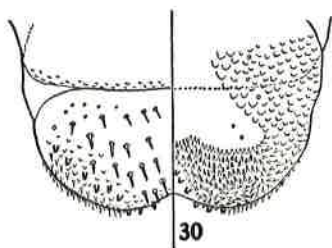
*Cerceris nigrescens* Smith



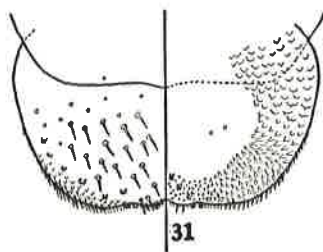
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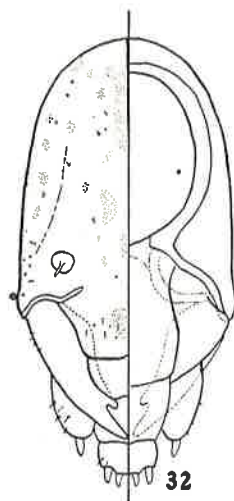
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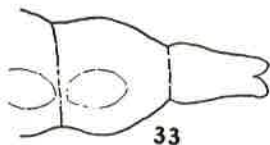
*Cerceris robertsoni* Fox



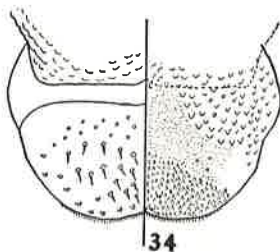
*Cerceris clypeata* Dahlbom



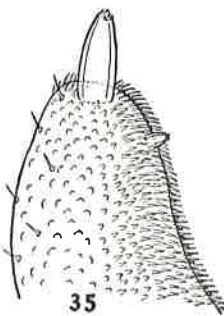
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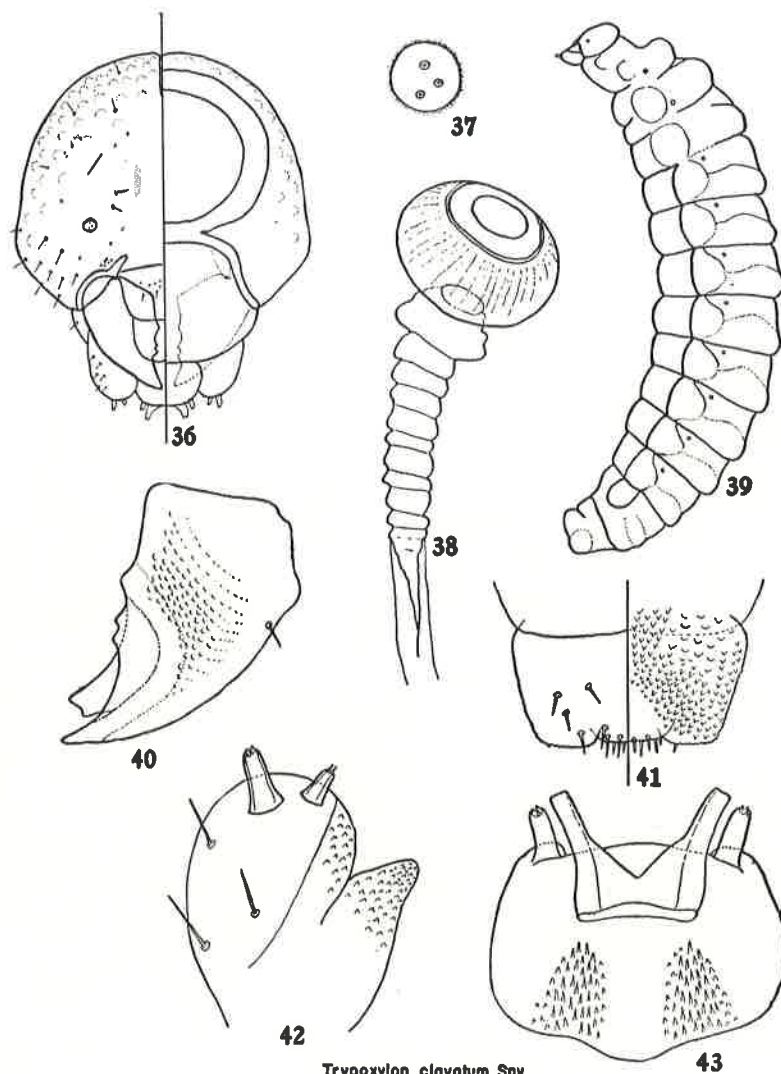


