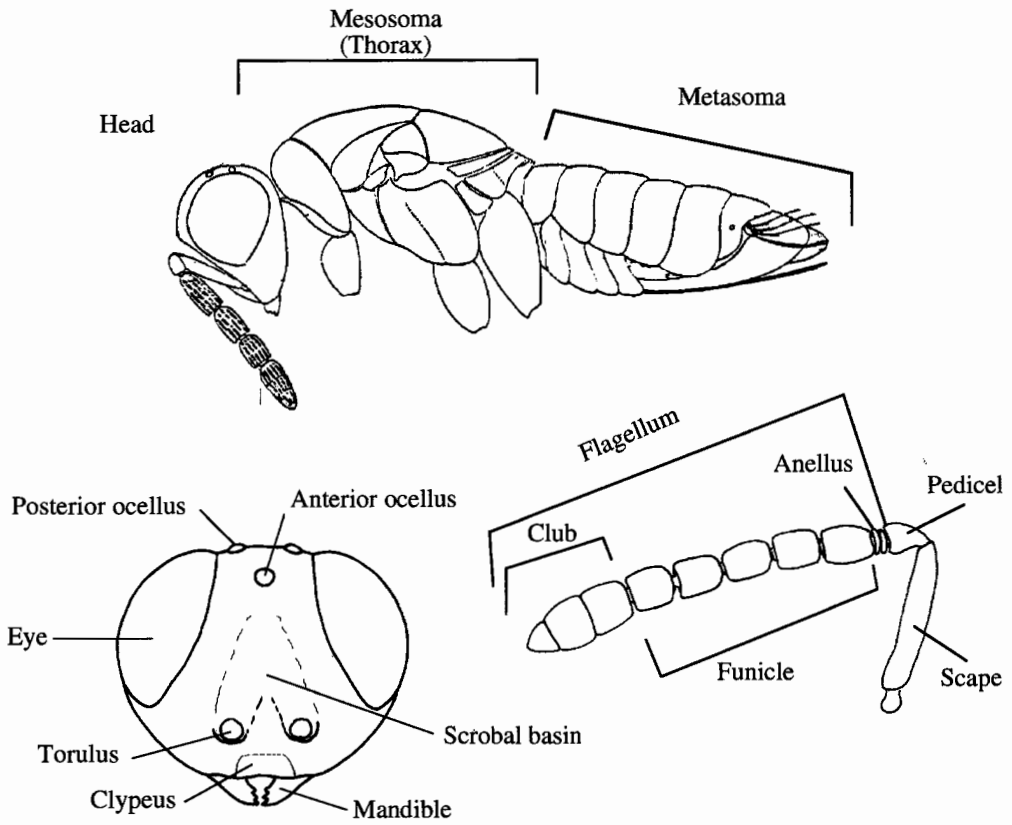
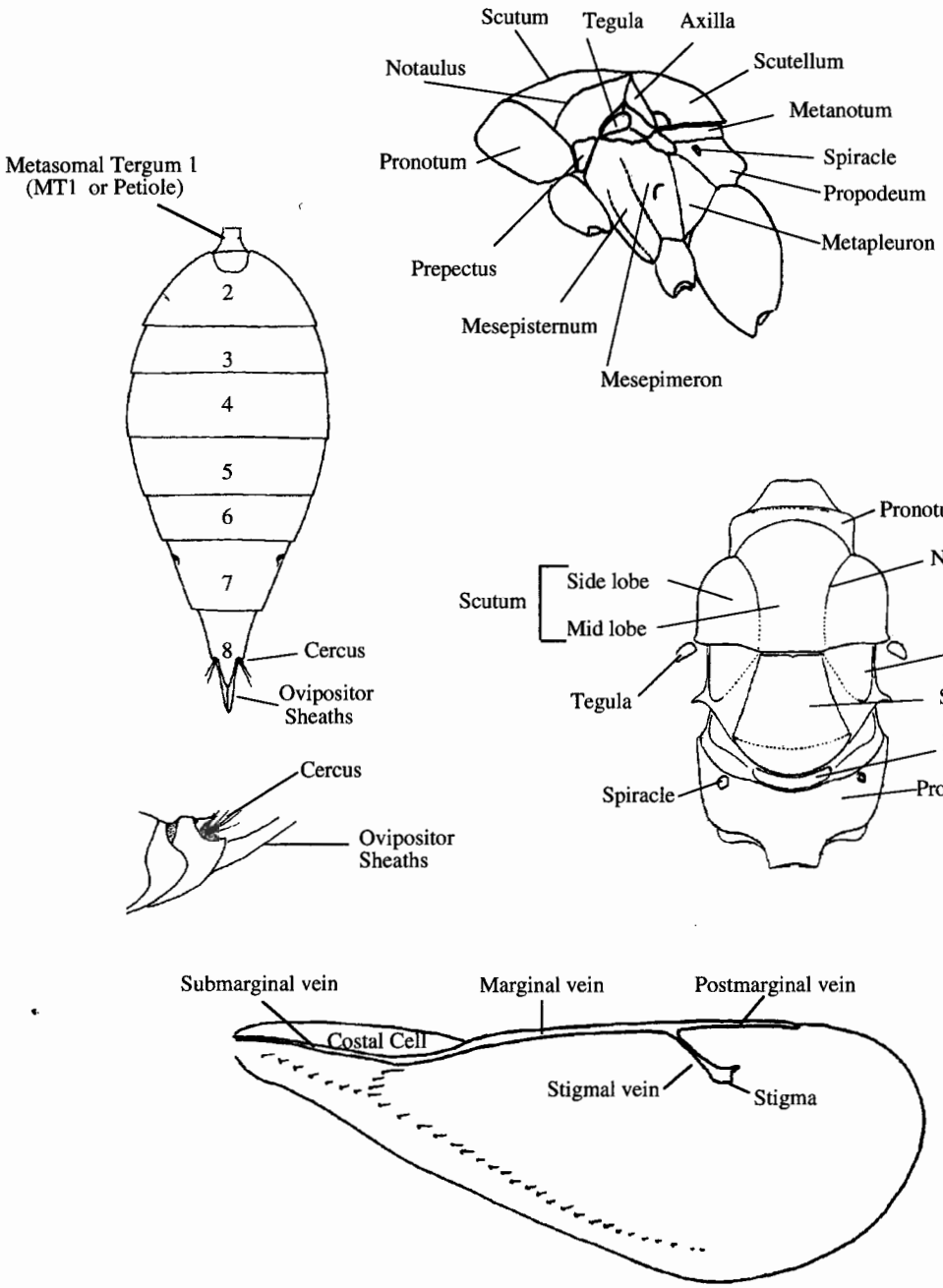
MORPHOLOGY

