

THE SPECIES OF *ENTEDON* IN AMERICA NORTH OF MEXICO (HYMENOPTERA: EULOPHIDAE)

MICHAEL E. SCHAUFF

Systematic Entomology Laboratory, USDA, Agricultural Research Service,
BBII, % U.S. National Museum NHB 168,
Washington, D.C. 20560

Abstract. — The species of the genus *Entedon* are revised for America north of Mexico. Eighteen species are recognized and a key is presented. Two species previously known from Europe (*methion* Walker and *stephanopachi* Heqvist) are present in North America as well as an additional species (*ergias* Walker) imported for biological control of smaller European elm bark beetle. Eight species are described as new (*ashmeadi*, *ernobii*, *genei*, *procerus*, *pecki*, *darleneae*, *teedoe*, and *anthonomi*). Lectotypes are designated for *Entedon bigeloviae* Ashmead, *E. occidentalis* Girault, *E. tachypterelli* Gahan, *Pleurotropis leucopus* Ashmead, and *Eriglyptus robustus* Crawford. Species of *Entedon* are primary parasites of a variety of beetles and one is known to attack Hymenoptera (Tenthredinidae). The known host species are indexed by family with their respective parasites.

Species in the genus *Entedon* are primary parasites of a variety of weevils, bruchids, bark beetles and other Coleoptera, with one species also attacking sawflies. The most recent North American Hymenoptera catalog (Burks, 1979) listed only 6 species from the Nearctic, with one species having been imported into the United States for the biological control of the smaller European elm bark beetle (*Scolytus multistriatus* (Marshall)). Aside from a short key by Girault (1922), the North American species have never been revised. It is apparent that there are undescribed species present, and that the limits of the previously known species are poorly defined. In addition, it has been discovered that some species known from Europe also occur in North America. This paper remedies these problems and also presents a key to the species found in North America.

The European species of *Entedon* have been revised for Britain (Graham, 1971) and Hungary (Erdős, 1944, 1951). Additional individual species have been described subsequent to these papers (e.g., Erdős, 1954; Boucek, 1974; Szelényi, 1977a, b). Unfortunately, no one has yet attempted to completely revise the Palearctic species for this genus and some gaps in our knowledge of that fauna remain.

Erdős (1944) proposed a number of subgenera within *Entedon*. Graham (1963, 1971) used a number of species groups, some of which corresponded to the subgenera of Erdős, while others consisted of various parts of those subgenera. The North American species will not fit either of these groupings and I believe that proposing further infrageneric groupings at this time would only further complicate the problem.

MATERIALS AND METHODS

The individual species are treated alphabetically after the key. Morphological terminology largely follows Graham (1959, 1963) and Gibson (1986). Terms for sculpture follows Harris (1979) and for common names of host species Werner (1982).

The metasoma includes the petiole (T1) so that T2 is the first gastral tergum. The funicular articles are numbered F1–3 in females and F1–5 in males and do not include the annelli. The term OCL refers to the distance from the posterior edge of a lateral ocellus to the occipital carina. Interscrobles refers to the area medially between and above the toruli which usually extends upwards to the junction of the frons and vertex. In most species it is indicated by a narrow smooth area interrupting the sculpturing of the frons. The frontal grooves (also called the arms of the frontal fork in Graham, 1959) extend outward from the middle of the face at an angle to dorsal edge of the eye. They form a v-shaped line, when present, and are very narrow and often difficult to see in females. They are absent in the majority of species and care should be taken when assessing this character.

The speculum is the area of the membrane of the forewing bounded by the lines of setae generally referred to as the cubital and basal veins. Since these setae are absent in most species of *Entedon*, the speculum is referred to as being open (closed when the setae are present, Fig. 25). I have referred to this character by the use of the presence or absence of the individual lines of setae. However, for clarity I have also included the corresponding condition of the speculum in parentheses.

The size of the individual alveoli on the midlobe of the mesoscutum is given in relative terms. This character is difficult to quantify and is subject to some variation. In specimens with larger alveoli, the distance between the sculptural ridges gives the appearance of a very shiny surface and even in species with moderate sized alveoli this shiny appearance remains. However, in some species these alveoli are small and close together and give the dorsum a dull appearance. Because of the subjective nature of this character and that fact that surface dirt may obscure the surface appearance, I have not used it in the key, but have only mentioned it in the species descriptions. All structures were measured at their longest or widest points.

The ratio of length to width of the metasoma is an often used character in this genus, but it is subject to considerable variation depending on the way in which it is preserved. Air-dried specimens always have the dorsum of the metasoma collapsed and in species in which the metasoma is 3 or 4 times as long as wide, the terminal segments tend to bend upwards. This distortion makes it difficult to obtain the exact ratio of length to width. As a result, the ratios given in the key are subject to some variation, but should not overlap those of the opposing part of the couplet. Thus, while the length to width of the metasoma of *E. ashmeadi* may vary slightly from exactly 2.0, it will not be anywhere close to the ratio of *E. teedoe*. Critical-point dried specimens generally do not suffer from these problems, but these are rare in collections.

Overall variation observed in specimens of new species is noted in the species descriptions, whereas for previously described species it is included under notes. In the key and in some of the diagnoses I have used a single estimate of length to width ratio, malar distance, and so on (e.g., couplet 4). These figures represent an approximate mean for that character and while there may be some variation around that estimate there will not be overlap.

Although this study is based primarily on North American material, I have studied specimens of most of the European species and consulted the available literature for that region. I have also examined species from other zoogeographic regions (e.g., Ethiopian and Oriental), but I have not attempted an exhaustive survey of those

species. As a result I have been able to include characters in the species descriptions which are known to vary in European species, even though none of the Nearctic species possess those features (e.g., the swollen marginal vein present in males of *E. costalis*).

Data on specimens examined is given in abbreviated form with the collector name omitted. The repository for specimens is indicated after each series or groups of series within a given state or province. Distribution data from the specimens examined is summarized under the distribution section. If the known distributional data is fragmentary, only the states or provinces are listed.

Acronyms for museums are given in the acknowledgments.

Entedon Dalman

Entedon Dalman, 1820:136,181.

Type-species. *Entedon cyanellus* Dalman. Designated by Ashmead, 1904. *Pleuropachus* Westwood, 1837:437.

Type-species. *Entedon costalis* Dalman. Orig. Desig. *Pleuropachys* Förster, 1856:78. Emendation.

Eriglyptus Crawford, 1907:179. Synonymy by Girault, 1916a.

Type-species. *Eriglyptus robustus* Crawford. Orig. Desig.

Entedonella Girault, 1913:154. Synonymy by Girault, 1916a.

Type-species. *Entedonella magnifica* Girault. Orig. Desig.

Metriocharis Silvestri, 1914:214. Synonymy by Boucek and Askew, 1968.

Type-species. *Metriocharis viridis* Silvestri. Orig. Desig.

Nephelentedon Erdös, 1944:18 (as subgenus of *Entedon*).

Type-species. *Entedon subfumatus* Erdös. Orig. Desig.

Megalentedon Erdös, 1944:27 (as subgenus of *Entedon*).

Types-species. *Entedon thomsonianus* Erdös. Orig. Desig.

Dolichentedon Erdös, 1944:31 (as subgenus of *Entedon*).

Type-species. *Entedon cioni* Thomson. Orig. Desig.

Chlorentedon Erdös, 1944:44 (as subgenus of *Entedon*).

Type-species. *Entedon subovatus* Thomson. Orig. Desig.

Trochentedon Erdös, 1944:61 (as subgenus of *Entedon*).

Type-species. *Entedon crassiscapus* Erdös. Orig. Desig.

Diagnosis. Species of *Entedon* can be separated from other Entedoninae by the following characters: female antenna with 3 annelli, 1st largest, 3 funiculars, and 2-segmented club (Figs. 26–42); mandibles with 2 teeth; pronotum reduced dorsally, expanded at lateral angles, without a transverse carina; notauli incomplete (Figs. 1, 2); propodeum with complete median longitudinal carina (Fig. 5), laterally with an inverted L-shaped sulcus anterior to and laterad of spiracle, tubercle present ventrally below the spiracle; second metasomal tergum (T2) with an oval membranous area adjacent to the petiolar emargination; stigmal vein petiolate; postmarginal vein about as long as stigmal (Figs. 23, 24); hind coxae triangular in cross section. In addition, the frontal grooves are generally absent, the petiole is reduced to a narrow transverse band dorsally (females), and the cubital and basal vein setae are absent at the base

of the wing (speculum open). However, one or all of these last 3 characters are known to occur in some species and should be checked against the species diagnoses.

Males are generally similar to the females, but differ consistently in some characteristics. The scape is generally broader relative to its width and has a long sensory strip along the anterior edge (Figs. 7, 8). The lengths of the flagellomeres are usually close to those of the females, except that the terminal two antennomeres are usually distinctly separated rather than fused and the setae on the segments are much denser. The interocular space is broader, so that in frontal view the eyes are wider apart and the overall width of the head is greater. The sculpturing of the interscrobal area and the face may differ, with the alveoli often larger and the smooth area more extensive. The frontal grooves, when present, and the occipital carina are often more strongly expressed than in the females. The metasoma is generally shorter relative to its width than in the females and may have an antero-medial light-colored spot. The petiole is usually at least as long as wide.

The monophyly of *Entedon* rests primarily on the structure of the median propodeum. None of the other genera which I consider to be closely related to *Entedon* possess a simple, complete, median carina situated in a narrow depressed area. Although the relationships of genera within the subfamily have not been critically assessed, a number of genera resemble *Entedon* in being strongly sclerotized (head and mesosoma not collapsing when dried), having strong alveolate sculpture on the head and mesosoma, and presence of a postero-lateral bump on the propodeum. This group includes the genera *Paracrias*, *Chrysocharis*, *Horismenus*, *Pediobius*, *Mestocharis*, *Derostenus*, and *Colpixys* (the last not known to occur in North America). *Mestocharis* has a median carina, but it is expanded anteriorly into a cup-shaped depression and lacks lateral depressions. Species of *Pediobius* have paired submedian carinae, and in *Horismenus* and *Paracrias* there is a broad, smooth, raised area bounded laterally by an equally broad, sunken, sculptured area. Species of *Colpixys* possess a broad sunken area medially and there is no median carina. The oval membranous area on the second metasomal tergum adjacent to the foramen is shared only with *Colpixys* and this character may indicate that these two genera are sister groups. I have also seen specimens that I would place as *Entedon* from Australia that have this oval area darkened and sclerotized rather than light colored and membranous. The postero-lateral expansions of the pronotum, which form a bump or protuberance, are not found in the same form in related genera. However, *Colpixys gigas* Boucek has a similar, although not as large, bump in this same area.

Another interesting character is the lack of scrobal grooves in species of *Entedon*. Almost all the other related genera (except *Derostenus*) possess distinct scrobal grooves which originate at the toruli and extend upwards to the frontal groove. Since the presence of scrobal grooves is almost certainly the primitive condition in entedonines, the lack of those grooves could be viewed as a synapomorphy for *Entedon*. Unfortunately, the lack of grooves in at least one other fairly closely related genus (*Derostenus*, which is not a likely sister group to *Entedon*) means that some independent losses of this character have occurred. In addition, several species of *Chrysocharis* and *Achrysocharoides* lack scrobal grooves and are similar in this respect to *Entedon*.

Entedon is a cosmopolitan genus which has been recorded from a number of hosts. The species are parasitic primarily on various families of Coleoptera, particularly Anobiidae, Bostrychidae, Buprestidae, Cerambycidae, Curculionidae, Mordellidae,

and Scolytidae (Boucek and Askew, 1968). There are also a number of records from hosts in the Lepidoptera, Diptera, and Hymenoptera which have been considered doubtful. It is now confirmed that one species parasitizes stem-gall forming tenthredinid sawflies.

This key will not always work for males, although some of them will run through with the characters common to both sexes (e.g., *occidentalis* and *darleneae*). However, since males remain unknown for several of the species, the construction of a separate key for males would be of limited value at this time. I have noted useful male characters where possible in the key and additional information is given, where available, in the species descriptions and diagnoses.

KEY TO FEMALES OF NORTH AMERICAN *ENTEDON*

- 1. Mandibles enlarged, with ventral tooth longer than dorsal (Fig. 3); oral fossa at least 4.0× malar space; clypeus protruding forward over mouthparts; foretibia with curved spine on anterior surface (Fig. 4) 2
 - Mandibles with teeth subequal in length (Fig. 9); oral fossa 3× as broad as malar space or less; clypeus truncate; foretibia without curved spine on anterior surface .. 3
- 2. Foretibia with a single longitudinal yellow stripe on anterior surface; metasoma about 2× as long as wide; F1 2-3× as long as wide (Fig. 34); posterior ocellus separated from occipital carina by 1/3 to 1/2 its own diameter; oral fossa about 6-6.5× as broad as malar space (Fig. 3); body length 2.4-4.0 mm *occidentalis* Girault
 - Foretibia without longitudinal yellow stripe; metasoma 1.1-1.4× as long as wide; F1 about 2× as long as wide (Fig. 37); posterior ocellus barely separated from occipital carina, often nearly touching it; oral fossa 4.0-5.0× as broad as malar space (Fig. 15); body length 1.8-2.1 mm *darleneae*, n. sp.
- 3. Female scape yellow to light brown; interscrobal area sculptured; mid-facial alveoli large, only 5-7 between eye margin and midline of face (Fig. 13); lateral surface of metasomal terga evenly alutaceous 4
 - Female scape dark; interscrobal area smooth; mid-facial alveoli smaller, at least 8-9 between eye margin and midline of face (Figs. 10, 11); lateral surface of metasomal terga mostly smooth, with only a small alutaceous patch (Fig. 16) 5
- 4. Metasoma about 2× as long as wide, F1 3-4× as long as wide (Fig. 27) *ashmeadi*, n. sp.
 - Metasoma about 3× as long as wide, F1 5× as long as wide (Fig. 28) *teedoe*, n. sp.
- 5. Frontal grooves present, extending to margin of eye (Figs. 11, 12) 6
 - Frontal grooves absent (Figs. 10, 15), if indicated medially, not extending to margin of eye 9
- 6. Scape 6× as long as wide (Fig. 33); speculum of forewing closed beneath submarginal vein (basal and cubital vein setae present) (Fig. 25) *ernobii*, n. sp.
 - Scape 8-9× as long as wide (Figs. 29, 30); speculum of forewing open below submarginal vein (basal and cubital vein setae absent) (Figs. 23, 24) 7
- 7. Metasoma 2× as long as wide, posterior margin of second tergum excised medially (Fig. 22) *washingtoni* Girault
 - Metasoma 2.5 or more × as long as wide, posterior margin of second tergum straight 8
- 8. Foretibia with two longitudinal stripes, mid and hindfemora yellow except at base; F1 3.5× as long as wide (Fig. 30) *stephanopachi* Heqvist
 - Foretibia without longitudinal stripes; mid and hindfemora dark except at apex; F1 5.5× as long as wide (Fig. 29) *methion* Walker

