



THE  
HYMENOPTERA OF  
COSTA RICA

EDITED BY  
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THE NATURAL HISTORY MUSEUM

*Desantisella*), *Metaphycus*, *Microterys*, *Mucencyrtus*, *Neococcidencyrtus* (= *Platylyca*), *Ooencyrtus*, *Parablastothrix*, *Parablatticida* (= *Amaurilyma*, *Desobius*), *Paraleurocerus*, *Paralitomastix*, *Pentelicus* (= *Hemaenasius*; *Bothriothorax* misident.), *Plagiomerus*, *Prionomastix*, *Prochiloneurus*, *Protyndarichoides*, *Pseudaphycus*, *Pseudectroma* (= *Timberlakia*), *Pseudhomalopoda*, *Psyllaephagus*, *Rhytidothorax*, *Stemmatosteres*, *Syrphophagus* (= *Aphidencyrtus*), *Szelenyiola*, *Tetarticlava*, *Trechnites*, *Trichomasthus*, and *Zaomma*.

The following genera, except for *Paratetracnemoidea*, are new records for the Neotropical region; the previous key (Noyes, 1980) should therefore be amended as follows (in most cases female specimens only):

*Blastothrix*—runs with difficulty to couplet 85 but differs from both included genera (*Rhytidothorax* and *Exoristobia*) in having distinctive punctate sculpture on the frontovertex and dorsum of mesosoma.

*Bothriothorax*—runs to *Pentelicus* (*Bothriothorax* misident.) (couplet 184), but differs in that there is no hairless line connecting the apex of the postmarginal vein with the apex of the stigmal, while in *Pentelicus* this is present. The ovipositor is not exerted (see *Coenocercus* below).

*Cercobelus*—runs to *Homalopoda* (couplet 4) but differs in having hyaline fore wings, whereas in *Homalopoda* the fore wings have a distinct infuscate pattern. Males run to couplet 9, but differ from all included genera in having only four funicle segments, these all longer than broad.

*Coenocercus*—runs to *Pentelicus* (*Bothriothorax* misident.) (couplet 184), but differs in having the ovipositor clearly exerted by about one-third of the length of the metasoma, while in *Pentelicus* the ovipositor is more or less hidden (see also *Bothriothorax* above).

*Epiencyrtus*—runs to couplet 241, but differing from all other included genera except *Agarwalencyrtus* (misident.), in having the clava strongly obliquely truncate, and from *Agarwalencyrtus* in the body being completely dark with no orange areas and the thoracic dorsum quite shiny with relatively shallow sculpture. In *Agarwalencyrtus* the mesosoma is normally at least partly orange and thoracic dorsum always matt with very characteristic striate-reticulate sculpture. The funicle segments are all transverse (see *Trjapitzinellus* below).

*Eusemion*—runs with difficulty to couplet 63 (*Aenasius* and *Pentelicus*) and differs from these genera in the combination of the marginal vein of the fore wing being long and the stigmal and postmarginal veins relatively short, the flagellum being clavate with strongly transverse funicle segments, the hypopygium not reaching more than two-thirds along metasoma, and the body being relatively elongate.

*Paratetracnemoidea*—runs to couplet 156, but differs from all included species in having the interantennal prominence characteristically produced above the clypeus and between the antennal sockets in the form of a short ridge-like or horn-like structure. Males run with difficulty to couplet 69 and differ from all included genera by the same character as the female.

*Philosindia*—runs to couplet 67, but the antennae are inserted very nearly half way between the anterior ocellus and mouth margin and the first funicle segment is at least twice as long as the pedicel. The other genera of the group generally have the antenna inserted conspicuously nearer the mouth margin than the anterior ocellus, and the first funicle segment not longer than the pedicel.

*Prionomitus*—runs best to *Psyllaephagus* (couplet 198), differing in having the hypopygium reaching the apex of the metasoma.

*Thomsonisca*—runs to couplet 154, but differs from included genera in having the speculum interrupted by two or three lines of setae.