The terminology of Graham (1969) is shown below with the exception of the side view of several thoraxes (from Compere 1931 and Grissell 1976). Most of the illustrations are of a pteromalid, but the terms apply fairly well to most chalcidoids. Some synonymous terms, which you might find used in the references cited, are ring segment for anellus, abdomen for gaster or metasoma, mesoscutum for scutum, parapsides for notauli, thorax for mesosoma, and postspiracular sclerite for prepectus. The numbering of metasomal segments is not always consistent. Some start with the propodeum as segment 1 and the petiole as segment 2. Others start with the first apparent segment (basal tergite of Graham) as segment 1. The most difficult problems of numbering are usually associated with the antennae. It is sometimes difficult to decide what is a funicle segment and what is a club segment. The interpretation of such segments may vary from worker to worker. We have tried to avoid the use of antennae as much as possible but they offer important characters and cannot be ignored entirely.




Scutum
Tegula
Axilla
Notaulus
Scutellum
Metanotum
Pronotum
Spiracle
Propodeum
Metapleuron
Prepectus
Mesepisternum
Mesepimeron
Metasomal Tergum 1
(MT1 or Petiole)
2
3
4
5
6
7
8
Cercus
Ovipositor
Sheaths
Cercus
Ovipositor
Sheaths
Pronotum
Notaulus
Scutum
Side lobe
Mid lobe
Axilla
Tegula
Scutellum
Metanotun
Spiracle
Propodeum
Submarginal vein
Marginal vein
Postmarginal vein
Costal Cell
Stigmal vein
Stigma

HOW TO RECOGNIZE A CHALCID

In order to use this handbook it is necessary first to recognize a chalcidoid. One clue is their size. Rarely are specimens much over 5 mm in length. In the field or the lab chalcidoids are most easily confused with small gnatlike flies and other small wasps. Chalcidoids, being Hymenoptera, have two pairs of membranous wings as opposed to the single pair found in flies. Among the majority of wasps, chalcidoids are noted for their much reduced wing venation. In the forewing there are no cells that are completely surrounded by veins (see wing, p. 18; note that the "costal cell" has no vein on the forward edge). Most other Hymenoptera not only have several (or many) closed cells, but they have many veins on the wing as well. Chalcidoids have essentially only one vein that is branched at the end (into postmarginal and stigmal) and rarely not even this is branched. Among all wasps, chalcidoids are only likely to be confused with some of the proctotrupoid families (especially Scelionidae and Platygastridae) because the wing venation is similar. Here the distinctions become somewhat more difficult and technical. Most chalcidoids have a sclerite (side of mesosoma , p. 18) called the prepectus between the base of the forewing and the pronotum, whereas proctotrupoids lack this sclerite. As a result, in most chalcidoids the base of the forewing appears to be removed some distance from the lateral corner of the pronotum, but in proctotrupoids the base appears to touch the corner of the pronotum. There is a technically more reliable character involving the position of the mesothoracic spiracle in chalcidoids (see Gibson 1993), but it is difficult to see and its use so seldom called upon, that it is of value mostly in esoteric cases of classification. Most Chalcidoidea also have elongate, raised sensilla on the antennae (usually seen as parallel white lines on the funicle segments) which proctotrupoids do not have. In the case of a few wingless chalcidoids, the spiracle and sensilla are the only technically accurate methods to separate them from proctotrupoids. Finally, it should be noted that many chalcidoids tend to be metallic in coloration or to have mixtures of colors such as black and yellow. Proctotrupoids are never metallic and are generally black.