9. Midtibia almost entirely yellow, only with a small brown area at base; hindtibia at least half yellow *tachypterelli* Gahan
 – Midtibia mostly dark, only a small yellow area at apex; hindtibia with apical ¼ or less yellow 10
10. Propodeum laterad of median carina alveolate or rugosely sculptured (Fig. 6) 11
 – Propodeum laterad of median carina smooth or nearly so (Fig. 5) 12
11. Foretibia with 2 longitudinal stripes, F1 about 2× as long as wide, other funiculars longer than wide (Fig. 26); metasoma about 1.4× as long as wide; dorsal head width 3.0× length (Fig. 19) *anthonomi*, n. sp.
 – Foretibia without longitudinal stripes; funiculars all about as long as wide (Fig. 40); metasoma about 1.1× as long as wide; dorsal head width 2.5× length (Fig. 17) ...
 *leucopus* (Ashmead)
12. Metasoma 1.1–1.5× as long as wide 13
 – Metasoma at least 2× as long as wide 14
13. OOL equal to OCL (Fig. 18); propodeum laterad of median carina smooth and shining (Fig. 5); foretibiae with stripes; F1 2.5–3× as long as wide (Fig. 38) *ergias* Walker
 – OOL greater than OCL (as in Fig. 19); propodeum laterad of median carina with at least some light alutaceous sculpture; foretibiae without stripes; F1 1.5–2.0× as long as wide (Fig. 36) *columbianus* Ashmead
14. Metasoma 3.2–3.4× as long as wide *procerus*, n. sp.
 – Metasoma less than 3× as long as wide, usually only about 2–2.5× 15
15. Foretibia with 2 longitudinal stripes; interocular distance 4× eye width (Fig. 20); malar space ½ eye height *pecki*, n. sp.
 – Foretibia without longitudinal stripes; interocular distance 3× eye width or less (Fig. 21), malar space less than ½ eye height 16
16. F1 3× as long as wide (Fig. 39); area between toruli smooth (Fig. 10); length 2.5–3 mm *genei*, n. sp.
 – F1 2× as long as wide or less (Figs. 35, 43); area between toruli alutaceous; length about 2 mm 17
17. F2 & 3 subquadrate (Fig. 35); dorsal head width 2.4× length (as in Fig. 17); forewing densely setose (Fig. 23), with setae under basal half of submarginal vein *bigeloviae* Ashmead
 – F2 & 3 longer than wide (Fig. 43); dorsal head width 3× length (as in Fig. 19); forewing sparsely setose and bare under basal half of submarginal vein (Fig. 24)
 *robustus* (Crawford)

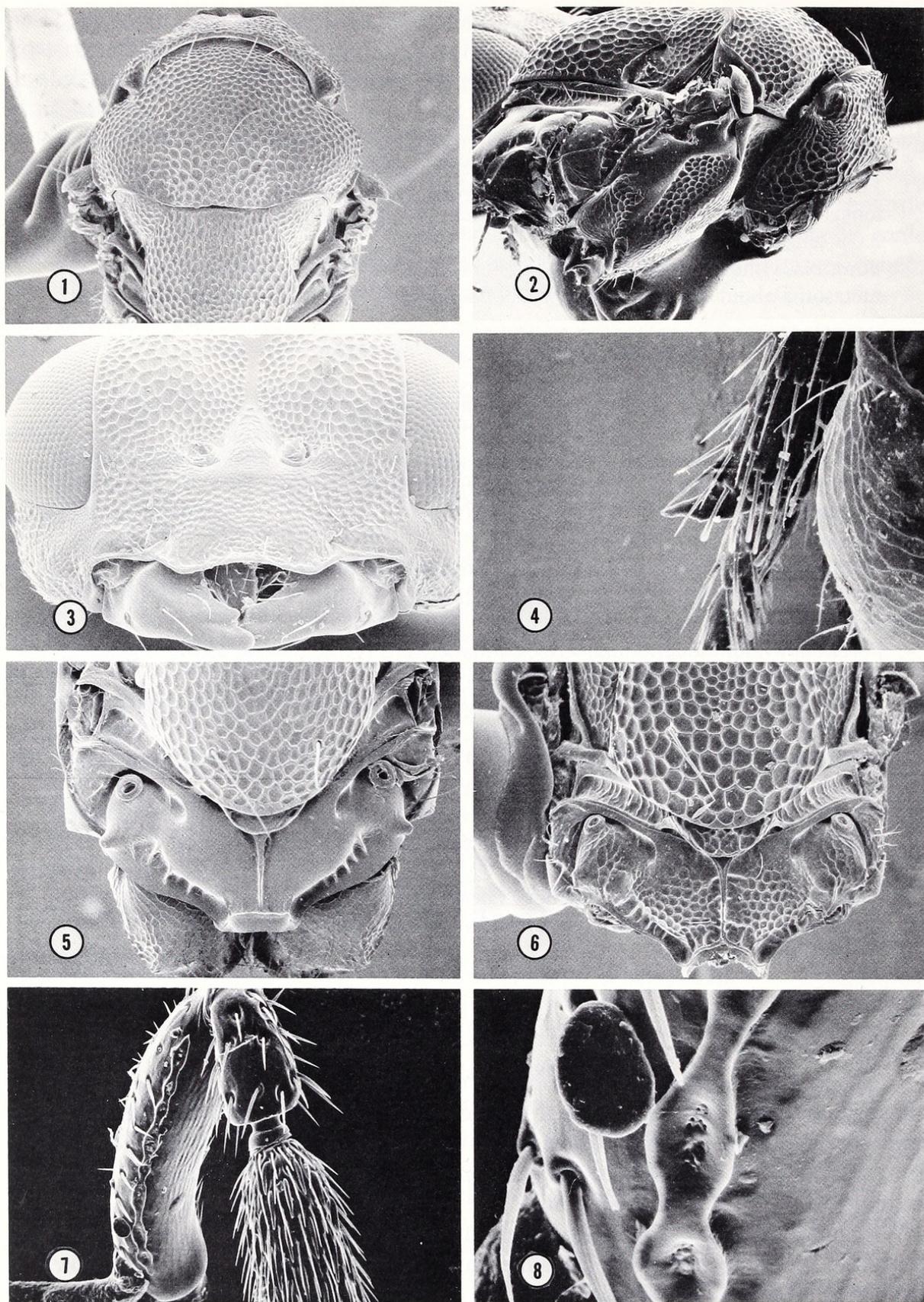
Entedon anthonomi, new species

Figs. 6, 19, 26, 48

Diagnosis. Foretibia with 2 longitudinal stripes; mid and hindtibia dark in basal half; eye height 2.5× malar space; metasoma about 1.5× as long as wide; frontal groove absent; interscrobles smooth; propodeum rugose or alveolate laterad of median carina (Fig. 6); F1 2× as long as wide, F2 & 3 1.5× as long as wide.

This species shares the evenly rugose propodeum with *leucopus*. It can be separated from that species by the foretibial stripes (absent in *leucopus*) and the longer funicular segments (all about as long as wide in *leucopus* (Fig. 40)). In other species which are similar (generally 1–3 mm and black bodied) the propodeum is nearly smooth or only lightly sculptured (e.g., *bigeloviae*, *robustus*, and *pecki*).

Description. Female length 2.0–2.2 mm. Color black, usually with some metallic



Figs. 1-8. Scanning electron micrographs. 1. *E. darleneae*, dorsal thorax. 2-4. *E. occidentalis*. 2. lateral thorax. 3. mandibles. 4. foretibial spine. 5. *E. ergias*, propodeum. 6. *E. anthonomi*, propodeum. 7-8. *E. occidentalis* ♂. 7. scape. 8. anterior edge enlarged.

dark blue or blue green reflections on the dorsal thorax. Femora, and first two metasomal terga, mandibles, flagellum, basal half of mid and hindfemora, foretibia except at base and apex, femora except at apex, basal half of mid and hindtibia, metasoma, black to dark brown. Lateral surfaces of foretibia, fourth tarsomere of all legs brown. Tips of femora, anterior and posterior surface of foretibia, apical half of mid and hindtibia, tarsomeres 1–3 of all legs yellow.

Head: Mandibles not enlarged, teeth subequal in length. Clypeus truncate, oral fossa $1.5\text{--}1.8\times$ malar space. Interscrobles smooth, space between toruli alutaceous. Toruli inserted above ventral margin of eye, mid facial alveoli of moderate size, about 8–9 between midline and margin of eye. Interocular distance $2.5\text{--}3.0\times$ width of eye, eye height $2.5\text{--}3.0\times$ malar space. Head width in dorsal view $3.0\text{--}3.8\times$ length, frontal groove absent, POL : OOL : OCL 13:6:2. Antennae as in Figure 26.

Mesosoma: Mesoscutum with postero-medial alveoli small, surface dull in appearance. Scutellum slightly longer than wide, evenly alveolate or with few elongated alveoli antero-medially. Posterior margin of metanotum overlapping anterior propodeum. Propodeum (Fig. 6) rugose laterad of median carina, callus with 2 large setae and about 10 smaller ones.

Metasoma: Petiole (T1) wider than long, smooth. Metasoma $1.0\text{--}1.5\times$ as long as wide, posterior margin of T2 straight, lateral surface smooth except for a small, alutaceous, setose area at antero-dorsal edge of each tergum.

Legs and wings: Foretibia with 2 longitudinal light stripes, without a curved spine at apex. Forewing hyaline, approximately $1.6\times$ as long as broad, densely setose, marginal fringe present. Basal and cubital vein setae absent under submarginal vein, few subcubital setae present; ratio submarginal : marginal : stigmal : postmarginal 36:45:6:6. Marginal vein not swollen at base.

Male. Generally similar to the female except: head and thorax metallic green. First three tarsomeres of forelegs light brown to yellow. Antennae as in Fig. 48. Petiole conical and about as long as wide. Metasoma $1.6\text{--}1.8\times$ as long as wide, without a basal yellow spot.

Hosts. Coleoptera, Curculionidae: *Anthonomus signatus* Say.

Distribution. Maryland, Ontario, New Brunswick.

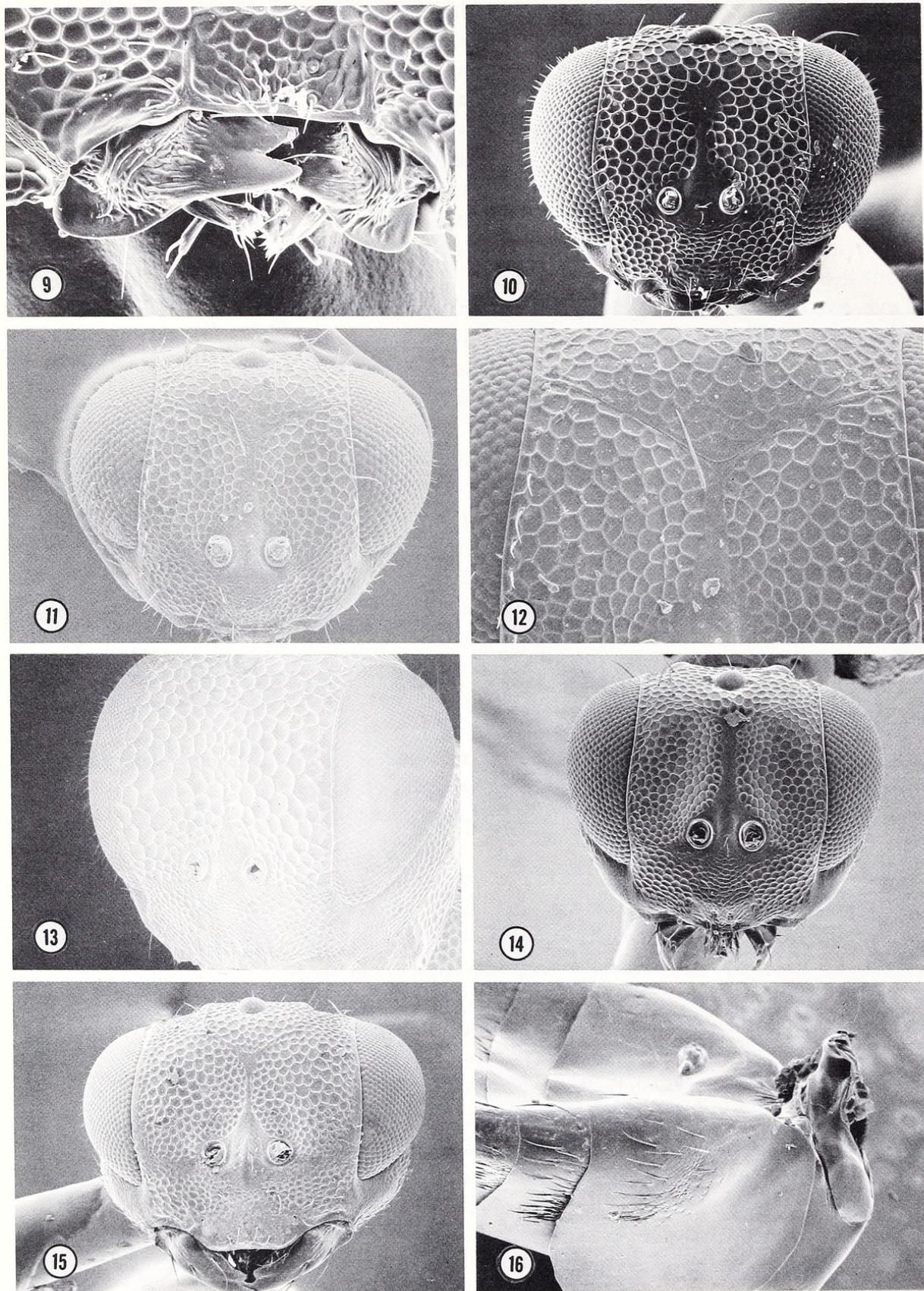
Types. Holotype female on point with data: Maryland, Calvert Co., Chesapeake Beach, 13-VI-1985. L. Masner, sweeping (Deposited in USNM). Paratypes: 1♀ with same data as the holotype (USNM); 1♀, Virginia, Louisa Co., 4 mi S. Cuckoo, 18-V-1985, J. Kloke & D. R. Smith, Malaise trap (USNM); 27♀, 17♂, Ontario, Kempville, 26-VI-1974, Collector L. Masner; 1♀, Ontario, Oxford Mills, 21-V-1975, L. Masner; 1♀, Ontario, Blackburn, 9-VI-1939, O. Peck; 1♀, Ontario, Marmora, 1-5-VI-1952, J. R. Vockeroth; 1♀, Ontario, Leitrim [?, illegible], 14-VI-1940, O. Peck; 5♀, 3♂, New Brunswick, Washademoak, Sept., 1941, C. W. Maxwell; Ex. *Anthonomus signatus* (all CNC). 1♀, 1♂, New York, Lancaster, June 4, 1917 (UCR).

Etymology. The species epithet is derived from the generic name of the host, *Anthonomus*.