*Trjapitzinellus*—runs to couplet 241 and would fit *Agarwalencyrtus* (*Epiencyrtus* misident.), except that the clava is not twice as wide as the funicle and the marginal vein is less than three times as long as broad. The funicle segments are all quadrate or longer than broad (see *Epiencyrtus* above).

*Tyndarichus*—runs to couplet 89, but differs from both included genera in the submarginal vein having a strong, distinct subapical triangular expansion.

## 11.6 EUCHARITIDAE

John Heraty

**Diagnosis.** Mostly 2.0 to 5.0 mm in length; colour varying from metallic to black, or with striking yellow and black patterns. Antennae with 13 or fewer

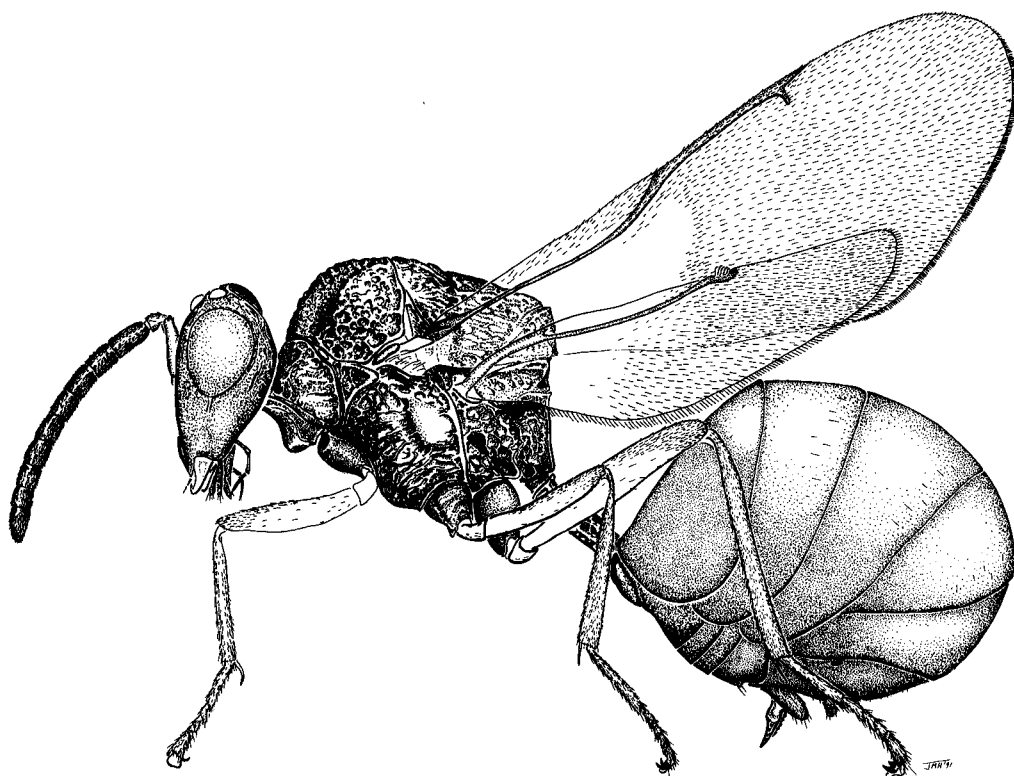


Fig. 11.88. *Orasema* sp. (Eucharitidae).

segments (up to 26 in some Old World members of the family), anellus present or absent; mandibles usually sickle-shaped with elongate apical tooth; labrum planar with 4 to 16 elongate digits; genal sulcus absent. *Pronotum reduced and ventral to mesoscutum, hidden (not visible) in dorsal view*; notauli deep and conspicuous; axillae enlarged and usually broadly fused in middle; scutellum sometimes with a pair of elongate spines projecting from apex. Fore wing with marginal vein relatively long. Tarsi 5-segmented. *Metasoma with an elongate petiole, usually longer than hind coxae*; female metasoma large, ovipositor not exceeding apex of metasoma; male metasoma small.

Only two subfamilies of Eucharitidae occur in the New World and all species can be readily recognized by these diagnostic features. Exceptions to the diagnosis are found in three additional palaeotropical subfamilies (see below) that were included in Eucharitidae by Bouček (1988).