Although a difficult task at first glance, recognizing chalcidoids is not the impossible endeavor it might appear to be. With experience, chalcidoids may be identified to family level in the field and even on the wing. All it requires is a little practice.

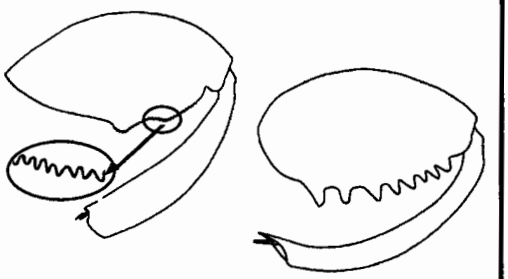
INTRODUCTION TO KEY

The key is designed to be "easy" to use, not necessarily absolutely technically or phylogenetically correct. It proceeds somewhat along the mental process we use to sort chalcidoids to family, i.e., the easily observed characters are used first. The first alternative states the conspicuous character, and if you cannot see the character because the specimen is too small, it usually means you should take the second alternative. All known chalcidoid families (except the obscure Rotoitidae from New Zealand and Chile) are included (some as subfamilies). The key, however, is based on Nearctic species so that it will not work in all instances for Old World groups even at the family level. A few odd genera are keyed out near families other than the correct one because they appear aberrant (compared to the rest of the family) and generally cause a key to become filled with "either-or," and "if, and, or but" type statements. Generally, the families are fairly distinct morphologically (at least in one sex), but a few odd forms may cause a relatively simple key to become overly complex. Our feeling is that these few odd forms may be keyed out pragmatically (or learned by sight) and removed from the majority of species so that identification of the remaining forms becomes possible without too much difficulty. We have tried to structure the key so that all common material will run through it. Many uncommon taxa should run through it as well. Male specimens of a few families (e.g., some eupelmids, pteromalids) will not run through the key. For males we've added additional comments in the discussion of Distinguishing Characters to help.

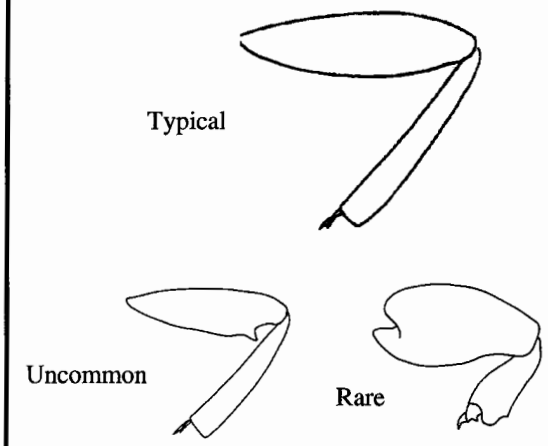
The illustrations for the key were rendered in large part by Linda Lawrence and Deborah Roney. A few drawings were borrowed (with modification) from sources listed in the text under the taxon being identified.

Start

Hindfemur enlarged, with ventral teeth, either a few large ones or many small ones (saw-like); hindtibia subequal in length to femur and curved; specimens generally 5-15 mm, robust, rarely less than 1-2 mm.

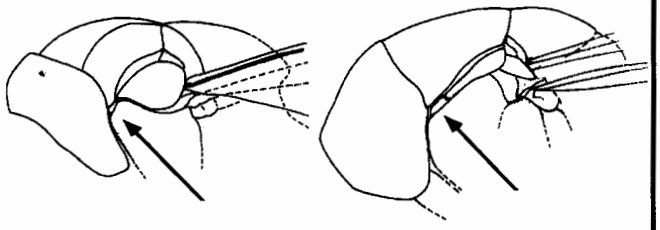


Hindfemur not enlarged, ventral teeth, if present, 2 or less, or ventral edge serrate; hindtibia straight (rarely half length of femur); specimens generally 1-10 mm, robust to fragile.



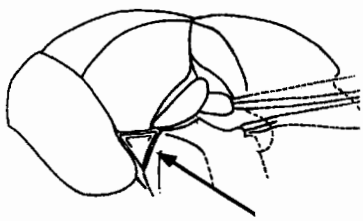
To Page 22:B

Prepectus reduced or fused, not readily apparent, or if so, not triangular in outline.