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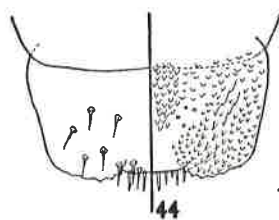
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*Eucerceris flavocincta* Cresson

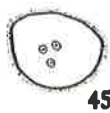


*Trypoxylon clavatum* Say

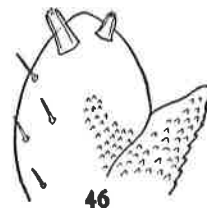
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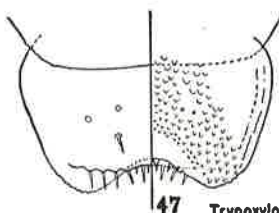
*Trypoxylon johannis* Richards



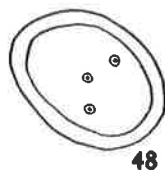
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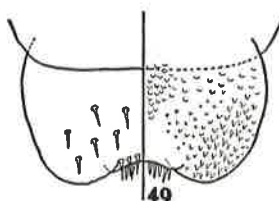
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*Trypoxylon arizonense* Fox

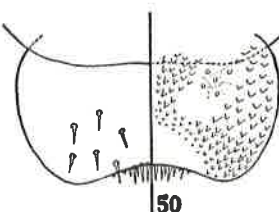


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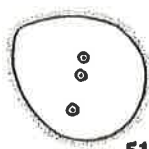
*Trypoxylon spinosum* Cameron

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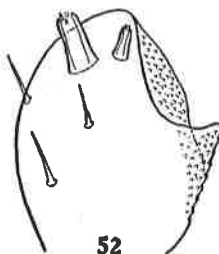


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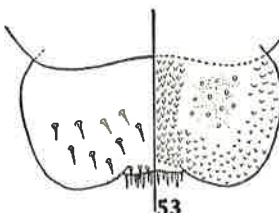
*Trypoxylon tridentatum* Packard



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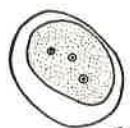


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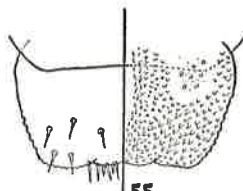


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*Trypoxylon polltum* Say



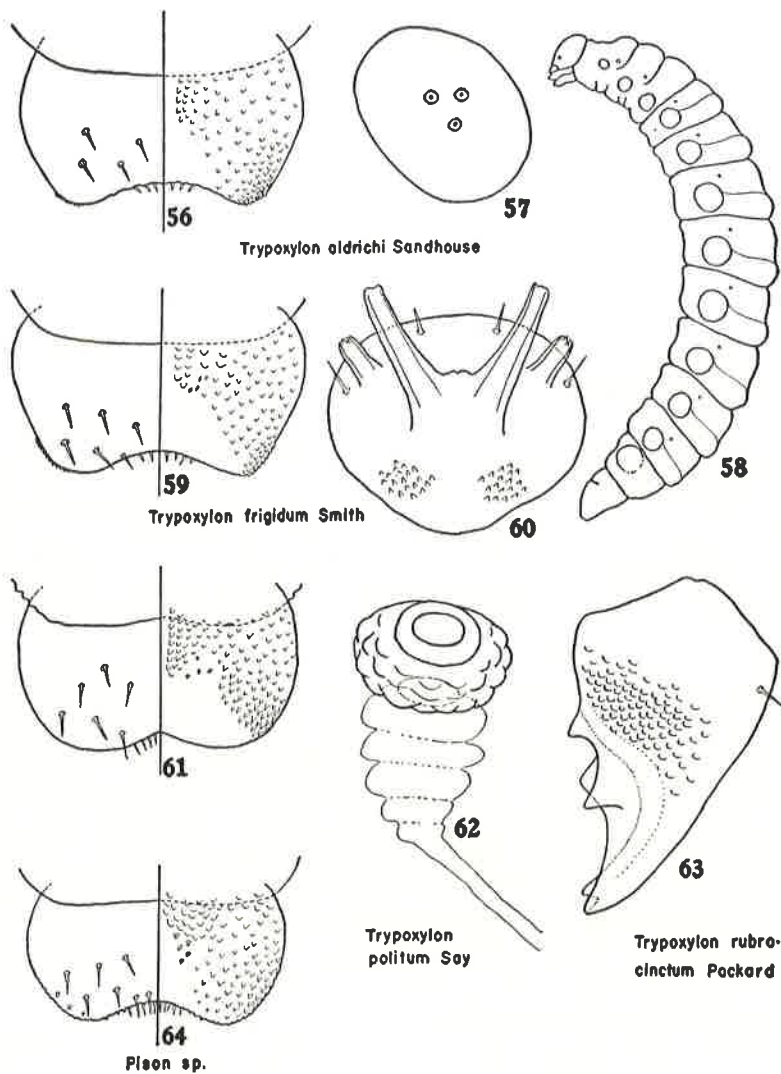
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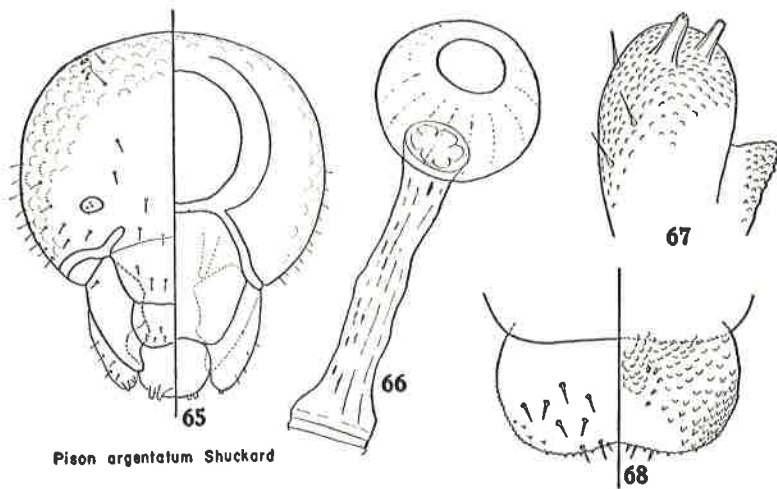
*Trypoxylon striatum* Provancher