**Classification and distribution.** Eucharitids are widespread and occur in almost every zoogeographical region of the world (except New Zealand), but are most abundant and diverse in the tropical regions (Heraty, 1985). Worldwide the Eucharitidae comprises 47 genera and 394 species (Heraty, unpublished), which are classified in five subfamilies by Bouček (1988):

Akapalinae	Australia, 1 genus
Echthrodapinae	Africa and New Guinea, 1 genus
Eucharitinae	cosmopolitan, 39 genera
Oraseminae	cosmopolitan, 4 genera
Philomidinae	Palaeotropics and Mediterranean, 2 genera

The higher classification of the family has not been resolved. Some studies place Oraseminae + Eucharitinae as the sister group to the Perilampidae,

excluding the other three subfamilies from either family (Heraty & Darling, 1984; Darling, 1988). Based on larval morphology Darling (1992) placed Philomidinae as sister group to the Perilampinae + Eucharitinae + Oraseminae and excluded the Chrysolampinae (Fig. 11.89). This suggests that the Eucharitidae *sensu* Bouček (1988) is paraphyletic with respect to the Perilampidae. Gibson (*in* Goulet & Huber, 1993) classified Akapalinae and Philomidinae as subfamilies of Pteromalidae, and echthrodapines in the subfamily Monodontomerinae of Torymidae. Echthrodapinae and Torymidae share an occipital carina, a setose epipygium and peg-like cerci articulated with metasomal tergite VIII.

Only two subfamilies occur in the New World, where 18 genera and 114 species are presently recognized. In Costa Rica the subfamily Oraseminae is represented by nine species of *Orasema*, while the Eucharitinae is represented by 13 species in seven genera.

**Biology.** Philomidinae are ectoparasitoids of ground nesting bees of the genus *Halictus* (Halictinae) (Darling, 1992), whereas Echthrodapinae are parasitoids of twig nesting bees of the genus *Braunsapis* (Allodapinae) (Michener, 1969). The host of Akapalinae is unknown. The following description of life histories refers only to the ant-parasitic subfamilies, Oraseminae and Eucharitinae, which are similar in many respects but show differences in ovipositional strategy and host choice.

Eggs are deposited away from the host into plant tissue, and the active first instar larva, termed a PLANIDIUM, is responsible for gaining access to the ant colony. The planidium is less than 0.15 mm in length with 12 well-sclerotized tergites, a caudal sucker, and an extensible labial region (Heraty & Darling, 1984). Larvae move by looping or jumping and can be extremely mobile. Access to the ant nest is

achieved by some form of phoretic attachment to the host or another insect (Clausen, 1940a & c; Johnson *et al.*, 1986).

Once in the ant colony, the planidium attaches to the ant larva but does not develop until the host begins to pupate. When the ant larva pupates the eucharitid planidium relocates to the ventral thoracic region of the host pupa, where it completes three instars. In most Eucharitidae all stages are ectoparasitic. In *Orasema* and *Pseudometagea* the planidium burrows just under the cuticle of the host larva where partial feeding takes place, but further development of the first and later instars is external on the host pupa (Ayre, 1962). Thus eucharitid larvae are ectoparasitic koinobionts. They show hypermetamorphosis with later instars being more typically hymenopteriform. Usually only one parasitoid develops per host, but as many as four *Pseudochalcura* can develop on a single pupa of *Camponotus* (Wheeler, 1907; Heraty & Barber, 1990).

After pupation, the eucharitid pupae are mixed with ant pupae and cared for in the same manner as ant pupae (Williams, 1980). Ecdysis of adult eucharitids is assisted by worker ants. They are completely integrated into the ant colony, being fed and groomed by the host ants. If the nest is disturbed, pupal and adult eucharitids are rescued by the ants in preference to their own brood (Wheeler, 1907; Mann, 1914).