Entedon ashmeadi, new species

Fig. 27

Diagnosis. Scape yellow; interscrobles alveolate, without smooth area; frontal grooves absent; facial alveoli large, only about 5 or 6 between scrobe and edge of eye (as in Fig. 13); F1 $3\text{--}4\times$ as long as wide (Fig. 27); metasoma $2\times$ as long as wide, with terga



Figs. 9–16. Scanning electron micrographs. 9–10. *E. genei*. 9. mandibles. 10. head. 11–12. *E. methion*. 11. head. 12. frontal groove. 13. *E. teedoe*, head (uncoated). 14. *E. ergias*, head. 15. *E. darleneae*, head. 16. *E. occidentalis*, lateral metasoma.

evenly sculptured laterally; foretibia with longitudinal stripes; mid and hindtibia yellow over at least half of length. Larger species, body length 3.7 mm.

This species is most closely related to *teedoe* with which it shares a yellow or light brown scape, the enlarged facial alveoli, and lack of a smooth interscrobal impression. It can be separated from that species by the length to width of the metasoma ($3\times$ as long as wide in *teedoe*) and F1 ($5\times$ as long as wide in *teedoe* (Fig. 28)).

Description. Female. Length 3.7–3.8 mm. Color as follows: head, mesosoma, second metasomal tergum, coxae, inner and outer lateral surface of foretibia iridescent blue-green. Antennal flagellum, mandibles, rest of metasoma, femora except postero-dorsal tip dark brown. Scape yellow except light brown at apex. Foretarsi and 4th tarsomere of mid and hindleg light brown. Mid and hindtibia dark brown basally fading to light brown and then yellow at approximately the middle of the tibia. Postero-dorsal tip of mid and hindfemur, anterior and posterior surface of foretibia, and 1st three tarsomeres of mid and hindleg yellow.

Head: Mandibles with teeth subequal in length. Clypeus truncate, oral fossa $2.3\times$ malar space. Interscrobles alveolate, without smooth area, space between toruli sculptured. Toruli inserted above ventral margin of eye, mid facial alveoli large, only about 5–6 between midline and margin of eye. Interocular distance $2.3\times$ width of eye, eye height $3.8\times$ malar space. Head width in dorsal view $3\times$ length, frontal grooves absent, POL : OOL : OCL 25:6:5. Antenna as in Fig. 27.

Mesosoma: Mesoscutum with postero-medial alveoli larger, surface shiny in appearance. Scutellum longer than wide, medially with a line of elongate alveoli. Posterior margin of metanotum overlapping anterior propodeum. Propodeum with very weak alutaceous sculpture laterad of median carina, callus with 2 large and about 20 smaller setae.

Metasoma: Petiole (T1) wider than long, smooth. Metasoma $2\times$ as long as wide, posterior margin of T2 straight, lateral surface evenly alutaceous.

Legs and wings: Foretibia with 2 longitudinal light stripes, without a curved spine on anterior edge. Forewing hyaline, $2.5\times$ as long as wide, densely setose. Marginal fringe present. Basal and cubital vein setae absent under submarginal vein, ratio submarginal : marginal : stigmal : postmarginal 57:67:6:6. Marginal vein not swollen at base.

Male. Unknown.

Host. Unknown.

Distribution. Known only from Wisconsin.

Types. Holotype ♀ with data: "Wisconsin, Douglass Co. T43W, R11W, S11; Plot no. 14A, May 28, 1956. ex boxes containing Pj and overwintering Budworm, also *Petrova*" (Deposited in USNM). 3 paratype ♀♀ with same state and county, other data as follows: T44N 10W S16, Plot no. 16A, V-25-1956; T44N 10W S29, Plot no. 185, V-23-1956; T43W R11W S11, Plot no. 5Cre, V-28-1956. One paratype deposited in BMNH.

Etymology. This species is named in honor of W. H. Ashmead, one of the first hymenopterists at the U.S. National Museum.

Entedon bigeloviae Ashmead

Figs. 23, 35

Entedon bigeloviae Ashmead, 1894:342.

Diagnosis. Foretibia without longitudinal stripes, metasoma $2\times$ as long as wide; frontal groove absent; forewing densely setose, with setae under basal submarginal vein (Fig. 23); interscrobles smooth; area between toruli alutaceous; interocular distance $3\times$ eye width, malar space $\frac{1}{3}$ eye height; propodeum nearly smooth laterad of median carina; F1 $1.5\times$ as long as wide (Fig. 35), F2 and F3 quadrate; dorsal head width $2.4\times$ length; body length 1.8–2.1 mm.

This species is most easily confused with *robustus*, *genei*, or *pecki* which are similar in size and black bodied. The presence of foretibial stripes and the longer malar space ($\frac{1}{2}$ eye height) distinguishes *pecki*, while *robustus* has the wings much more sparsely setose (Fig. 24), the dorsal head width is $3\times$ the length, and F 2 and 3 are longer than wide (Fig. 43). F1 is $3\times$ as long as wide in *genei* (Fig. 39) and the area between the toruli is smooth (Fig. 10).

Male. Unknown.

Hosts. Coleoptera, Curculionidae: *Epimechus* sp. on *Artemesia tridentata*.

Distribution. Western U.S. and Canada (also see notes below).

Types. Lectotype ♀ (present designation) on point with data: "N. Mex. [New Mexico], USNM type no. 2185. Two Paralectotype ♀♀ with same data (USNM).

Notes. Body length varies from 1.9–2.1 mm. There is color variation with some specimens markedly metallic green, while others are nearly entirely black. The legs may be black to brown and often with some purple cast. There is also some slight variation in the sculpturing of the dorsal thorax with the size of the alveoli on the scutum being larger in some specimens and giving more of a shiny appearance to the midlobe. The extent to which the alveoli on the scutellum are elongated also varies slightly, with some specimens nearly evenly alveolate.

There is a series of 4 specimens in the USNM collection from the Patuxent Wildlife Research Center, Prince George's Co., Maryland. Except for minor sculptural differences, I am unable to find any characters which might separate them from *bige-loviae*. However, since all the other specimens of this species are from the West I am reluctant to state definitely that these eastern specimens belong to the same species without additional material.

Other specimens examined. UNITED STATES. IDAHO. 1♀, Carey, Mar. 2♀♀, 1926, ex. bullet gall on *Artemesia tridentata* (USNM). MONTANA. 1♀, Wheatland Co., Deadman's Basin St. Rec. Area. 3,600'. 5-VI-1982 (CNC). NEVADA. 2♀♀, Arthur, I. LaRivers, 1937–38. *Artemesia tridentata* gall (USNM). TEXAS. 1♀, Del Rio, 10-V-1907. par. of *Epimechus*. Hunter no. 1423. 4♀♀, Devils River, 4-V-1907, bred from stem of *Sphaeralc. augustifol.* Hunter no. 1407. UTAH. 1♀, Logan, 10-IV-1933, bred from *Chrysothamnus* gall (USNM). CANADA. BRITISH COLUMBIA. 2♀♀, Walhachin. 23-IV-1954 (CNC).

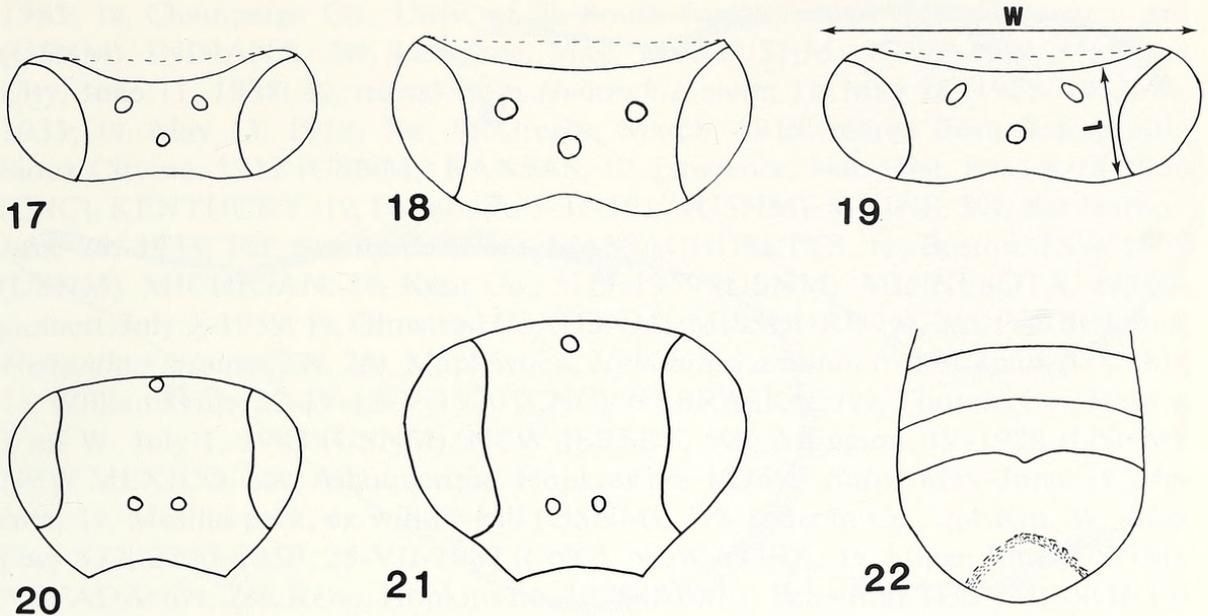
Entedon columbianus Ashmead

Figs. 36, 49

Entedon columbiana Ashmead, 1888:103.

Entedon columbianus Ashmead. Peck, 1951.

Diagnosis. Mandibles with teeth subequal in length; clypeus truncate; frontal groove absent; foretibia without longitudinal stripes, mid and hindtibia dark except at apex;



Figs. 17–22. 17–21. Female heads. 17. *E. leucopus*, dorsal. 18. *E. ergias*, dorsal. 19. *E. anthonomi*, dorsal. 20. *E. pecki*, frontal. 21. *E. robustus*, frontal. 22. *E. washingtoni*, dorsal anterior metasoma.

metasoma about $1.3\text{--}1.6\times$ as long as wide; F1 about $1.5\text{--}2.0\times$ as long as wide, F2, 3 about as long as wide (Fig. 36); OOL greater than OCL; propodeum lightly sculptured laterad of median carina then becoming smooth and shining. Body usually metallic green (or black) and about 2–3 mm in length.

This species is most easily confused with *E. ergias* which is about the same size, is usually metallic green, and otherwise similar in habitus. However, *ergias* has foretibial stripes, F1 is $2.5\text{--}3\times$ as long as wide (Fig. 38), and OOL is equal to OCL (Fig. 18).

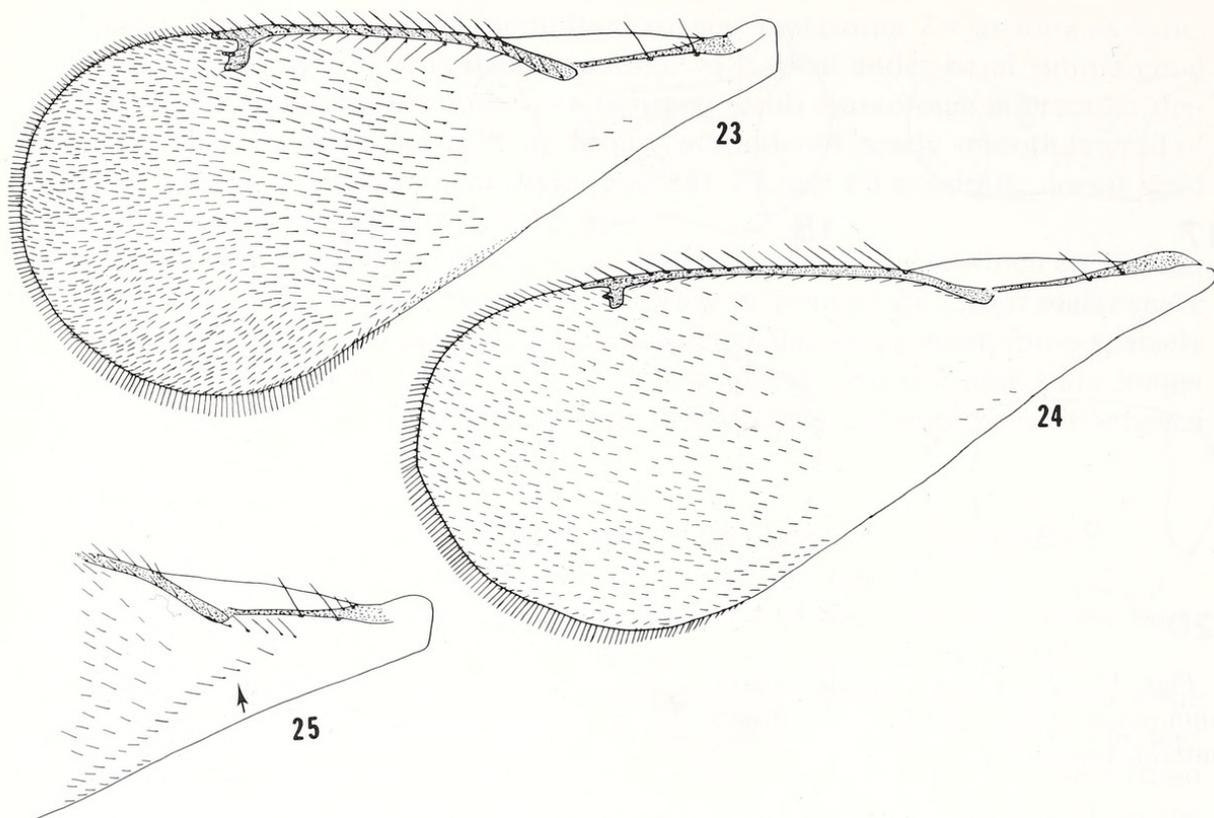
The males of *columbianus* have the metasoma $1.5\text{--}2.0\times$ as long as wide, without an anterior yellow spot and F1 is $2\text{--}2.5\times$ as long as wide and $1\text{--}1.5\times$ as long as F2 (Fig. 49).

Hosts. Coleoptera, Curculionidae: *Apion occidentale* Fall (Black sunflower stem weevil). Hymenoptera: Tenthredinidae. *Euura exiguae* Smith, *E. lasiolepis* Smith, *E. geyerianae* Smith. *Pontania* sp. The parasitization of sawfly hosts by species of *Entedon* has been questioned and most such records have been listed as doubtful (e.g., Boucek and Askew, 1968). The USNM and CNC collections contain series of specimens which are recorded from *Euura* species and these appear to be reliable. Considering that these sawfly hosts are gall formers in stems, the host habitat is not markedly different from that of other host taxa (e.g., *A. occidentale* in sunflower stems).

Distribution. Widespread throughout the United States and Canada.

Types. Holotype ♀ on point with data: "Washington [sic], D.C., USNM type no. 13146. *Entedon columbiana* Ashm." The specimen is missing the flagella of both antennae, all wings, right mid and hindleg, and left hindtibia and tarsi.

Notes. Body length varies from 1.7–2.6 mm. Smaller specimens tend to have the funicular segments shorter relative to their width. There are also some differences in



Figs. 23–25. Forewings. 23. *E. bigeloviae*. 24. *E. robustus*. 25. *E. ernobii*.

the size of the individual alveoli on the face, frons, midlobe of the scutum, and median scutellum. There is some variation in coloration from distinctly blue green to green and some specimens have a small yellow patch on the apex of the foretibia which may extend about $\frac{1}{4}$ of the length (in some this appears to be an incomplete stripe). The metasoma varies from black to brown, although the first two terga are always metallic.