To Page 21

Prepectus apparent as a triangular plate.



To Page 22:A

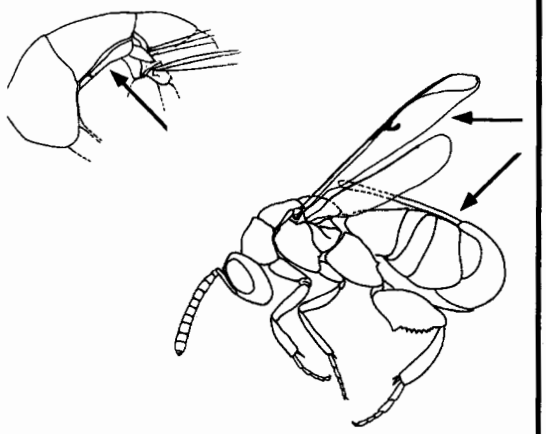
From Page 20

Ovipositor directed horizontally (in most species not extended beyond apex of metasoma (gaster)); tegula a nearly oval disc; forewing not folded longitudinally.

Family Chalcididae

Ovipositor curved dorsally over metasoma (gaster); tegula narrowly extended forward; forewing often folded longitudinally.

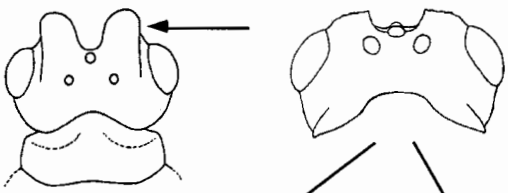
Family Leucospidae



Head projecting as 2 "horns" (surrounding antennae) in dorsal view.

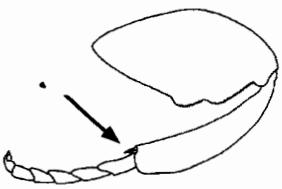
Head not modified as "horns," essentially flat in dorsal view.

Dirhininae

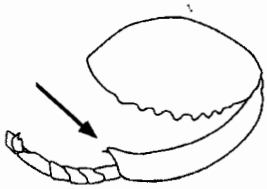


Hindtibia squarely truncate, at apex; 2 hindtibial spurs.

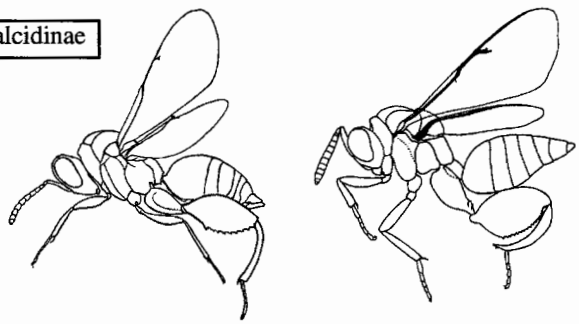
Haltichellinae



Hindtibia obliquely truncate at apex; either 1 hindtibial spur or spur not apparent.



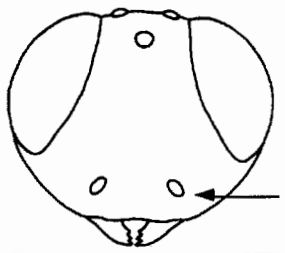
Chalcidinae



A
From page 20

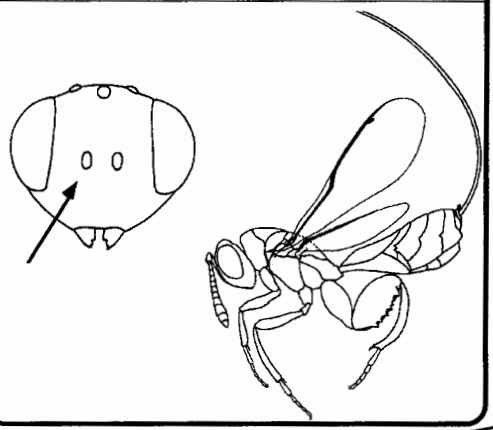
Inner eye margins diverging ventrally; antennae inserted low on face; ovipositor not exserted.

Chalcedectini: Cleonyminae
Pteromalidae



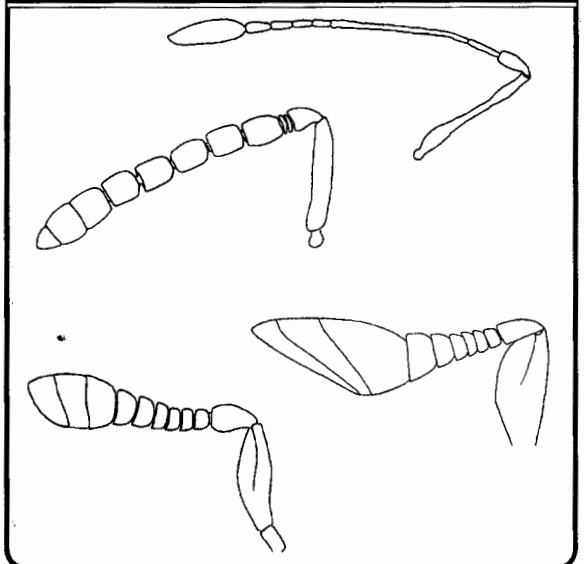
Inner eye margins nearly parallel; antennae inserted near middle of face; ovipositor exserted.