*Oraseminae.* Species of Oraseminae deposit single eggs into punctures made in plant tissue using their specialized ovipositor. Eggs are deposited into involucre bracts of flowers, flower stems, undersides of oak and mango leaves, or in the skin of young banana fruits (Heraty & Darling, 1984; Johnson *et al.*, 1986). In South America *Orasema* species have earned the common name 'bicho costuriero' (seamstress insect) for their characteristic oviposition marks on leaves of various plants (Tocchetto, 1942). Planidia are often

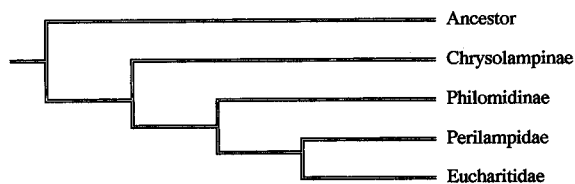


Fig. 11.89. Proposed phylogenetic relationships of the eucharitid/perilampid groups (modified after Darling, 1992).

phoretic on immature stages of thrips. Although the planidia may consume fluid while on the thrips, they apparently cannot complete their development on thrips (Wilson & Cooley, 1972; Johnson *et al.*, 1986). Ants may be collecting thrips (and planidia) as prey items, thus providing direct transport of planidia to the host larva (Heraty, 1994). Almost all Oraseminae are parasitoids of myrmicine ants, rarely of Ecitoninae and Formicinae (Table 11.8). These ants generally do not form cocoons. Feeding by the larva of *Orasema*, which is partially endoparasitic, results in a deformed pupa (Wheeler, 1907; Pelt, 1950).

**Eucharitinae.** Species of Eucharitinae usually deposit large egg masses into preformed cavities in plant tissue such as flower buds, and as many as 10,000 eggs may be deposited in a single oviposition (Clausen, 1940a). Some *Kapala* deposit their eggs into undeveloped flower buds of *Cordia* or *Hamelia*, and emergence of planidia is timed to coincide with opening of the flower. Eggs may also be scattered over the leaf surface or laid into the outer skin of small fruits (Clausen, 1940a; Heraty & Barber, 1990). Planidia do not require an intermediate host, but rather attach directly to adult ants for transport back to the ant nest. All New World Eucharitinae are parasitoids of Ponerinae or Formicinae (Table 11.8). Unlike hosts of Oraseminae, these ants generally form cocoons, and the eucharitid larva develops within the host cocoon.

Eucharitidae are generally a rare group of Hymenoptera but can be locally abundant. *Kapala* is probably the most common genus of Eucharitidae in the Neotropics, the males in particular being quite abundant in some Malaise trap samples. Males are more active in mate location and may form swarms over an ant nest with emerging females. Females mate soon after emergence from the ant nest and deposit eggs on suitable host plants in the vicinity of the ant host. Eucharitid females are usually attracted to certain types of plant structures for oviposition, and are less specific to plant taxa. If one can locate the oviposition sites it is relatively easy to collect eggs and planidia, and to gather other biological information.

**Economic importance.** *Orasema costaricensis* has been regarded as a pest of banana in Central America where it causes a brown spotting of fruit during oviposition (Roberts, 1958). It is possible that the females are actually ovipositing in association with thrips, which are usually more serious pests of banana (Hanson, pers. comm.). On the other hand, some eucharitids parasitize pestiferous species of ants (e.g. *Solenopsis*) and may offer possibilities for use in biological control of such pest species (D.W. Johnson, 1988).

**Identification.** Revisionary studies of New World groups relevant to the Central American fauna have been made for the nearctic Eucharitinae (Heraty, 1985).

Ant host	Eucharitid genus
<b>PONERINAE</b>	
<i>Ectatomma</i>	<i>Isomerula</i>
<i>Odontomachus</i>	<i>Kapala</i>
<i>Pachycondyla</i>	<i>Kapala</i>
<b>MYRMICINAE</b>	
<i>Pheidole</i>	<i>Orasema</i>
<i>Solenopsis</i>	<i>Orasema</i>
<i>Leptothorax</i>	<i>Orasema</i>
<i>Wasmannia</i>	<i>Orasema</i>
<b>FORMICINAE</b>	
<i>Camponotus</i>	<i>Obeza</i> , <i>Pseudochalcura</i>
<i>Lasius</i>	<i>Pseudometagea</i>