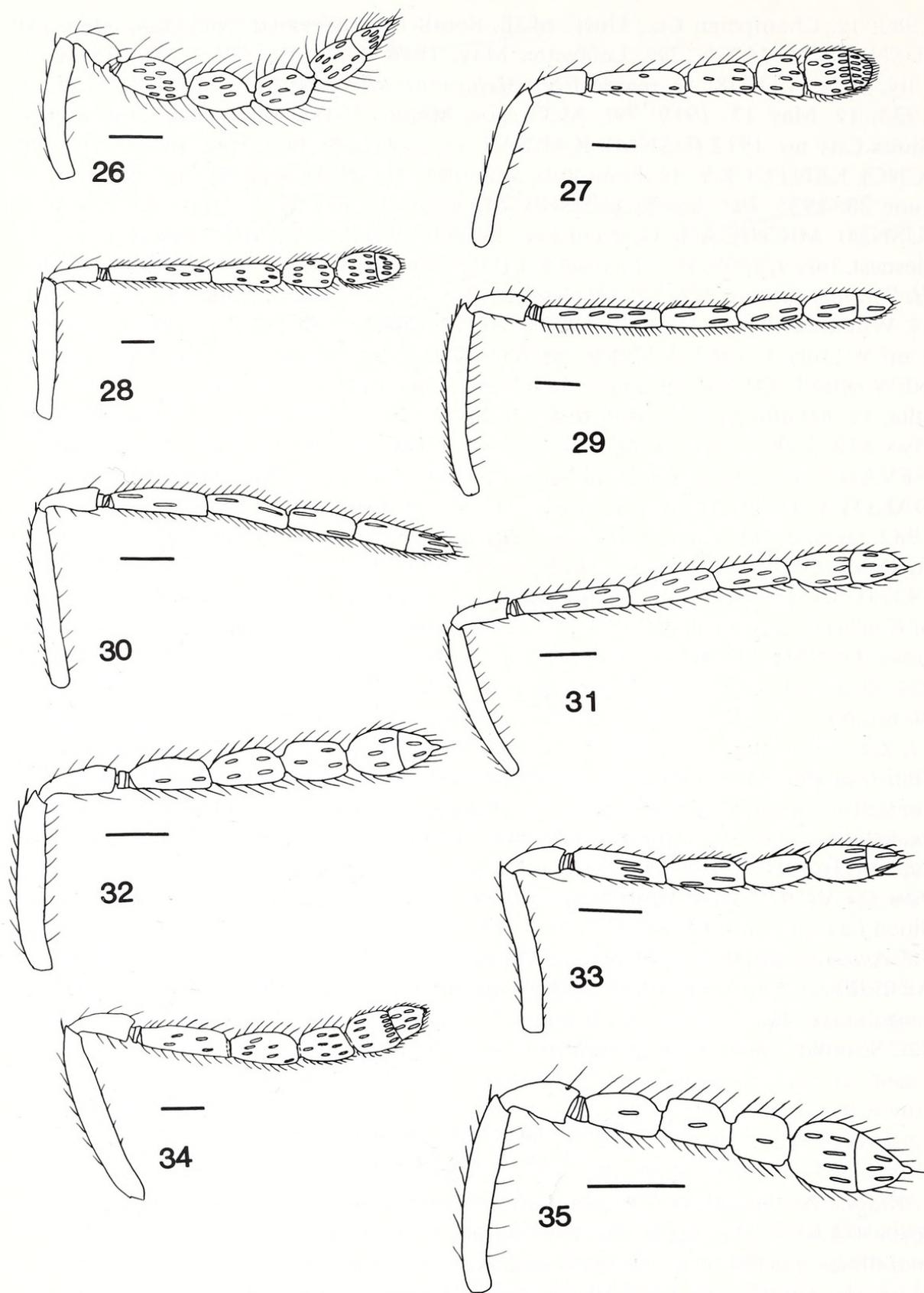
Other specimens examined. UNITED STATES. ARIZONA. 4♀♀, Baker no. 2123 (USNM). CALIFORNIA. 1♀, Fresno (USNM); 14♀♀, 9♂♂, Contra Costa Co., Antioch, 26-II-1967, ex. paratype series of *Euura (E.) exiguae*, *Salix exiguae* Nutt., *hiudsiana*, *melanopsis* (interior); 10♀♀, 5♂♂, Placer Co., 3.2 mi W. Emigrant Gap. 1,600 m, 23-IV-1968, Ex. paratypic series of *Euura (E.) lasiolepis*, Orange (interior) race; 1♀, Soda Springs, 6,760', 13-V-1966, ex. *Euura* stem gall on *Salix breweri* Bebb, or *S. lemmonii* Bebb (CNC). COLORADO. 9♀♀, Baker no. 1176; 1♀, Baker no. 2560; 1♀, Baker no. 1395; 1♀, Baker no. 1563; 15♀♀, 2♂♂, Colorado Springs, Hopkins no. 1202a, *Salix luteosericea*, various dates, May thru June; 1♀, Colorado Springs, Hopkins no. 10739, *Salix*; 3♀♀, N. Cheyenne Canyon, Hopkins no. 12082g & f July 29, 1915; 1♀, Douglas Co., Larkspur, Hopk. no. 12082f, on *Salix* with sawfly galls; 4♀♀, Larkspur, Hopkins no. 12081d & b; 1♀♀, Steamboat Springs, 9,000', 7-30-1953; 1♀, Ouray, 7-1-1937 (USNM), 1♀♀, Mt. Evans, Dolittle Ranch 9,800', 10-VIII-1961; 6♀♀, 2 mi. S. Meeker, 11-VII-1984; 1♀, Estes Park, 7,500' 20-VII-1961 (CNC). DISTRICT OF COLUMBIA. 1♀, D.C., May 24, 1894 (USNM). ILLINOIS. 1♀, Mississippi Palisades, 11-VI-

1983; 1♀, Champaign Co., Univ. of Ill. South Farms, reared from *Salix* stem gall (USNM). INDIANA. 2♀♀, Lafayette, May, 1918 (USNM). IOWA. 5♀♀, 1♂, Sioux City, June 11, 1938; 1♀, reared from *Helianthus* stem; 1♀, May 28, 1928; 1♀, June, 1933; 1♀, May 13, 1919; 7♀♀, McGregor, March, 1919, reared from *Bidens* pith, Sioux City no. 1912 (USNM). KANSAS. 1♀, Lawrence, Nat. Hist. Res., 8-16-1956 (CNC). KENTUCKY. 1♀, Falmouth, 5-31-1917 (USNM). MAINE. 3♀♀, Bar Harbor. June 28, 1935, Par. Sawfly (USNM). MASSACHUSETTS. 1♀, Boston, IX-4-1909 (USNM). MICHIGAN. 1♀, Kent Co., 5-17-1959 (USNM). MINNESOTA. 1♀, Eaglesnest, July 9, 1959; 1♀, Olmstead Co. (USNM). MISSOURI. 7♀♀, 2♂♂, East St. Louis, *Helianthus annuus*; 3♀♀, 2♂♂, Maplewood, *Helianthus annuus*, from ? *Apion* (USNM); 1♀, Williamsville, 22-IV-13-V-1970 (CNC). NEBRASKA. 7♀♀, Thomas Co., Halsey, 1 mi W. July 1, 1983 (USNM). NEW JERSEY. 5♀♀, Arlington, IV-1928 (USNM). NEW MEXICO. 3♀♀, Albuquerque. Hopkins no. 10769e, *Salix*. May-June; 1♀, Mesilla; 1♀, Mesilla park, ex willow gall (USNM); 3♀♀, Lincoln Co., 2.4 Km. W. Alto, Hwy 532, 2200-2250, 25-VII-1982 (CNC). NEW YORK. 1♀, Utica, June (USNM). NEVADA. 6♀♀, 2♂♂, Reno, Hopkins no. 10784f, *Salix*, Feb.-Mar. (USNM). NORTH DAKOTA. 1♀, Minot; 9♀♀, 1♂, Cass Co., Vining's test plot n. of Casselton, 26 Oct. 1982, taken in cultivated *Helianthus annuus* L., emerged from *Apion occidentale* Fall (USNM). OHIO. 1♀, Wayne Co., Smartweed; 1♀, Columbus; 1♀, Summit Co., 6-9-1937 (USNM). OREGON. 1♀, Klamath Co., Beatty, 24-V-1967, Ex., paratypic series of *Euura (E.) geyerianae* (CNC). SOUTH DAKOTA. 1♀, Elk Point, Swept from Blue grass (USNM). UTAH. 1♀, Logan Can., 5,500', 4-29-1957 (USNM). VERMONT. 2♀♀, Rutland Co., 3 mi. E. Danby, 31 July 1979 (USNM). WYOMING. 1♀, Laramie, 40 mi. NE, 7-13-37 (USNM). CANADA. QUEBEC. 3♀♀, 13♂♂, Hull, 27-28-II-1957; 1♀, 2♂♂, Cap Rouge, 8-VII-1953; 1♀, Lac. Mondor, 13-VI-1951; 1♀, Harrington Lk., Gatineau Pk., 31-V-1954 (CNC). ONTARIO. 1♀, ex. *Pontania* sp., 1964 (USNM). 1♀, Bell's Corner, ex. *Pontania* sp., F.I. Survey, 13-II-1945; 1♀, Merivale, 7-V-1956, ex. gall on willow; 1♀, Ottawa, 22-V-1941; 1♀, Ottawa, 24-VI-1958; 2♀♀, 7-VII-1943; 1♀, 25-VII-1957; 1♀, 26-V-1960; 2♀♀, Rainy River, 3-VII-1960; 2;♀♀, Hwy. 15, Stittsville, 24-V-1970, Host *Hexomyia schineri*; 1♀, Constance Bay, 11-V-1941. 2♀♀, One Sided Lake, 13 July 1960 (CNC). MANITOBA. 1♀, Pipestone, 7-IV-1965; 3♀♀, Criddle Aweme, 28-III-1905 (CNC). SASKATCHEWAN. 1♀, Snowden, 26-VII-1944. ALBERTA. 2♀♀, Lethbridge, 5-VI-1956; 3♀♀, Waterton, 18-VI-1956, Swept from range grass; 4♀♀, 13.5 Mi. S. Drion, 14-VI-1982. 1♀, Elkwater Lake, 21-VII-1956. 8♀♀, Scandia, 26-VI-1956. Swept from range grass (CNC).

Entedon darleneae, new species

Figs. 1, 15, 37, 50

Diagnosis. Mandibles enlarged, bottom tooth longer than top tooth (Fig. 15); oral fossa 4-5.0 × malar space; anterior margin of clypeus projecting forward over the mandibles; posterior ocellus separated from occipital carina by less than ½ its own diameter, often nearly touching the carina; F1 slightly less than 2 × as long as wide (Fig. 37), F3 usually broader than long; metasoma about 1.0-1.4 × as long as wide; foretibia without longitudinal stripes, anterior apex with curved projecting spine (as in Fig. 4); submarginal vein equal to marginal; 1.8-2.1 mm in length.



Figs. 26–35. Female antennae. 26. *E. anthonomi*. 27. *E. ashmeadi*. 28. *E. teedoe*. 29. *E. methion*. 30. *E. stephanopachi*. 31. *E. washingtoni*. 32. *E. tachypterelli*. 33. *E. ernobii*. 34. *E. occidentalis*. 35. *E. bigeloviae*. Scale line equals 0.1 mm.

This species is most easily confused with *occidentalis* which shares the mandibles with larger lower tooth, projecting clypeus, and curved spine on the anterior surface of the foretibia. That species can be separated from *darleneae* by: oral fossa $6-6.5 \times$ malar space (Fig. 3), posterior ocellus separated from occipital carina by at least $\frac{1}{2}$ its own diameter, foretibia with a single longitudinal stripe, F1 $2-3 \times$ as long as wide (Fig. 34), metasoma $2 \times$ as long as wide, and body length 2.5–4.0 mm.

Description. Female. Length 1.8–2.1 mm. Color metallic green except the following: flagellum, mandibles, middle of tibia, foretarsi, last two mid and hind tarsomeres dark brown. Apex of femora and base of tibia, distal $\frac{1}{5}$ to $\frac{1}{8}$ of tibia, first 2 mid and hind tarsomeres yellow.

Head: Mandibles enlarged, with bottom tooth longer than top. Clypeus produced forward, oral fossa $4-5.0 \times$ malar space. Interscrobles smooth, space between toruli alutaceous. Toruli inserted above ventral margin of eye, mid facial alveoli moderate, about 10–12 between midline and margin of eye. Interocular distance $3.8 \times$ width of eye, eye height $3.2 \times$ malar space. Head width in dorsal view $3.3 \times$ length, frontal grooves absent, POL : OOL : OCL 18:7:1. Antennae as in Fig. 36.

Mesosoma: Mesoscutum with postero-medial alveoli larger, surface shiny in appearance. Scutellum longer than wide, medially with a line of elongate alveoli. Posterior margin of metanotum overlapping anterior propodeum. Propodeum smooth laterad of median carina, rarely with very weakly expressed alveoli, callus with 2 large setae and 10–15 smaller setae.

Metasoma: Petiole (T1) wider than long, smooth. Metasoma $1.0-1.4 \times$ as long as wide, posterior margin of T2 straight, lateral surface smooth except for a small, alutaceous, setose area at antero-dorsal edge of each tergum.