Podagrionini: Toryminae
Torymidae



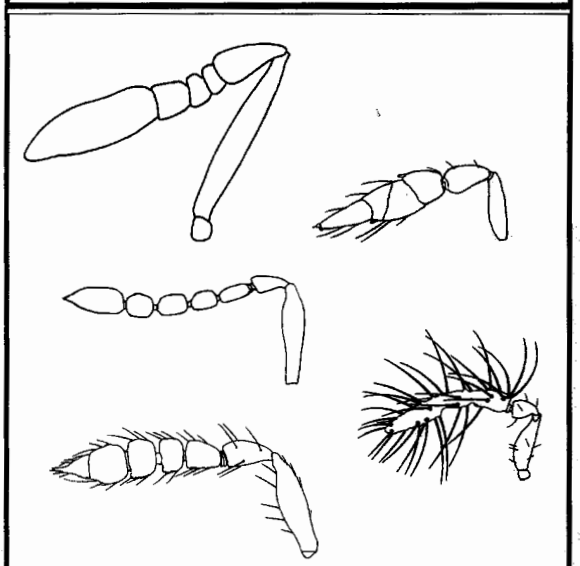
B
From page 20

Antenna with 5-8 segments between pedicel and club; tarsi normally 5-segmented (if with 4, then males of Tetracampidae, or tiny specimens with long antennae and characteristic wings, see Mymaridae illustration on next page).



To Page 23

Antenna with 0-4 segments between pedicel and club; tarsi 3, 4, or 5-segmented; or specimens 0.2-1 or 2 mm long and these characters difficult to see (many tiny, fragile specimens key here).



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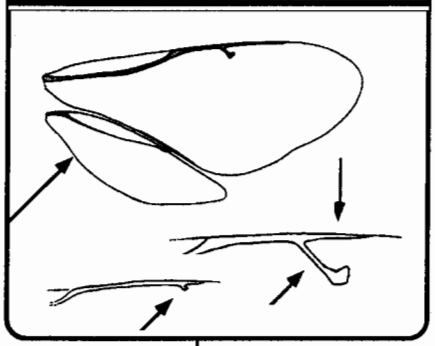
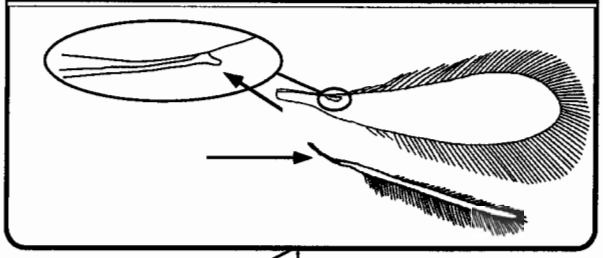
From Page 22

Hindwing without stalk, expanded as shown; forewing venation ending beyond basal 1/3 (postmarginal present, stigmal elongate to sessile); specimens generally larger than 2 mm.



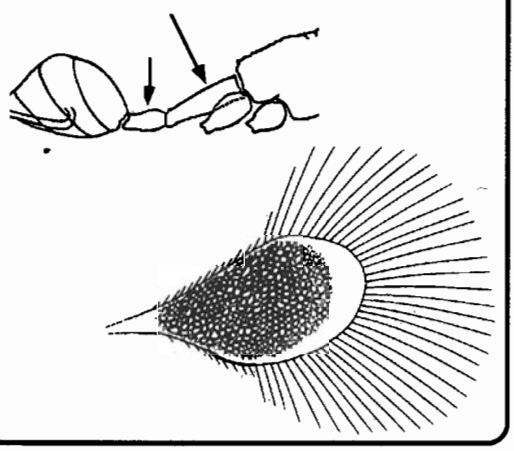
To Page 24

Hindwing stalked and elongate (rarely reduced to only a short stub, hooked at tip); forewing venation linear, ending in basal 1/3 (postmarginal absent, stigmal rudimentary), or apparently absent; specimens generally less than 2 mm.