**Table 11.8.** Recorded hosts of eucharitid genera occurring in Central America (from Heraty, 1994).

### Key to subfamilies and genera of Eucharitidae of Central America

- 1 Metallic coloured; anellus present, flagellar segments cylindrical in both sexes; prepectus not fused to pronotum (Fig. 11.88); scutellum unadorned; second metasomal (first gastral) sternite with transverse furrow; ovipositor sub-apically expanded, with strong apical teeth. ....(Oraseminae) .....*Orasema*
- Variously coloured; anellus absent, flagellar segments often serrate to branched; prepectus fused to pronotum (Figs 11.90, 11.93); scutellum often with elongate apical spines (Figs 11.90, 11.92); second metasomal sternite smooth; ovipositor needle-like, at most with minute teeth. ....(Eucharitinae) .....2

- 2 Scutellar spines very long, reaching to apex of metasoma (Fig. 11.90). ..... 3
- Scutellar spines absent (Fig. 11.93), or if present, much shorter than above, not reaching to apex of metasoma (Fig. 11.92). ..... 5
- 3 Scuto-scutellar sulcus deeply invaginated and filled with dense, golden hairs; scutellar spines of female dorso-ventrally flattened, those of male cylindrical. .... *Dilocantha*
- Scuto-scutellar sulcus not deeply invaginated, bare; scutellar spines cylindrical. .... 4
- 4 Eyes conical (pointed above), frons strongly bulging (Fig. 11.91). .... *Isomeralla*
- Eyes normal, not conical, frons not strongly bulging (Fig. 11.90). .... *Kapala*
- 5 Scutellum posteriorly with two blunt spines (Fig. 11.92). .... 6
- Scutellum rounded posteriorly (Fig. 11.93). .... 7
- 6 Mesosoma having at least some yellow to brown coloration; propodeum weakly developed; antenna cylindrical in both sexes. .... *Obeza*
- Mesosoma entirely black or metallic; propodeum with lateral margins strongly developed; male antenna branched. .... *Lophyrocera*
- 7 Prepectus reaching tegula; occiput broadly concave; axillae constricted medially, antennae cylindrical in both sexes. *Pseudometagea*<sup>EX</sup>
- Prepectus not reaching tegula (Fig. 11.93); occiput flat; axillae transverse, not constricted medially; male antennae with branches on basal flagellar segments. .... *Pseudochalcura*

### Synopsis of the Costa Rican fauna

In Costa Rica eucharitids are most abundant at lower altitudes (below 1000 m) and they are entirely absent above 2200 metres, where their hosts also become scarce. Most genera of Eucharitidae found in Costa Rica are northern extensions of a more widespread South American fauna, with the exception of *Pseudometagea*, in which Costa Rica may represent the most southern

record of this nearctic genus. Presently 21 to 22 species of eucharitids are known to occur in Costa Rica.

#### ORASEMINAE

Only a single genus of this subfamily is present in Central America.

***Orasema***. Africa, Asia, Australia, New World; 53 known species. Nine species occur in Costa Rica. Biology: Wheeler and Wheeler (1937); Heraty *et al.* (1993).

#### EUCHARITINAE

Seven genera of this subfamily are known to occur in Central America. The phylogeny of the subfamily is discussed in Heraty (1989).

***Dilocantha***. A neotropical genus with two or three described species whose cumulative range extends north to Mexico. Only one species is present in Costa Rica. Biology unknown.

***Isomeralla***. A neotropical genus whose range extends north to Mexico. It comprises two species, one of which is present in Costa Rica.