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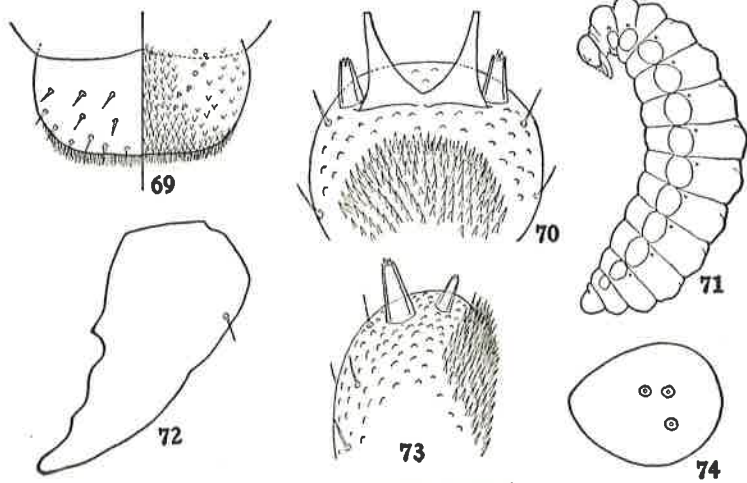


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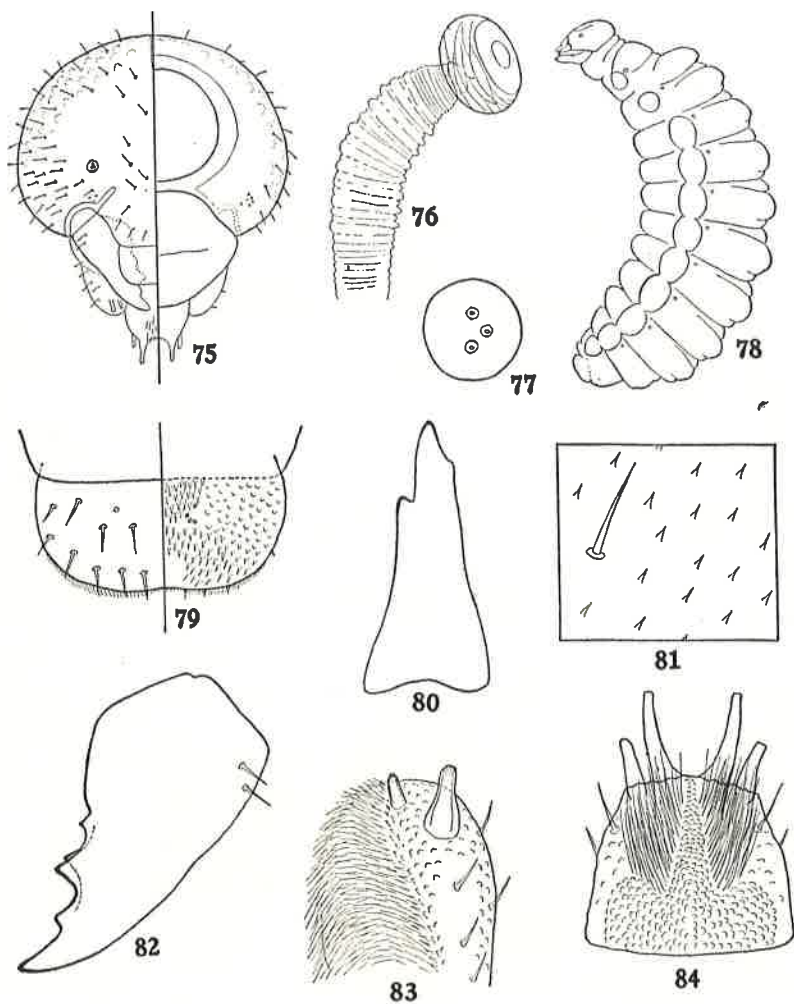