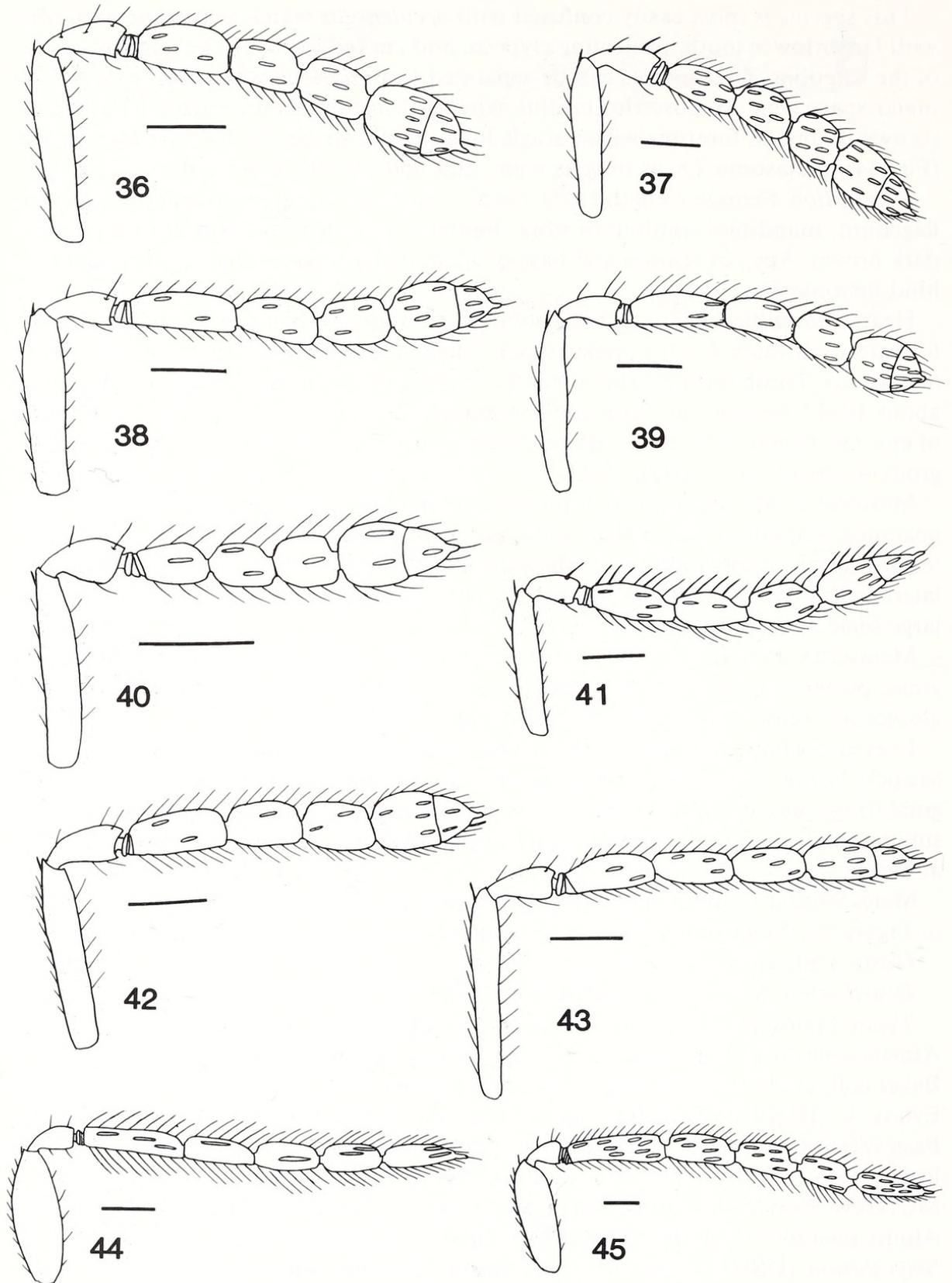
Legs and wings: Foretibia without longitudinal light stripes, with a curved spine at apex. Forewing hyaline, densely setose, approximately $2 \times$ as long as broad, marginal fringe present. Basal and cubital vein setae absent under submarginal vein, ratio submarginal : marginal : stigmal : postmarginal 25:25:4:4. Marginal vein not swollen at base.

Male. Similar to the female except the following: length 1.4–1.8 mm. Antennae as in Figure 50. Metasoma $1.8-2.0 \times$ as long as broad, without anterior yellow spot.

Hosts. Unknown.

Distribution. Midwestern and Western U.S. and Canada.

Types. Holotype ♀ on point with data: "Sioux City, Ia., Je., 11 [June], 1938. C. N. Ainslie collector (Deposited in USNM). Paratypes: COLORADO. 1♀, 2♂♂, 1582, Baker coll; 1♀, 1019, C. F. Baker collection (USNM); 1♀, Doolittle Ranch, 9,800' Mt. Evans, 4-VIII-1961; 1♀, Echo Lake, 10,600' Mt. Evans, July 26, 1961; 2♀♀, Loveland Pass West Slope, 9,850', 28-VII-1961, (CNC). MICHIGAN. 1♀, Michigan Agr. College, #234; 1♀, Mich. (no other data) (USNM). MONTANA. 1♀, Gallatin Co., 23 Mi. NNW West Yellowstone, Beaver Ck., 6,500 ft., July 24, 1978, Sweeping flowering Alpine meadow (AMNH). NEW MEXICO. 1♀, 4♂♂, Las Cruces, 17 Apr., 1895, on *Sisymbrium* (USNM); 2♀♀, 1♂, Bluff Spring, Lincoln National Forest, 26-30 VII-1977, Malaise trap (CNC). WYOMING. 1♀, Battle L. Road, Sierra Madre Range, 18-VII-1961, 8,500' (CNC). CANADA. ALBERTA. 5♀♀, 1♂, Scandia, 26-VI-1956; 1♀, Scandia, 11-VI-1956; 1♀, Lethbridge, 7-VII-1956; 1♂, Lethbridge, 25-VI-1956; 1♀, Lethbridge, 6-VII-1956; 3♀♀, Medicine Hat, 15-VII-1956; 4♀♀, McMurray, 30-



Figs. 36-45. Antennae. 36-42. Females. 36. *E. columbianus*. 37. *E. darleneae*. 38. *E. ergias*. 39. *E. genei*. 40. *E. leucopus*. 41. *E. procerus*. 42. *E. pecki*. 43. *E. robustus*. 44-45. Males. 44. *E. teedoe*. 45. *E. stephanopachi*. Scale line equals 0.1 mm.

VII-1953; 1♀, McMurray, 8-VIII-1953; 1♀, Aspen Beach, Aug. 22, 1944, O. Peck (CNC). MANITOBA. 1♀, Brandon, 16-VII-1958 (CNC). NORTH WEST TERRITORIES. 1♂, Yellowknife, 19-VIII-1949; 1♀, Norman Wells, 10-VII-1949 (CNC). ONTARIO. 1♀, Ottawa, 10-17 VII-1979 (CNC). SASKATCHEWAN. 1♀, Snowden, 28-VII-1944; 2♀♀, 1♂, White Fox, 10-VII-1944; 1♀, White Fox, 11-VII-1944 (CNC).

Etymology. This species is named in honor of my mother Darlene M. Schauff.

Entedon ergias Walker

Figs. 5, 14, 18, 38, 55

Entedon ergias Walker, 1839:100.

Entedon busiris Walker, 1839:99.

Entedon merion Walker, 1839:100.

Elachestus annulatus Förster, 1841:39.

Ichneumon leucogramma Ratzeburg, 1844:170.

Eulophus albipes Ratzeburg, 1844:165.

Diagnosis. Frontal groove absent; interscrobles smooth; OOL equal to OCL (Fig. 18); F1 2.5–3× as long as wide (Fig. 38); foretibia with 2 longitudinal light stripes (see below) (males with 2 distinct stripes); propodeum laterad of median carina smooth; metasoma only about 1.2× as long as wide. Body color generally black or dark metallic green and about 1.8–2.5 mm in length.

Males of *ergias* have the metasoma about 1.3–2× as long as wide and with a large basal yellow spot. The midtibia may be almost entirely yellow or with the basal ¼–½ light brown. F1 is about 3× as long as wide and 1.5× as long as F2 (Fig. 55).

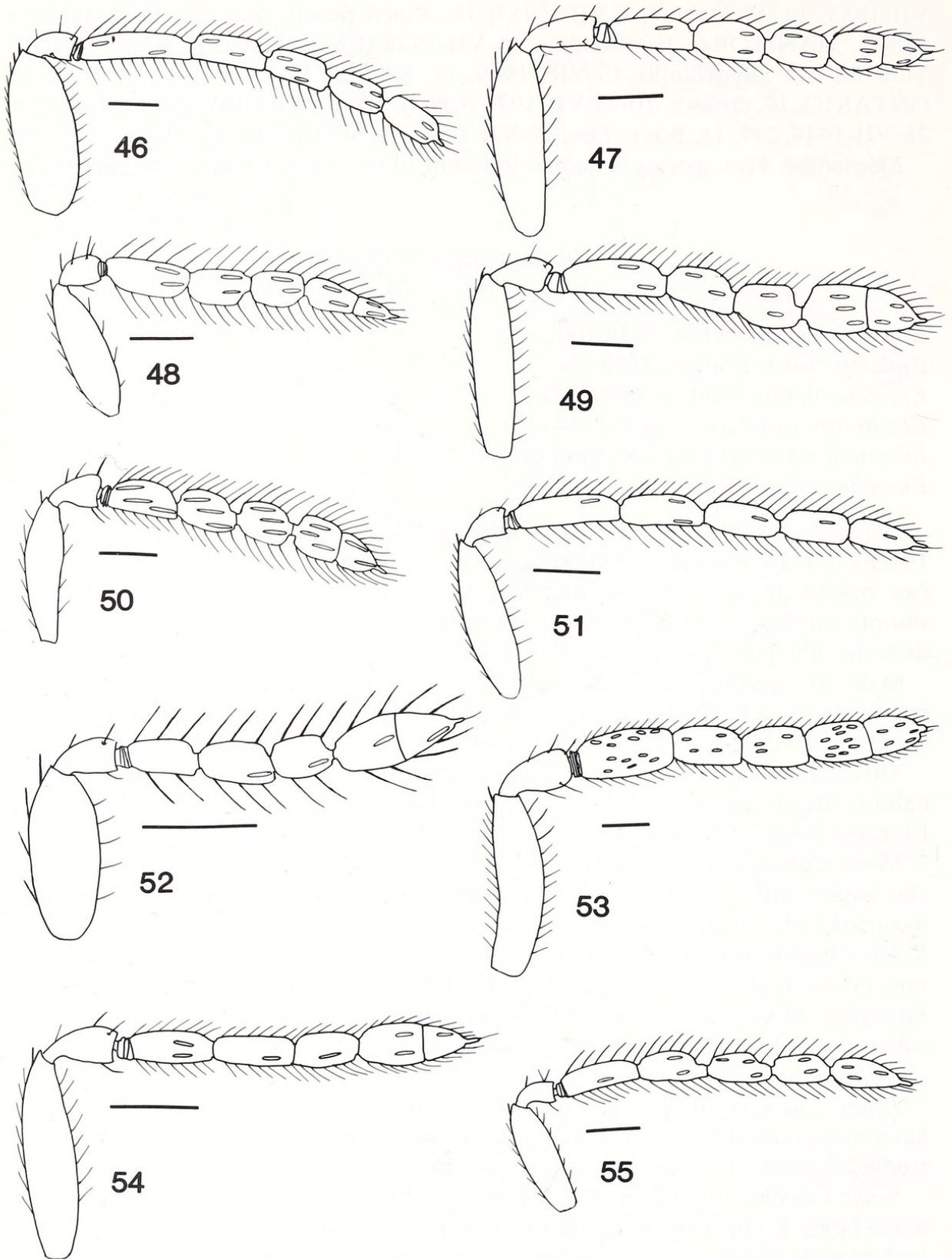
This species is most easily confused with *E. columbianus*, which is similar in habitus. However, *columbianus* can be differentiated by the lack of foretibial stripes, F1 1.5–2.0× as long as wide (Fig. 36), and OOL greater than OCL.

Hosts. Coleoptera, Scolytidae: *Scolytus multistriatus* (Marsham) (smaller European elm bark beetle), *S. rugulosus* (Muller) (shot hole borer). Several other hosts are recorded for Europe (Boucek and Askew, 1968), including *Scolytus scolytus* Fabricius, *S. mali* (Bechstein) (larger shothole borer), *S. intricatus* (Ratzeburg), and *s. ratzeburgi* Janson. As noted by Beaver (1966), there are also records of this species attacking *Pityogenes bidentatus* (Herbst) (Scolytidae) and *Magdalis armigera* (Geoffroy) (Curculionidae) which are considered as questionable.

Distribution. Eastern U.S. and Canada. Europe.

Types. The type of this species is in the British Museum (Graham, 1963) and I have not examined it. This species, however, is readily recognizable and I have studied reliably identified specimens from Europe.

Notes. Length varies from 1.8–2.3 mm (up to 2.8 mm in some European specimens). Some larger European specimens also may have the metasoma as much as 1.6× as long as wide. General body color ranges from black to metallic green or blue green. Although most specimens have the propodeum laterad of the median carina completely smooth, they may occasionally have some very light indication of alutaceous sculpture. Graham (1971) and others have noted that this species has the sculpturing on the dorsum of the thorax very weakly raised from the surface. While this is true,



Figs. 46–55. Male Antennae. 46. *E. methion*. 47. *E. tachypterelli*. 48. *E. anthonomi*. 49. *E. columbianus*. 50. *E. darleneae*. 51. *E. ernobii*. 52. *E. leucopus*. 53. *E. occidentalis*. 54. *E. robustus*. 55. *E. ergias*. Scale line equals 0.1 mm.

it is difficult to assess this character without other specimens for comparison. Some specimens have the longitudinal stripes on the foretibia present only as slightly lighter areas than the rest of the tibia or with the stripes fading toward the middle of the tibia.

For many years this species was cited in the literature as *E. leucogramma* (Ratzeburg). That name was recognized as a junior synonym of *E. ergias* by Boucek and Askew (1968). This species has been introduced into the United States from Europe for the control of elm bark beetles. The life history and immature stages of this species was studied by Beaver (1966). Its biology is unusual in that the female enters the gallery of the scolytid host and oviposits in the egg. However, the parasite does not complete its development until the host larva is quite large. This egg-larval mode of development is uncommon in chalcidoids and especially in Entedoninae.

Specimens examined. UNITED STATES. CALIFORNIA. 1♀, Heraldsburg, 7-21-1944, at entrance of shot-hole borer (USNM). CONNECTICUT. 1♀, 1♂, New Haven, Sept. 12, 1957, reared elm; 1♀, Fairfield, Mar. 1, 1934, Hopk. no. 17620c, ex. *S. multistriatus* (USNM). IOWA. 1♂, Hamburg, V-28-1953, ex. *S. rugulosus* (USNM). NEW YORK. 2♂♂, Rockland Co., 1 June, 1936, Bred from Elm; 1♀, 3♂♂, Yonkers, 3 Aug., 1937, C.U. invest. Dutch Elm Dis.; 1♀, 1♂, Pearl River, June 5, 1936, C.U. Inves. Dutch Elm Dis.; 1♀, 3♂♂, Westchester Co., Lowr., Reared elm (USNM). NORTH CAROLINA. 2♀♀, 1♂, Durham, Oct. 6, 1941, Reared, Host: *S. rugulosus* (USNM). OHIO. 1♀, Barberton, 6-30-1936; 2♀♀, Warren, Aug. 26, 1939 ex. *S. rugulosus* (USNM). PENNSYLVANIA. 2♀♀, Allegheny Co., ex. elm branches infested with *S. multistriatus*; 1♀, 1♂, Chestnut Hill, XII-27-1958, reared *S. rugulosus*; 6♀♀, Hatboro, June 8, 1922, from trees infested with scolytidae; 6♀♀, 4♂♂, Dauphine Co., Middleton, 18-VIII-18-X, 1977, ex. American elm (USNM). SOUTH CAROLINA. 1♂, Clemson (USNM). VIRGINIA. 1♀, Fairfax Co., nr. Annandale, V-30-31, 1981, Malaise trap; 1♀, Alexandria, Dec. 1, 1970, *Scolytus rugulosus* (USNM). CANADA. ONTARIO. 2♀♀, 1♂, Toronto, 20-VII-1970, ex. elm log with scolytid beetles; 2♀♀, 3♂♂, Toronto, 22-VI-1971, ex. *Scolytus multistriatus*; 1♀, Brampton, 20-IX-1966, Host: *Scolytus multistriatus*; 2♀♀, 2♂♂, Belfountain, F.I.S., 70-595 ex. *S. multistriatus*; 1♀, Rondeau Park, 22-VI-1922. QUEBEC. 1♀, 1♂, St. Hilaire, 4-IX-1968, ex. *Scolytus rugulosus* (CNC). NOVA SCOTIA. 2♀♀, Crosby, Sept. 23, 1952, taken on apple (CNC). Also about 28 specimens from Europe (CNC, USNM).