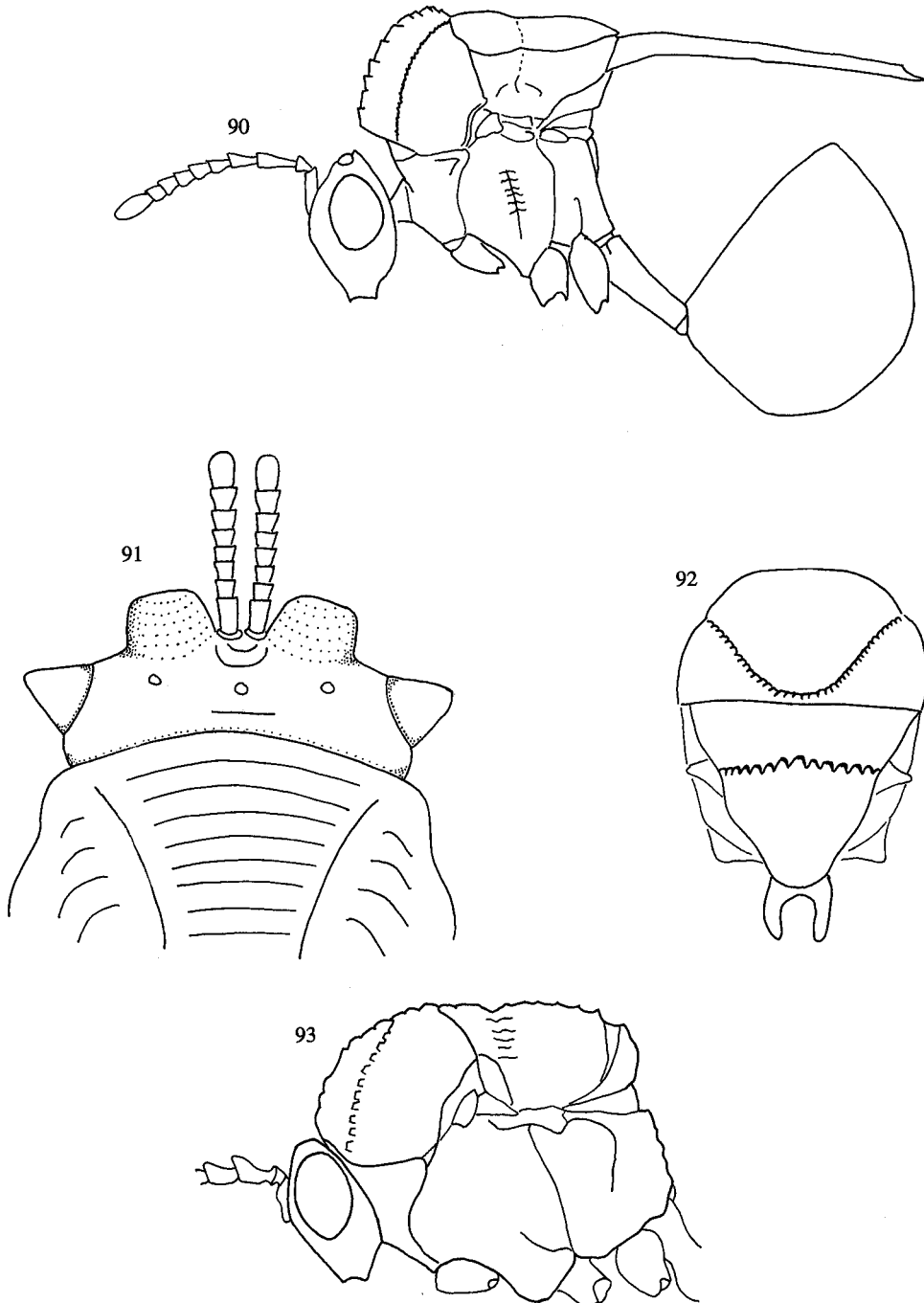
***Kapala***. A predominantly neotropical genus whose range extends north to the southern part of the United States, and with one species recorded from Africa and Madagascar. A total of 17 species are known, five of which occur in Costa Rica. Taxonomy: Heraty and Woolley (1993).

***Lophyrocera***. A predominantly neotropical genus comprising three species whose cumulative range extends north to the western United States. Two species occur in Costa Rica. Biology unknown.

***Obeza***. A predominantly neotropical genus whose range extends north to the southern part of the United States. Eight species are known, but only one seems to be present in Costa Rica.

***Pseudochalcura***. A New World genus comprising 13 species, two of which occur in Costa Rica. Taxonomy: Heraty (1986).