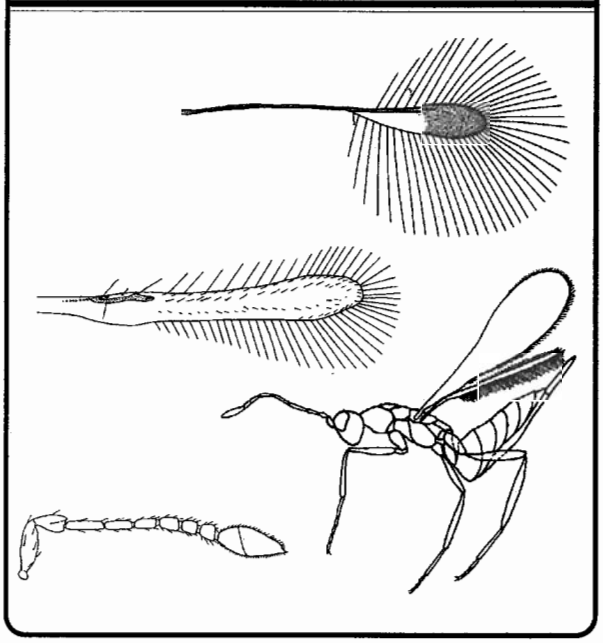
MT1 and MT2 petiolate; forewing reticulate. Rarely collected.

Family Mymarommatidae



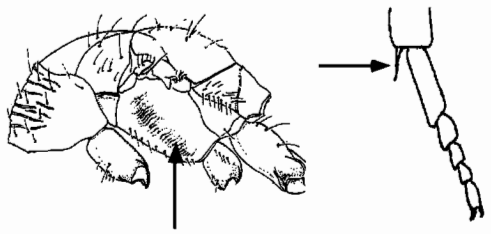
Only MT1 petiolate, often not visible and metasoma appearing broadly joined to thorax; forewing membrane smooth. Commonly collected.

Family Mymaridae

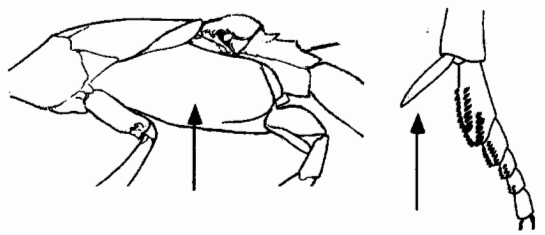


From Page 23

Mesopleuron concave; midtibial spur thin and spinelike.



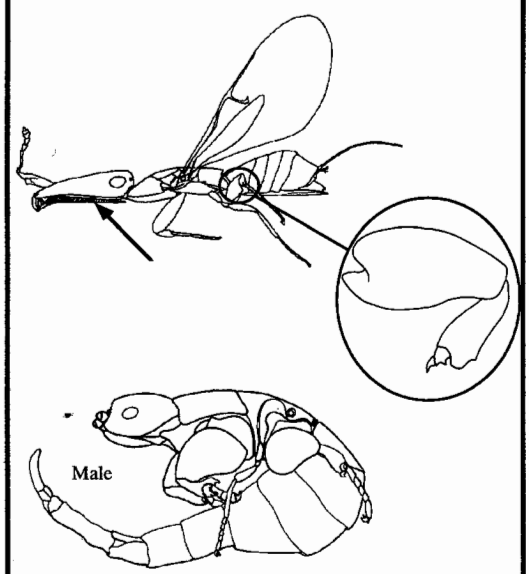
Mesopleuron convex (bulging); midtibial spur relatively thick.



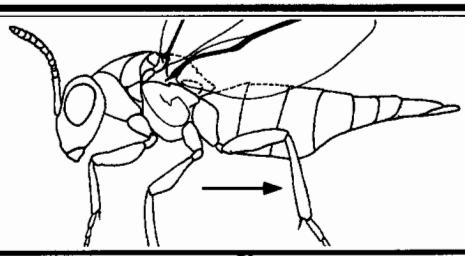
To Page 35:B

Head projecting forward, female mandible with rasplike appendage; at least hindtibia shorter than femur; male wingless (highly modified); from fruits of fig.

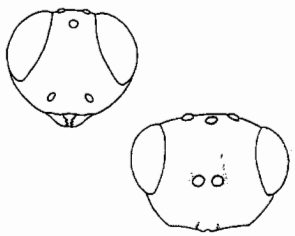
Agaoninae: Agaonidae



Head projecting downward, female without appendage on mandible; hindtibia at least as long as femur, usually longer; male similar to female.

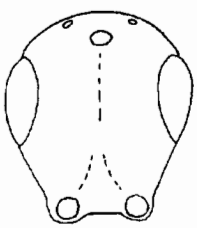


Antennal insertion clearly more than one torulus diameter above apical margin of clypeus; if questionable, then either eyes diverging ventrally or side of head ("cheeks") carinate.



To Page 25:B

Antennal insertion less tha one torulus diameter above apical margin of clypeus; i questionable, side of head without carinae.