*Pison argentatum* Shuckard



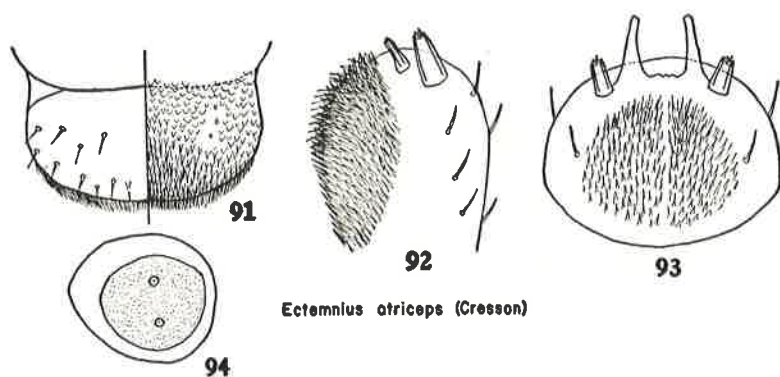
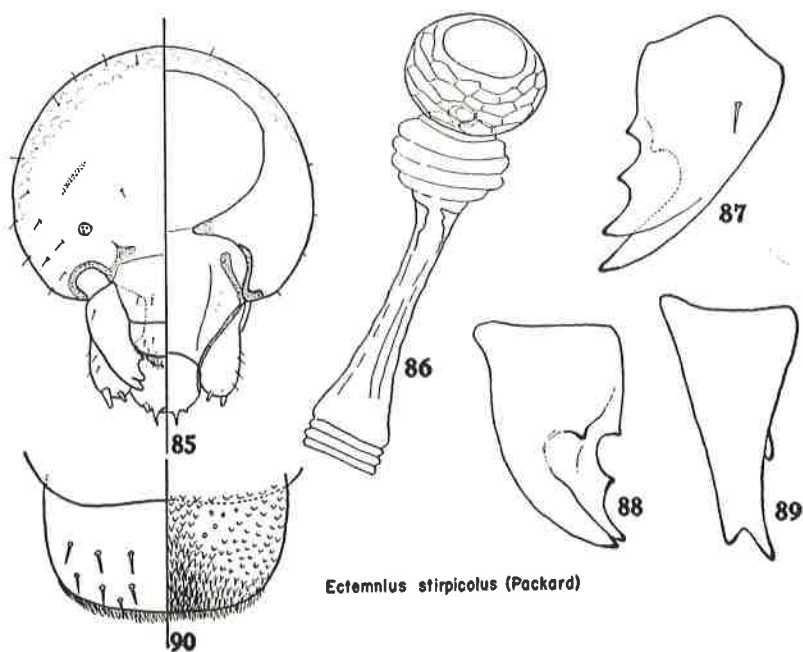
*Crossocerus ambiguus* (Dahlbom)