Entedon ernobii, new species

Figs. 25, 33, 51

Diagnosis. Foretibia without stripes; frontal grooves present; metasoma 2× as long as wide, posterior margin of T2 straight; forewing (Fig. 25) with cubital and basal vein setae present (speculum closed); antennae (Fig. 33) with scape 6× as long as wide, F1 4× as long as wide; midtibia with basal ½ brown, remainder yellow.

This species is most easily confused with *methion*, *stephanopachi*, and *washingtoni* which also have the frontal grooves present. All of these other species have the speculum open (as in Figs. 23, 24) (basal and cubital vein setae absent under submarginal). In addition, *washingtoni* has the second metasoma tergum excised medially (Fig. 22), *stephanopachi* has foretibial stripes, and *methion* has F1 5.5× as long as wide (Fig. 29).

Description. Female. Length 2.1–2.5 mm. Color black, usually with some metallic dark blue or blue green reflections on the first two metasomal terga. Mandibles,

antennae, metasoma except basal segments dark brown to black. Apex and base of all femora and tibia, apical $\frac{1}{4}$ to $\frac{1}{5}$ of tibia, first 3 tarsomeres of all legs yellow.

Head: Mandibles not enlarged, teeth subequal in length. Clypeus truncate, oral fossa $1.5-1.7 \times$ malar space. Interscrobles smooth, space between toruli alutaceous. Toruli inserted above ventral margin of eye, mid facial alveoli moderate, about 8-9 between midline and margin of eye. Interocular distance $2.5-3.0 \times$ width of eye, eye height $2.0-2.2 \times$ malar space. Head width in dorsal view $2.7-3.0 \times$ length, frontal groove present, POL : OOL : OCL 13:6:3. Antenna as in Figure 33.

Mesosoma: Mesoscutum with postero-medial alveoli moderate in size, surface shiny in appearance. Scutellum longer than wide, evenly alveolate or with few elongated alveoli antero-medially. Posterior margin of metanotum overlapping anterior propodeum. Propodeum smooth to lightly alveolate laterad of median carina, callus with 2 setae and about 6 smaller ones.

Metasoma: Petiole wider than long, smooth. Metasoma $1.5 \times$ as long as wide, posterior margin of T2 straight, lateral surface smooth except for a small, alutaceous, setose area at antero-dorsal edge of each tergum.

Legs and wings: Foretibia without longitudinal light stripes, without a curved spine at apex. Forewing hyaline, approximately $2.4 \times$ as long as broad, densely setose, marginal fringe present. Basal and cubital vein setae present under submarginal vein (speculum closed) (Fig. 25), few subcubital setae present, ratio submarginal : marginal : stigmal : postmarginal 37:46:5:5. Marginal vein not swollen at base.

Male. Generally similar to the female except: body length 1.9-2.2 mm; head and thorax usually more distinctly metallic green. Antenna as in Figure 51. Interocular distance $3.4 \times$ eye width. Petiole conical and about as long as wide. Metasoma $2.5 \times$ as long as wide, without a basal yellow spot.

Hosts. Coleoptera, Anobiidae: *Ernobius pinicola* Ruckes, *E. melanoventris* Ruckes.

Distribution. California and Nevada.

Notes. The darkened areas of the mid and hindtibia vary from black to brown. The tarsomeres of the foreleg, and the apical tarsomeres of the mid and hindleg vary from yellow to light brown.

Types. Holotype female on point with data: "California, Tuolumne Co., Pinecrest. VI-5-1957. ex. cones of *Pinus jeffreyi*. H. Ruckes, Jr. No. 290" (Deposited in USNM). Paratypes as follows: CALIFORNIA. 10♀♀, 6♂♂, Cuyamaca St. Pk., Green View Meadow, ex. *Ernobius pinicola* & *E. melanoventris* on *P. jeffreyi* and *P. monophylla*, various dates from Jan. 1956-Aug. 1957, H. Ruckes, Jr.; 1♀, 1♂, San Diego Co., Cuyamaca, ex. *Ernobius* sp. cones of *Pinus jeffreyi*, H. Ruckes; 1♀, 2♂♂, Siskyou Co., Lava Beds Natl. Pk., 22-VII-1953. NEVADA. 3♀♀, 1♂, Storey Co., Crystal Bay, 3-X-1955. ex cones of *Pinus ponderosa*, H. Ruckes, Jr. All paratypes in USNM except one pair in CNC and BMNH.

Etymology. This species is named for the genus of the known hosts, *Ernobius*.

Entedon genei, new species

Figs. 9, 10, 39

Diagnosis. Foretibia without longitudinal stripes; interscrobles smooth and area between toruli smooth (Fig. 10); frontal groove absent; F1 $3 \times$ as long as wide (Fig.

39); propodeum laterad of median carina smooth or very lightly alutaceous; metasoma $2\times$ as long as wide. Larger species, body length 2.5–3.1 mm.

This species is most easily confused with *robustus* or *bigeloviae* which are also black bodied, lack foretibial stripes, are without frontal grooves, and have the median propodeum lightly sculptured. It can be separated by the length of F1 (1.5 or $2.0\times$ as long as wide in the other species (Figs. 35, 43)) and the area between the toruli is smooth (alutaceous in other species). Additionally, *robustus* has the forewing with much sparser setation (Fig. 24).

Description. Female. Length 2.5–3.1 mm. Color black, usually with some metallic dark blue or purplish reflections on the dorsal thorax. Femora, and first two metasomal terga, mandibles and fourth tarsomere of all legs brown. Apices of femora, apical $\frac{1}{4}$ – $\frac{1}{5}$ of tibia, first 3 tarsomeres of all legs yellow.

Head: Mandibles not enlarged, teeth subequal in length; clypeus truncate, oral fossa 2.0 – $2.5\times$ malar space. Interscrobles smooth, space between toruli smooth. Toruli inserted above ventral margin of eye, mid facial alveoli moderate, about 8–9 between midline and margin of eye. Interocular distance $2.6\times$ width of eye, eye height $3.0\times$ malar space. Head width in dorsal view $2.8\times$ length; frontal grooves absent, POL : OOL : OCL 18:7:2. Antennae as in Figure 39.

Mesosoma: Mesoscutum with postero-medial alveoli large, surface shiny in appearance. Scutellum longer than wide, evenly alveolate. Posterior margin of metanotum overlapping anterior propodeum. Propodeum smooth or very lightly alutaceous laterad of median carina, callus with 2 large and about 15 to 20 smaller setae.

Metasoma: Petiole (T1) wider than long, smooth. Metasoma $2.0\times$ as long as wide, posterior margin of T2 straight, lateral surface smooth except for a small, alutaceous, setose area at antero-dorsal edge of each tergum.

Legs and wings: Foretibia without longitudinal light stripes, without a curved spine at apex. Forewing hyaline, $2.0\times$ as long as wide, densely setose, marginal fringe present. Basal and cubital vein setae absent under submarginal vein, few subcubital setae present; ratio submarginal : marginal : stigmal : postmarginal 28:30:3:3. Marginal vein not swollen at base.

Male. Unknown.

Hosts. Unknown.

Distribution. Northeastern U.S. and Canada.

Types. Holotype female on point with data: "USA, New York, Long Island, South Haven, June 1–9, 1974. M Kamran" (Deposited in AMNH). Paratypes: 2♀, same locality as holotype with collection dates of VI-19-1974 (AMNH) and June 23–30, 1976 (USNM). 1♀, RHODE ISLAND, Westerly, VI-20-1936, M. Chapman (AEI). 2♀, NEW YORK, Ithaca, Coll. F. H. Chittenden (USNM). 1♀, Flatbush, 25-V-1894, J. L. Zabriskie, 615 *Entedon*, parasite on 614 (USNM). 1♀, Otsego, VII-3-1935, H. K. Townes (AEI). 3♀, New Brunswick, Kouchibouguac N.P., 11-12-VII-1977. M. Ivanochko. code 5594D (CNC). 1♀, on plastic card with red label "*Metacolus conicus*" [other writing illegible] (CNC). 1♀, with red tag that reads "Bathroom, III, Cooper" (CNC).

Etymology. This species is named in honor of my father Leo E. Schauff, known to his friends as Gene.

Entedon leucopus (Ashmead)

Figs. 17, 40, 52

Pleurotropis leucopus Ashmead, 1888:102.*Entedon leucopus* (Ashmead). Peck, 1951.

Diagnosis. Foretibia without longitudinal stripes, metasoma 1–1.2× as long as wide; frontal grooves absent; interscrobles smooth; propodeum rugose or alveolate laterad of median carina then becoming smooth towards spiracle; F1 1.5× as long as wide (Fig. 40), F2 and F3 quadrate; dorsal head width 2.5× length (Fig. 17). Body length 1.1–1.5 mm, color black.

Males have the head metallic blue green. The antenna (Fig. 52) has F4 and F5 forming a club. The metasoma is 1.9× as long as wide, and with a light brown spot antero-dorsally. The mid and hindtibia are yellow in apical half.

This species shares the rugose propodeum with *anthonomi* and can be separated from it by the absence of foretibial stripes (present in *anthonomi*) and the shorter funicular segments (all segments longer than wide in *anthonomi* (Fig. 26)). In addition, the alveolate sculpture of the vertex and the mid lobe of the scutum is weak in *leucopus*, the individual alveoli large (about equal in diameter to an ocellus) and the surface appears shiny. The sculpture of *anthonomi* is much coarser, the individual alveoli smaller, and the appearance of the head and scutum is dull by comparison. The size of individual alveoli seems to vary with size and may also vary with host. I am therefore reluctant to place too much emphasis on this character.

Hosts. Unknown.

Distribution. Only known from Florida, Ontario, and Quebec.

Types. Lectotype ♀ (present designation) on pin with 4 card mounts containing 5 specimens. The lectotype is on the third card from the top and has been marked with a black arrow on the card. The only data attached to the specimens is a small card with the name "*Pleurotropis leucopus* Ashm." and a small red USNM type card with the number "41375" (Ashmead indicated Florida as the type locality in the original publication). There are 12 paralectotype females on three other pins. Lectotype and paralectotype labels have been attached to each pin (all USNM).

Notes. Some variation was observed in the amount of yellow on the mid and hindtibia. Most specimens have only the distal ¼ yellow, but two females had the yellow coloration extended for ⅓ to ½ the length of the tibia.

Other specimens examined. CANADA. ONTARIO. 1♀, Ottawa, 3-VI-1940; 1♀ Bell's Corner, 23-V-1945 (CNC). QUEBEC. 1♀, Cap Rouge, 8-VII-1953; 1♀, Laniel, 14-VI-1941; 1♀, Gatineau Pk., 13-VI-1980 (CNC).

Entedon methion Walker

Figs. 11, 12, 29, 46

Entedon methion Walker, 1839:105.*Entedon gyorfii* Erdős, 1954:348.

Diagnosis. Frontal grooves present (Fig. 12); scape 8–9× as long as wide, F1 5.5× as long as wide (Fig. 29); malar space nearly half of eye height; foretibia without longitudinal stripes; metasoma 3–4× as long as wide; mid and hind femora dark

brown except at apex. Body color is generally black. This is a generally larger species with body length ranging from 3.0–3.5 mm (about 2.5 mm for males).

Males have some metallic green or blue on the head and thorax. The metasoma is about 2× as long as wide and without an anterior yellow spot. F1 is 5× as long as wide with F2 3× as long as wide and F5 clearly separated from the other funiculars (Fig. 46).

This species is most easily confused with *stephanopachi*, *washingtoni*, and *ernobii* which also have the frontal grooves present. It can be separated from them by: foretibial stripes present and mid and hindtibia yellow except at base in *stephanopachi*; metasoma 2× as long as wide in *washingtoni*; speculum closed in *ernobii* (Fig. 25).

Hosts. Coleoptera, Anobiidae: *Ernobius mollis* L. In Europe, *methion* is also recorded from *Ernobius nigrinus* Sturm and *Ips acuminatus* Gyllenhal (Scolytidae).

Types. I have not examined the type of this species which is in the British Museum (Graham, 1971). However, this species is quite distinctive and I have studied specimens determined by Z. Boucek who has examined the type.

Distribution. Eastern U.S., Colorado, and Europe.

Notes. Foretarsi may be yellow to dark brown; sculpture of propodeum from lightly alutaceous to lightly rugose.

Other specimens examined. UNITED STATES. MAINE. 1♀, Mt. Desert, July 31, 1922 (USNM). RHODE ISLAND. 1♀, Tiverton, Mar. 23, 1951 (USNM). MARYLAND. 1♀, Plummers Island, 6-VI-1913, *Acer*, Hopkins no. 11338 (USNM). MASSACHUSETTS. 2♀♀, 2♂♂, Worcester, July 27, 1917, Par. *Ernobius mollis*, *Pinus* (USNM). COLORADO. 1♀, 1♂, El Paso Co., reared July 8, 1915, *Pinus flexilis* Hopkins no. 12421 (USNM). I have also examined several European specimens determined by Z. Boucek (USNM).

Entedon occidentalis Girault

Figs. 2, 3, 4, 7, 8, 16, 34, 53

Entedon occidentalis Girault, 1916b:48

Diagnosis. Mandibles enlarged, oral fossa 6–6.5× malar space, bottom tooth longer than top tooth (Fig. 3), anterior margin of clypeus projecting forward. Posterior ocellus separated from occipital carina by about ½ to ⅔ its own diameter. F1 2.0–3× as long as wide (Fig. 34), F2 & 3 at least as long as wide. Metasoma about 2× as long as wide. Foretibia with a single light longitudinal stripe, anterior apex with curved projecting spine (Fig. 4). Submarginal vein equal in length to marginal. Generally larger species, 2.5–4.0 mm in length, with color predominately metallic green.

The males of *occidentalis* have the metasoma about 1.3× as long as wide and without a basal yellow spot. The antenna is as in Fig. 53.

This species is most easily confused with *darleneae* which shares the enlarged mandibles with bottom tooth longest and the projecting clypeus. In *darleneae*, the following characters differ from above: oral fossa 4–5.0× malar space, F1 less than 2× as long as wide and F3 at least as long as wide (Fig. 37), metasoma 1–1.4× as long as broad, foretibia without a longitudinal stripe.

Hosts. Unknown.

Distribution. Western U.S. and Canada.

Types. Girault apparently described this species from 7 specimens, but only designated two females from Los Angeles as types. Both of these specimens bear USNM type labels (no. 19626). The lectotype (present designation) is missing one forewing and three of the four tarsomeres of the left fore and hindleg. One fore and hindwing have been slide mounted. The paralectotype has been knocked from the point and badly damaged. It has been remounted, but the wings, 1 antenna, and most of the legs are missing (one antenna and one hindleg were slide mounted by Girault).