***Pseudometagea***<sup>EX</sup>. A nearctic genus whose range extends south to Mexico and possibly to Costa Rica.



**Figs 11.90–11.93.** Genera of Eucharitidae. Fig. 11.90. *Kapala* sp., whole insect, lateral view. Fig. 11.91. Head of *Isomerala* sp., dorsal view. Fig. 11.92. Mesosoma of *Lophyrocera* sp., dorsal view. Fig. 11.93. Head and mesosoma of *Pseudochalcura* sp., lateral view.



Eight species are known and one of these possibly occurs in Costa Rica. Taxonomy: Heraty (1985). Biology: Ayre (1962).

### 11.7 EULOPHIDAE

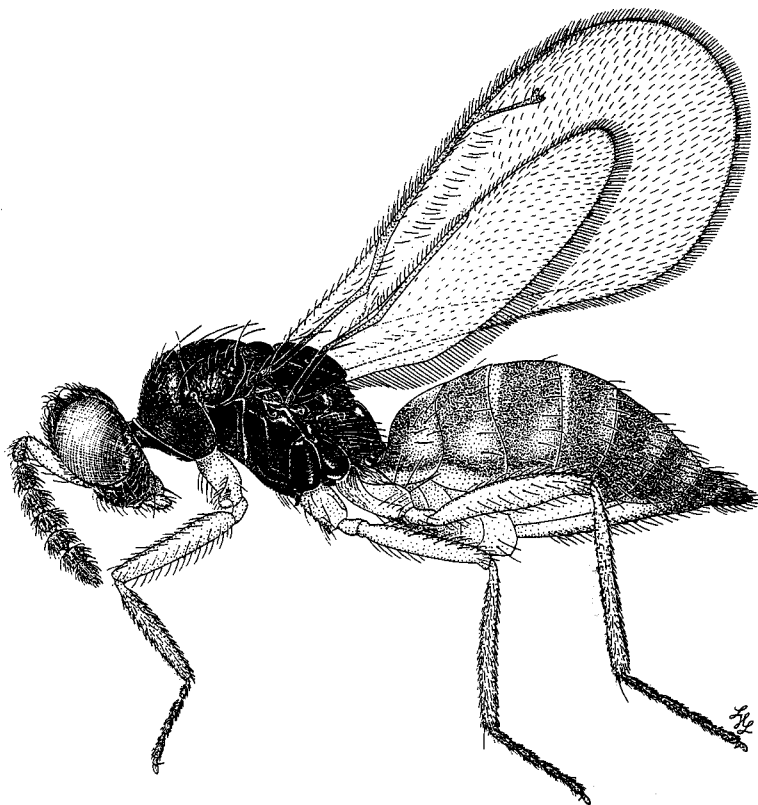
*John LaSalle and Michael E. Schauff*

**Diagnosis.** 0.4 to 6.0 mm in length (though rarely exceeding 3.0 mm), varying from squat to elongate, robust to dorso-ventrally flattened; often soft-bodied and collapsing after death; colour varying from metallic to black to yellow. *Antenna* usually inserted at about level of lower eye margin or below, *usually with 2 to 4 funicular segments* (rarely 1 or 5), funicle of male sometimes branched. Mesoscutum with or

without well marked notauli; axillae often produced forward of the scuto-scutellar suture. Fore wing with marginal vein long, postmarginal and stigmal veins often quite short. *Fore tibial spur short and straight; tarsi always 4-segmented. Metasoma constricted basally, not broadly attached to mesosoma; ovipositor hidden or exerted.*

Only one other family, the Elasmidae, has the combination of 4-segmented tarsi and a short, straight fore tibial spur. Elasmids, however, are sufficiently distinct (see Chapter 11.4) so as to not be easily confused with eulophids.

**Classification and distribution.** The Eulophidae are cosmopolitan in distribution, with about 3400 described species in 280 genera (Grissell & Schauff, 1990). It is the largest family of Chalcidoidea, and



**Fig. 11.94.** *Elachertus loh* (Eulophidae).