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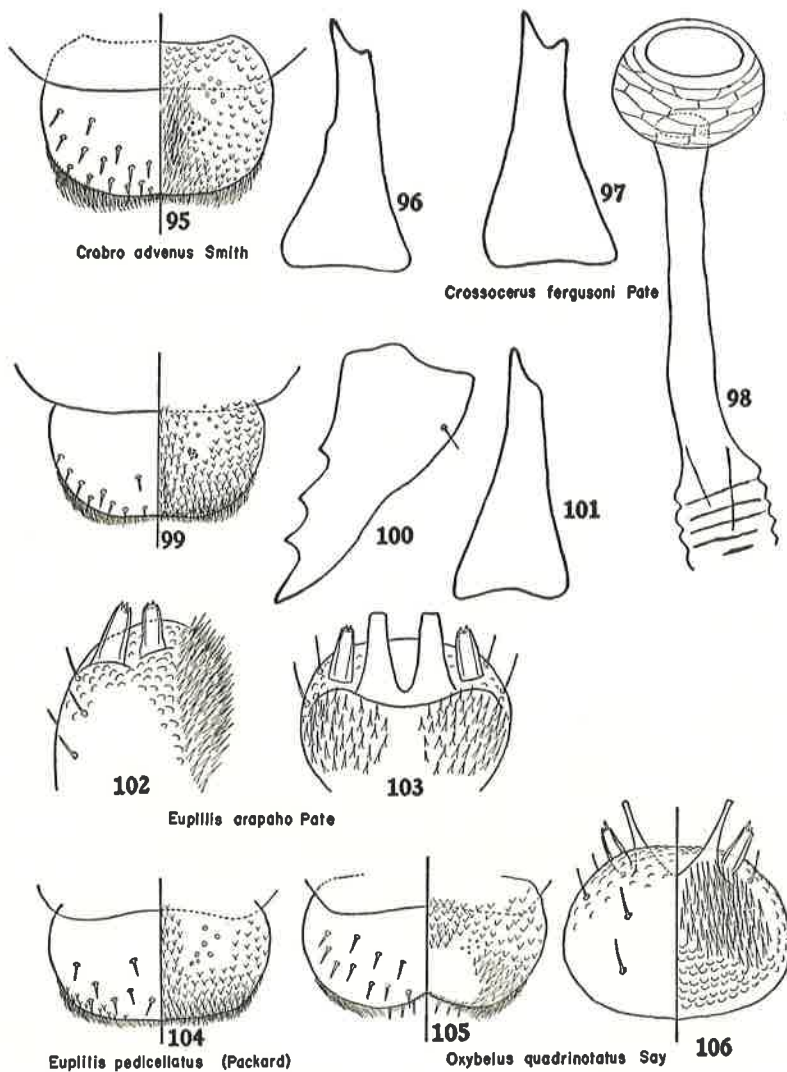


*Anacrabro ocellatus* Packard

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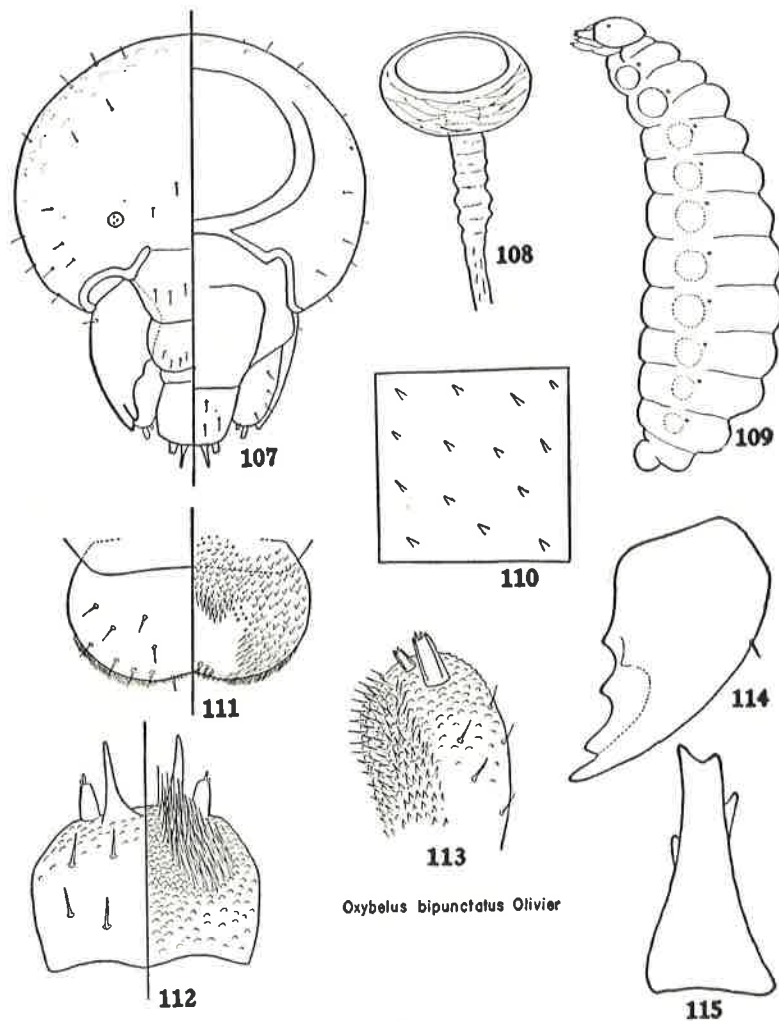


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