Other specimens examined. UNITED STATES. CALIFORNIA. 1♂, Fieldbrook, 28-V-1903; 1♀, Monterrey Co., Arroyo Seco Camp, 3 May, 1964 (USNM); 1♀, Apple Valley, 9-V-1955 (CNC). COLORADO. 1♀, Boulder, 5,500' June 9, 1961; 1♂, Jefferson, 9,400', 14-VII-1961 (CNC). KANSAS. 2♀♀, (no other data) (USNM). UTAH. 1♀, Wasatch, 27-6. 2♀, Logan Canyon, 5,500', V-29-1957 (USNM). MONTANA. 15♀♀, 19♂♂, Wheatland Co., Deadmans Basin St. Rec. Area. 3,600', 5-VI-1982 (CNC). NEVADA. 1♀, Mercury, 11 June, 1965 (USNM). CANADA. ALBERTA. 1♀, Lethbridge, 18-VI-1950; 1♀, Lethbridge, May 18, 1934; 1♀, Berwyn, July 15, 1940 (CNC). BRITISH COLUMBIA. 6♀♀, 1♂, Oliver, White Lake, 28-V-1959; 1♀, Oliver, Vaseaux L., 29-V-1959; 1♀, Kamloops, Paul L. 29-VI-1950 (CNC).

Entedon pecki, new species

Figs. 20, 42

Diagnosis. Foretibia with 2 longitudinal stripes; interocular distance $4\times$ eye width (Fig. 20), malar space $\frac{1}{2}$ eye height; propodeum with some lightly rugose sculpture immediately laterad of median carina, then becoming smooth. Metasoma $2.2\text{--}2.5\times$ as long as broad.

This species is very similar to both *robustus* and *bigeloviae* which are about the same size, have the metasoma about $2\times$ as long as wide and are generally black bodied. It can be separated from those species by the longer malar space relative to the height of the eye ($\frac{1}{4}$ eye height in *robustus* and $\frac{1}{3}$ eye height in *bigeloviae*) and the broader interocular space (slightly less than $3\times$ in *bigeloviae* and *robustus* (Fig. 21)). In addition, neither of those species have foretibial stripes and the area between the toruli is sculptured. *E. anthonomi* has foretibial stripes, but the metasoma of that species is shorter (about $1.5\times$ as long as wide) and the propodeum is almost uniformly rugose (Fig. 6).

Description. Female. Length 2.0–2.2 mm. Color black, with some bronze or dark blue green reflections on the first two metasomal terga. Mandibles, lateral surface of foretibia brown. All tarsomeres of foreleg and fourth tarsomere of mid and hindlegs brown. Apices of femora, apical $\frac{1}{4}$ to $\frac{1}{5}$ of mid and hindtibia light yellow to white.

Head: Mandibles not enlarged, teeth subequal in length. Clypeus truncate, oral fossa $1.4\text{--}1.5\times$ malar space. Interscrobles smooth, area between toruli alutaceous. Toruli inserted at ventral margin of eye, mid facial alveoli moderate, about 8–9 between midline and margin of eye. Interocular distance $4.0\times$ width of eye, eye height $1.8\text{--}2.0\times$ malar space. Head width in dorsal view $3.1\times$ length, frontal groove absent, POL : OOL : OCL 16:8:2. Antennae as in Figure 42.

Mesosoma: Mesoscutum with postero-medial alveoli moderate, surface appearing

shiny. Scutellum slightly longer than wide, evenly alveolate. Posterior margin of metanotum overlapping anterior propodeum. Propodeum mostly smooth laterad of median carina occasionally with light alutaceous or alveolate sculpture, callus with 2 large setae and about 10 smaller ones.

Metasoma: Petiole wider than long, smooth. Metasoma 2.2–2.5× as long as wide, posterior margin of T2 straight, lateral surface smooth except for a small, alutaceous, setose area at antero-dorsal edge of each tergum.

Legs and wings: Foretibia with 2 longitudinal light stripes, without a curved spine at apex. Forewing hyaline, approximately 2.1× as long as broad, densely setose, marginal fringe present. Basal and cubital vein setae absent under submarginal vein, few subcubital setae present, ratio submarginal : marginal : stigmal : postmarginal 33:47:5:5. Marginal vein not swollen at base.

Male. Unknown.

Host. Unknown.

Distribution. Known only from the type locality, Ontario.

Types. Holotype ♀ on point with data: "Ontario, Oxford Mills, 26-VI-1974. Collector, L. Masner" (Deposited in CNC, type no. 19576). Paratypes: 5♀♀, same data as holotype; 1♀, same locality as holotype, but collected 26-V-1975; 1♀, Ontario, Jockvale, 25-V-1951. O. Peck, swept from basswood. (CNC except 2 in USNM).

Etymology. This species is named in honor of O. Peck, well known chalcidologist who collected some of the type specimens.

Entedon procerus, new species

Fig. 41

Diagnosis. Foretibia without longitudinal stripes, metasoma 3.2–3.4× as long as wide; frontal grooves absent; interscrobles smooth; propodeum smooth laterad of median carina; all funiculars longer than wide (Fig. 41); toruli inserted above ventral margin of eye; eye height 2.7× malar space; dorsal head width 3.0× length.

This species is easily separated from other species with a black body by the elongate metasoma (metasoma no more than 2.2× length in *robustus*, *bigeloviae*, and *pecki*). The smooth or very lightly sculptured propodeum sets *procerus* apart from *leucopus* and *anthonomi*.

Description. Female. Length 2.7–2.9 mm. Color black except the following: some metallic dark blue reflections on the scape, dorsum of the thorax, propodeum, and T2. Mandibles, femora except at apex, foretibia except at base and apex, basal half of mid and hindtibia black to dark brown. Fourth tarsomere of all legs brown. Tips of femora, apex of foretibia, apical half of mid and hindtibia, first three tarsomeres of all legs yellow.

Head: Mandibles not enlarged, teeth subequal in length. Clypeus truncate, oral fossa 2.0× malar space. Interscrobles smooth, space between toruli alutaceous. Toruli inserted above ventral margin of eye, mid facial alveoli moderate in size, about 8–9 between midline and margin of eye. Interocular distance 3.0× width of eye, eye height 2.7× malar space. Head width in dorsal view 3.0× length, frontal groove absent, POL : OOL : OCL 13:5:3. Antennae as in Figure 41.

Mesosoma: Mesoscutum with postero-medial alveoli moderate in size, surface

shiny in appearance. Scutellum slightly longer than wide, medially with a few elongate alveoli at anterior edge. Posterior margin of metanotum overlapping anterior propodeum. Propodeum smooth laterad of median carina, callus with 2 large setae and 4–6 smaller ones.

Metasoma: Petiole (T1) wider than long, smooth. Metasoma 3.2–3.4× as long as wide, posterior margin of T2 straight, lateral surface smooth except for a small, alutaceous, setose area at antero-dorsal edge of each tergum.

Legs and wings: Foretibia without longitudinal light stripes, without a curved spine at apex. Forewing hyaline, approximately 2.3× as long as broad, densely setose, marginal fringe present. Basal and cubital vein setae absent under submarginal vein, ratio submarginal : marginal : stigmal : postmarginal 22:27:2:3. Marginal vein not swollen at base.

Male. Unknown.

Hosts. Unknown.

Distribution. Known only from Maryland and New York.

Types. Holotype ♀ on point with data: "MARYLAND, Plummers Island, 28-V-1911. J. C. Crawford Collector" (Deposited in USNM). Paratypes as follows: 1♀ with same data as holotype (USNM); 2♀♀, Laurel, Patuxent Wildlife Center, 4-VI-1981, L. Masner, Sweeping (CNC). NEW YORK, 1♀. Rome, June 24, 1934. H. K. Townes (AEI). 1♀, Long Island, New Haven, 22-VII-1974. M. Kamran (AMNH).

Etymology. The species epithet is from the Latin *procerus*, meaning long or slender and refers to the elongate metasoma of this species.

Entedon robustus (Crawford)

Figs. 21, 24, 43, 54

Eriglyptus robustus Crawford, 1907:180.

Entedon robustus (Crawford). Girault, 1916a.

Diagnosis. Frontal grooves absent; interscrobles smooth; malar space about ¼ eye height (Fig. 21); dorsal head width 3.1–3.1× length; foretibia without longitudinal stripes; F2 and 3 longer than wide (Fig. 43); metasoma about 2–2.2× as long as wide; forewing (Fig. 24) sparsely setose, bare under basal submarginal. Body black with dark blue or purplish metallic reflections, length about 2.2–2.4 mm.

Males with malar space ½ eye height. Interocular distance 2× eye width. Antenna as in Fig. 54. Metasoma about 2× as long as wide, with large basal yellow spot.

This species is most similar to *bigeloviae*, *genei*, and *pecki* which have a similar habitus with the metasoma about 2× as long as wide, body mostly black, and length about 2 mm (2.5–3 mm in *genei*). The presence of foretibial stripes readily separates *pecki*. F1 is 3× as long as wide in *genei* (Fig. 39) and the area between the toruli is smooth. The forewing is much more densely setose in *bigeloviae* (Fig. 23), the dorsal head width is 2.4× length and F 2 and 3 are subquadrate (Fig. 35).

Hosts. Coleoptera, Curculionidae: *Anthonomus nigrinus* Boheman.

Distribution. Southern and Southeastern U.S.

Types. Lectotype ♀ (present designation) on point with data: "Washington, D.C. VII-3-1906. P.1906.806.V.I.a 7/10. Par. *Anthon. nigrinus*. Hunter no. 1327." Type ♀. USNM no. 10045. *Eriglyptus robustus* Cwfd. 2♀♀, 1♂ paralectotypes with same data (all USNM). The lectotype ♀ is missing one antenna, one fore and hindwing,

and a hindleg. A head of one of the paralectotype females was slide mounted by Girault and is badly crushed. A fore and hind wing of the third female were slide mounted by the author.

Notes. Length varies from 1.9 mm (males) to 2.8 mm (females). There is often a distinct purple coloration to the head, side lobes of the mesoscutum, propodeum, and femora.

Other specimens examined. UNITED STATES. LOUISIANA. 7♀♀, 2♂♂, Tallulah, 7-5 & 8-19, 1909, bred from *Solanum carolinense*, Par. *Anthonomus nigrinus* (USNM). MISSOURI. 2♀♀, Boone Co., Columbia, Sept. 9, 1964; 7♀♀, same locality, 9 Dec., 1967 (USNM). NORTH CAROLINA. 1♀, Raleigh 4-VIII-1940 (USNM). VIRGINIA. 1♀, Louisa Co., 4 mi. S. Cuckoo, 1-VI-1985. Malaise; 1♀, Vienna, 9-7-1911, Parasite of *Anthonomus nigrinus* (USNM).

Entedon stephanopachi Heqvist

Figs. 30, 45

Entedon stephanopachi Heqvist, 1959:140.

Diagnosis. Frontal groove present (as in Fig. 12); scape 8× as long as wide, F1 4× as long as wide (Fig. 30); malar space ½ eye height; foretibia with longitudinal stripes; metasoma 3–4× as long as wide; mid and hind femora yellow except at base. Body length about 2.6 mm and color black.

The male of *stephanopachi* has the metasoma about 3× as long as wide and without a basal yellow spot, the mid and hindtibia are almost completely yellow with only a slight brown spot basally, and the antennae (Fig. 45) has all the funiculars longer than wide and the F5 is clearly separated from F4.

This species is most similar to *methion*, *ernobii*, and *washingtoni* which also have the frontal groove present. However, none of those species have foretibial stripes, and each has the mid and hindtibia dark except for the apex. This species may also be confused with *tachypterelli* which has the mid and hindtibia almost entirely yellow. However, that species lacks the frontal groove, the scape is about 6× as long as wide (Fig. 32), and F1 is 2–2.5× as long as wide.

Hosts. Coleoptera, Bostrichidae: *Stephanopachys substriatus* (Paykull) (as *pacificus* Casey), *S. rugosus* (Olivier). Scolytidae. *Dendroctonus ponderosae* Hopkins (mountain pine beetle). In Europe this species is recorded from an unidentified species of *Stephanopachys*.

Distribution. Oregon, California, North Carolina. Also occurs in Europe.

Types. Holotype ♀, on point with data: "Dal. Nos., 11/4/1959. B. Ehnstrom. *Stephanopachys* sp. Holotype *Entedon stephanopachi* ♀. K. J. Hedqvist" (SMNH). Examined.

Notes. No significant variation was observed in the few specimens available for study other than slight variation in length (2.3–2.8 mm), some of which is due to distortion of the metasoma.

Other specimens examined. UNITED STATES. CALIFORNIA. 1♀, Yosemite N.P., Summer 1970, *Dendroctonus ponderosae*. OREGON. 3♀♀, 1♂, Lambs mine, *Pinus ponderosae*, reared Dec. 5/14, *Stephanopachys pacificus*, Hopkins U.S. 12585 bx. NORTH CAROLINA. 1♀, Durham, reared, *Stephanop. rugosus*, 1293 (USNM).

Entedon tachypterelli Gahan

Figs. 32, 47

Entedon tachypterelli Gahan, 1931:38.

Diagnosis. Foretibia with 2 longitudinal stripes, midtibia with only basal $\frac{1}{4}$ to $\frac{1}{3}$ brown, occasionally nearly entirely yellow, hindtibia with basal $\frac{1}{4}$ to $\frac{1}{2}$ brown. Interscrobles smooth, frontal groove absent. F1 $2\times$ as long as wide (Fig. 32). Metasoma 3 to $3.3\times$ as long as wide. This is a larger species with a body length of about 3.5–4 mm. Body color is generally purplish with some metallic blue green, except the metasoma which is black.

The males have the metasoma only $1.4\times$ as long as broad. The malar space is narrow ($\frac{1}{5}$ eye height) and the oral fossa is $3\times$ the malar space. The midtibia are entirely yellow except for a slight brown infuscation at the base. The hindtibia are light brown over the basal $\frac{1}{3}$. Antennae as in Figure 47.

This species may be confused with *stephanopachi* which also has foretibial stripes, a long metasoma, and mostly yellow mid and hindtibia. However, *stephanopachi* has the frontal groove present and the antennal scape and F1 are longer (Fig. 30).

Hosts. Coleoptera, Curculionidae: *Tachypterellus concors cerasi* List; *T. quadrigibbus* (Say). There is a record of this species reared from *Coleophora* (Lepidoptera: Coleophoridae) that was cited as questionable on the label (see below). In view of the known host range of most of the species, I would regard that host association as probably erroneous.

Distribution. New York, North Carolina, Colorado, Ontario.

Types. Lectotype ♀ (present designation) on point with data: Colorado, G. M. List coll., 1927. ex. *Tachypterellus concors*. USNM type no. 43262. Gahan. Paralectotypes: 8♂♂ and 7♀♀ with same data as lectotype (USNM). Gahan stated in his original description that the specimens came from Ft. Collins.