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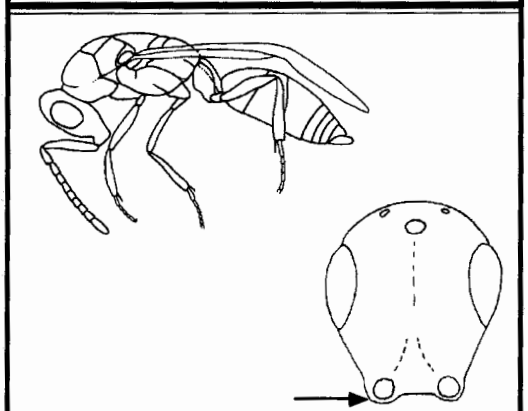
A
From Page 24

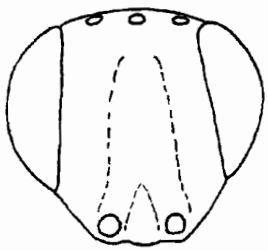
Antennae arising at side and below apical margin of clypeus; MT1 longer than wide (petiolate). Commonly collected.

Spalangiinae: Pteromalidae



Antennae arising slightly above apical margin of clypeus; MT1 (i.e., petiole) not visible. Rarely collected. (See also Asaphinae (p. 35) and Eunotinae (p. 32): Pteromalidae).

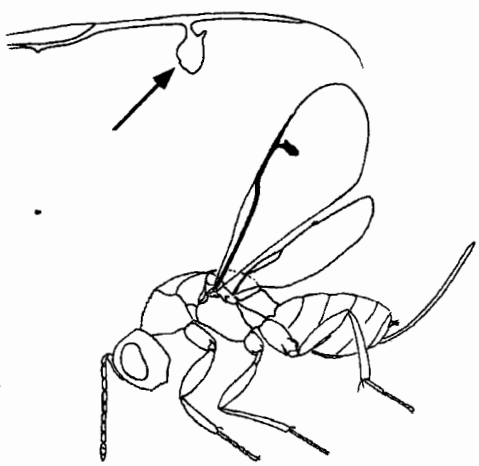
Ceinae: Pteromalidae



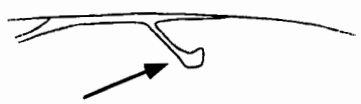
B
From Page 24

Forewing stigma enlarged, longer than stigmal vein, and projecting toward hind margin of wing; ovipositor sheaths always exserted; antenna with 7 funicle segments.

Megastigminae: Torymidae



Forewing stigma not enlarged, shorter than stigmal vein (stigma sometimes surrounded by pigmented area or stain; ovipositor and antenna variable.



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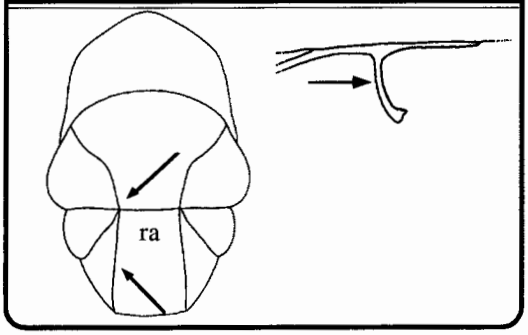
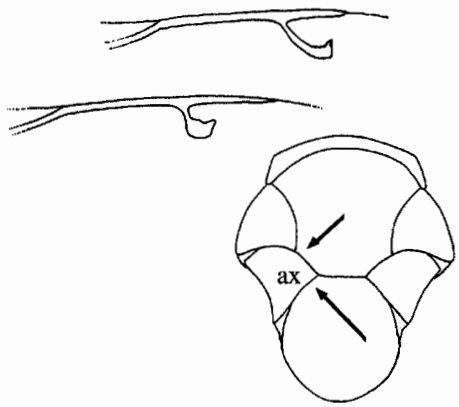
From Page 25

Scutellum with submedian grooves that meet notauli and delimit median rectangular area (ra), **or** stigmal vein long and nearly at right angle to marginal vein (postmarginal may be absent); from figs in Florida, Arizona, and California. Rarely collected.

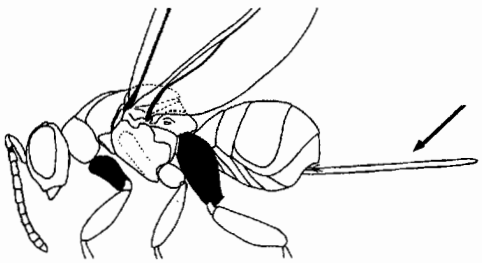
Sycophaginae, Epichrysomallinae, Sycoryctinae: Agaonidae



Scutellum without submedian grooves, or if present (rarely) then grooves do not meet notauli; notauli separated from scutellum by axilla (ax) or absent; either stigmal vein long and angled off of marginal vein or short. Common and widespread.