Notes. The specimen from *T. quadrigibbus* is over 1.1 mm longer than the type series that was reared from *T. concors*. It has the sculpture on the propodeum stronger and the area of the nucha and the supracoxal flange are covered by stronger plicae. A female specimen from Canada has the midtibia almost entirely yellow. The foretibia of this species has the darkened area on the lateral surfaces reduced so that the yellow area is greater than the darker area. This is the opposite of the other species with foretibial stripes.

Other specimens examined. UNITED STATES. NEW YORK. 1♀, Champlain Valley, ex. *Tachypterellus 4-gibbus*. 1933. (USNM). NORTH CAROLINA. 1♀, L. Junalaska, 5-24-1954 (USNM). ONTARIO. 1♀, Marmora, 7-VI-1950, ex. *Crataegus* fruit, Host ? *Coleophora prunivora* (CNC).

Entedon teedoe, new species

Figs. 13, 28, 44

Diagnosis. Interscrobles alveolate, frontal groove absent; mid facial alveoli large, only 5 or 6 between eye and scrobe (Fig. 13); scape yellow or very light brown; foretibia with longitudinal stripes; mid and hindtibia yellow over at least half of length; F1 $5\times$ as long as wide (Fig. 28); metasoma $3\times$ as long as wide, lateral surface of terga alutaceous. Large species, 4.7–5.2 mm and the thorax metallic green.

This species is most closely related to *ashmeadi* which shares the alveolate interscrobates and large mid facial alveolae, light colored scape, and evenly alutaceous metasomal terga. It can be separated by the length of the metasoma (only twice as long as wide in *ashmeadi*) and the length of F1 (only 3–4× as long as wide in *ashmeadi* (Fig. 27)).

Description. Female. Length 4.7–5.2 mm. Color as follows: head, mesosoma, second metasomal tergum, coxae blue black to blue green. Rest of metasoma black or dark brown. Antennal pedicel and flagellum, mandibles, femora except dorsal apices, inner and outer lateral surface of foretibia, basal halves of mid and hind tibia dark brown. Scape, foretarsi and fourth mid and hind tarsomere light, yellowish brown. Anterior and posterior surface of foretibia, apices of mid and hind femora, distal halves of mid and hind tibia, first 3 mid and hind tarsomeres, yellow.

Head: Mandibles with teeth subequal in length; clypeus truncate, oral fossa 2.5× malar space. Interscrobates alveolate, without smooth area, space between toruli alutaceous. Toruli inserted above ventral margin of eye, mid facial alveoli large, only 5–6 between midline and margin of eye. Interocular distance 2.8× width of eye, eye height 3.1× malar space. Head width in dorsal view 2.3× length, frontal groove absent, POL : OOL : OCL 25:8:7. Antenna as in Figure 28.

Mesosoma: Mesoscutum with postero-medial alveoli moderate, surface shiny in appearance. Scutellum slightly longer than wide, medially with a line of elongate alveoli. Posterior margin of metanotum overlapping anterior propodeum. Propodeum weakly sculptured laterad of median carina, callus with 2 large setae and 10–15 smaller setae.

Metasoma: Petiole (T1) wider than long, smooth. Metasoma 3.0–3.2× as long as wide, posterior margin of T2 straight, lateral surface evenly alutaceous, not restricted to area around setae.

Legs and wings: Foretibia with 2 longitudinal light stripes, without a curved spine at apex. Forewing hyaline, 2.5× as long as broad, densely setose, marginal fringe present. Basal and cubital vein setae absent under submarginal vein, ratio submarginal : marginal : stigmal : postmarginal 35:43:5:5. Marginal vein not swollen at base.

Male. Differs from the female by the following: scape (Fig. 44) black, 3× as long as broad, F5 clearly separated from F4. Interscrobatal area smooth, frontal groove indicated medially, not reaching margin of eyes. Mid-facial alveoli smaller, about 9 between eye margin and midline of face. Oral fossa 1.5× malar space. Interocular distance 4× width of eye, face along anterior margin of eye distinctly raised in side view. Midtibiae almost entirely yellow, with only a slight brownish tinge at base. Hindtibia stained very light brown over basal 1/3. The only available male specimen is somewhat damaged with the forewings misshapen and the posterior metasoma missing.

Hosts. Coleoptera, Curculionidae: *Podapion gallicola* Riley.

Distribution. Ontario and New York.

Types. Holotype ♀ on point with data: "ONTARIO, Barry's Bay, 30-VI-1966. S66.1418.01. Host: *Apion gallicola*" (Deposited in CNC, type no. 19577). 1♀ paratype with data: "NEW YORK, Clarksville, June 22, 1956. J. A. Wilcox, collr., from gall of *Podapion gallicola*" (USNM). 1♀, 1♂, paratypes with data: "ONTARIO, Arnprior, 15-VI-36. F.I.S. ex. *Podapion* gall" (CNC).

Etymology. The species epithet is an arbitrary combination of letters.

Entedon washingtoni Girault

Figs. 22, 31

Entedon washingtoni Girault, 1917:109.

Diagnosis. Foretibia without stripes; frontal grooves present; metasoma $2\times$ as long as wide, T2 excised medially (Fig. 22), forewing without cubital or basal vein setae (speculum open); antennae (Fig. 31) with scape $8\times$ as long as wide, F1 $4\times$ as long as wide; midtibia with basal $\frac{1}{2}$ brown, remainder yellow.

This species is most easily confused with *methion*, *stephanopachi*, and *ernobii* which also have the frontal grooves present. All of these other species have the metasoma more than $2\times$ as long as wide and T2 is not excised medially. In addition, *ernobii* has the speculum closed (Fig. 25) and *stephanopachi* has foretibial stripes.

The head of this species has been badly crushed on a slide and it is not possible to assess accurately the malar space or width of the oral fossa.

Notes. The only known specimen is the holotype.

Hosts. Unknown.

Types. Holotype ♀ on point with data: "Washngtn [sic] D.C. Red tag with no 20436. *Entedon washingtoni* Gir. ♀ type." (USNM).

HOSTS OF NORTH AMERICAN *ENTEDON*

	Host	<i>Entedon</i> sp.
	Coleoptera	
Curculionidae	<i>Anthonomus signatus</i> Say	<i>anthonomi</i>
	<i>A. nigrinus</i> Boheman	<i>robustus</i>
	<i>Epimechus</i> sp.	<i>bigeloviae</i>
	<i>Apion occidentale</i> Fall	<i>columbianus</i>
	<i>Podapion gallicola</i> Riley	<i>teedoe</i>
	<i>Tachypterellus concors</i>	
	<i>cerasi</i> List	<i>tachypterelli</i>
	<i>T. quadrigibbus</i> (Say)	<i>tachypterelli</i>
Scolytidae	<i>Scolytus multistriatus</i>	
	(Marsham)	<i>ergias</i>
	<i>S. rugulosus</i> (Muller)	<i>ergias</i>
	<i>Dendroctonus ponderosae</i>	
	Hopkins	<i>stephanopachi</i>
Anobiidae	<i>Ernobius pinicola</i> Ruckes	<i>ernobii</i>
	<i>E. melanoventris</i> Ruckes	<i>ernobii</i>
	<i>E. mollis</i> L.	<i>methion</i>
Bostrichidae	<i>Stephanopachys substriatus</i>	
	(Paykull)	<i>stephanopachi</i>
	<i>S. rugosus</i> (Olivier)	<i>stephanopachi</i>
	Hymenoptera	
Tenthredinidae	<i>Euura exiguae</i> Smith	<i>columbianus</i>
	<i>E. lasiolepis</i> Smith	<i>columbianus</i>
	<i>E. geyerianae</i> Smith	<i>columbianus</i>
	<i>Pontania</i> sp.	<i>columbianus</i>

ACKNOWLEDGMENTS

I thank the following institutions and curators for the generous loan of material. Z. Boucek and J. Noyes, British Museum of Natural History, London (BMNH); C. Yoshimoto and G. Gibson, Biosystematics Research Center, Agriculture Canada, Ottawa (CNC); H. Townes, American Entomological Institute, Gainesville, Florida (AEI); G. Gordh, University of California, Riverside (UCR); J. Carpenter, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ); M. Favreau, American Museum of Natural History, New York (AMNH); K. Hedqvist, Swedish Museum of Natural History, Stockholm (SMNH). D. R. Whitehead, D. M. Anderson, J. M. Kingsolver, and D. R. Smith (Systematic Ent. Lab, Agricultural Research Service, USDA) assisted with the proper names of host species. I am grateful to J. LaSalle, J. B. Woolley, A. Norrbom, E. E. Grissell, and two anonymous reviewers for reading the manuscript and for their many helpful comments.

LITERATURE CITED

- Ashmead, W. H. 1888. Descriptions of some new North American Chalcididae. *Can. Entomol.* 20:101-107.
- Ashmead, W. H. 1894. Descriptions of new parasitic Hymenoptera. *Trans. Amer. Entomol. Soc.* 21:318-344.
- Ashmead, W. H. 1904. Classification of Chalcid flies or the superfamily Chalcidoidea, with descriptions of new species in the Carnegie Museum, collected in South America by Herbert H. Smith. *Mem. Carnegie. Mus.* 1, pp. i-ix, 225-551.
- Beaver, R. A. 1966. The biology and immature stages of *Entedon leucogramma* (Ratzeburg) (Hymenoptera: Eulophidae), a parasite of bark beetles. *Trans. Royal Entomol. Soc. London* 41:37-41.
- Boucek, Z. 1974. On some European Eulophidae (Hymenoptera), with descriptions of three new species. *Acta entomol. Jugoslavica* 10:117-123.
- Boucek, Z. and R. R. Askew. 1968. Index of Palearctic Eulophidae (Excl. Tetrastichinae). Index of Entomophagous Insects 3. Le Francois, Paris, 260 pp.
- Burks, B. D. 1979. Family Eulophidae. Pages 967-1022 in: K. V. Krombein et al. (eds.), *Catalog of Hymenoptera in America North of Mexico. Vol. 1. Symphyta and Apocrita (Parasitica)*. Smithsonian Institution Press, Washington, D.C., 1, 198 pp.
- Crawford, J. C. 1907. New North American Hymenoptera. *J. N. Y. Entomol. Soc.* 15:177-189.
- Dalmañ, J. W. 1820. Forsök till Uppställning af insectenfamiljen Pteromalini, i synerhed med afseende på de i Sverige funne arter. *Tab. 2. K. svenska VetenskAkad. Handl.* 41:123-174, 340-385.
- Erdős, J. 1944. Species Hungaricae Generis *Entedon* Dalm. *Kalocsa*, 63 pp.
- Erdős, J. 1951. Eulophidae Novae. *Acta. Biol. Hung.* 2:169-237.
- Erdős, J. 1954. Eulophidae hungaricae indeductae. *Ann. Hist. Nat. Mus. Nat. Hung. (series nova)* 5:323-366.
- Förster, A. 1841. Beiträge zur Monographie der Pteromalinen Nees. Aachen, 46 pp.
- Förster, A. 1856. Hymenopterologischen Studien II. Chalcidiae und Proctotrupii. Aachen, 152 pp.
- Gahan, A. B. 1931. Two new hymenopterous parasites of *Tachypterellus consors* Dietz. *J. Wash. Acad. Sci.* 21:37-39.
- Gibson, G. A. P. 1986. Mesothoracic skeletomusculature and mechanics of flight and jumping in Eupelminae (Hymenoptera, Chalcidoidea: Eupelmidae). *Can. Entomol.* 118:691-728.
- Girault, A. A. 1913. Australian Hymenoptera Chalcidoidea—IV. The family Eulophidae with descriptions of new genera and species. *Mem. Queensland Mus.* 2:140-334.
- Girault, A. A. 1916a. Descriptions of miscellaneous Chalcid-Flies. *Ins. Ins. Mens.* 4:109-121.
- Girault, A. A. 1916b. Descriptions of miscellaneous North American Chalcidoid Hymenoptera of the family Eulophidae. *Proc. U.S. Nat. Mus.* 51:39-52.

- Girault, A. A. 1922. The North American species of *Emersonella* and *Entedon* with excuses, etc. Priv. Publ. Queensland, 1 p.
- Graham, M. W. R. deV. 1959. Keys to the British genera and species of Elachertinae, Eulophinae, Entedontinae, and Euderinae (Hym., Chalcidoidea). Trans Soc. Br. Entomol. 13:171-204.
- Graham, M. W. R. deV. 1963. Additions and corrections to the British list of Eulophidae (Hym., Chalcidoidea), with descriptions of some new species. Trans. Soc. Br. Entomol. 15:167-275.
- Graham, M. W. R. deV. 1971. Revision of the British *Entedon* (Hymenoptera: Chalcidoidea), with descriptions of four new species. Trans R. Entomol. Soc. London. 123:313-358.
- Harris, R. A. 1979. A glossary of surface sculpturing. Occasional papers in Entomology. No. 28. California Department of Food and Agriculture, Division of plant Industry, 31 pp.
- Heqvist, K. J. 1959. Notes on Chalcidoidea. IV Description of two new species and the male of *Dasyneurophaga japonica* Heqv. (Eulophidae and Pteromalidae). Entomol. Tids. 80: 140-145.
- Peck, O. 1951. Superfamily Chalcidoidea. In: C. F. W. Muesebeck et al. (eds.), Hymenoptera in America North of Mexico. U.S. Dept. Agric., Agric. Monogr. 2, 1,420 pp.
- Ratzeburg, J. T. C. 1844. Die Ichneumoniden der Forstinsecten in forstlicher und entomologischer Beziehung; ein anhang zur abbildung und beschreibung der Forstinsecten. Berlin. 1,224 pp.
- Silvestri, F. 1914. Viaggio in Eritrea per cercare parassiti della mosca delle olive. Boll. Lab. Zool. Portici 9:186-226.
- Szelényi, G. 1977a. A contribution to the knowledge of the *Entedon* fauna of Mongolia (Hymenoptera: Chalcidoidea, Eulophidae). Act. Zool. Acad. Sci. Hung. 23:213-220.
- Szelényi, G. 1977b. New Palaearctic Chalcid Flies (Hymenoptera: Eulophidae). Ann. Hist.-nat. Mus. Nat. Hung. 69:241-247.
- Walker, F. 1839. Monographie Chalciditum. 1. London, 333 pp.
- Werner, F. 1982. Common Names of Insects and Related Organisms (1982 revision). Entomological Society of America, special publication, 132 pp.
- Westwood, J. 1837. Descriptions of two new Genera belonging to the family Chalcidae. Entomol. Mag. 4:435-438.

Received April 20, 1987; accepted July 9, 1987.



Schauff, Michael E. 1988. "The Species of Entedon in America North of Mexico (Hymenoptera: Eulophidae)." *Journal of the New York Entomological Society* 96, 30–62.

View This Item Online: <https://www.biodiversitylibrary.org/item/206088>

Permalink: <https://www.biodiversitylibrary.org/partpdf/180410>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In Copyright. Digitized with the permission of the rights holder

Rights Holder: New York Entomological Society

License: <http://creativecommons.org/licenses/by-nc/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.