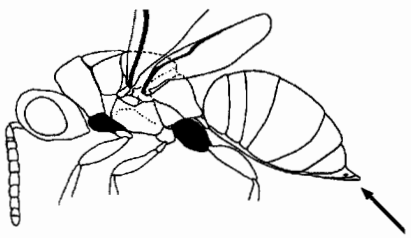


Hindcoxa much longer and wider than forecoxa (2-3X); if questionable, then notauli absent or weak and female with exserted ovipositor.



To Page 27

Hindcoxa nearly same size as forecoxa; if questionable, then notauli well developed and female ovipositor not exserted.



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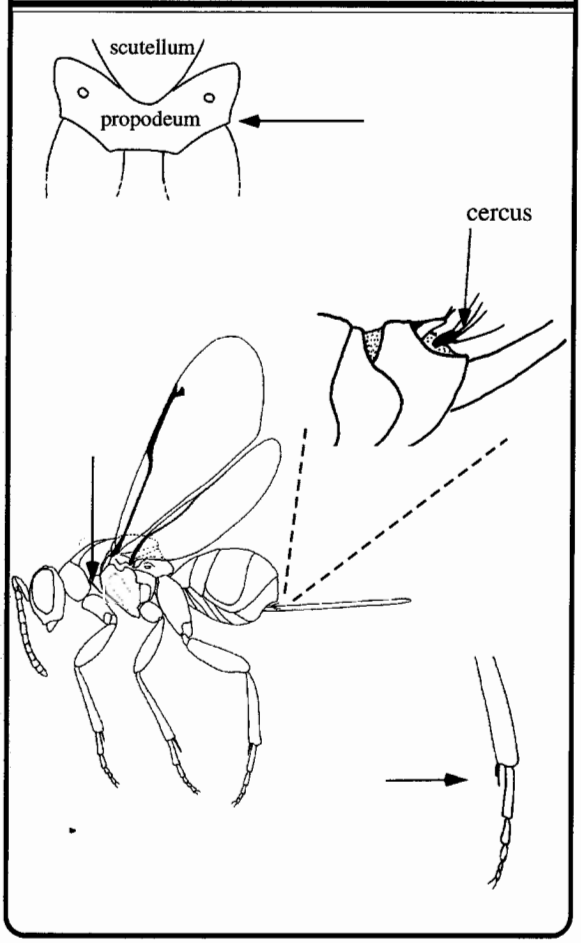
From Page 26

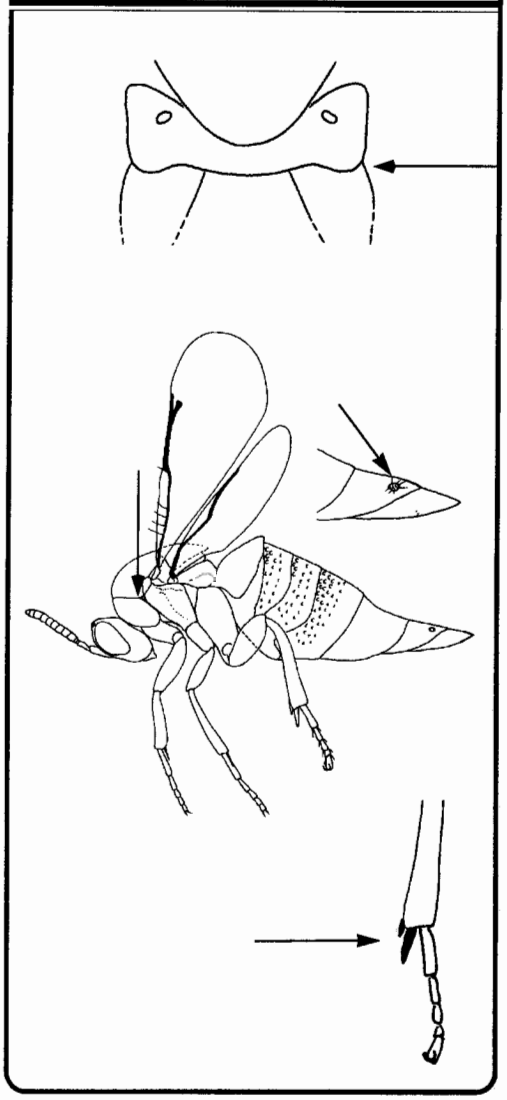
In female, ovipositor strongly exserted; both sexes: metasoma without pits; propodeum posterolaterally angled and not projecting over hindcoxa (dorsal view); cerci of last tergum elongated and with long setae (not as apparent in male as female); prepectus subequal to tegula; hindtibial spurs thin.

Toryminae: Torymidae



In female, ovipositor not exserted; both sexes: metasoma with pits; propodeum posterolaterally rounded and projecting over hindcoxa (dorsal view); cerci of last tergum disk-like; prepectus much smaller than tegula; hindtibial spurs thickened.

Family Ormyridae



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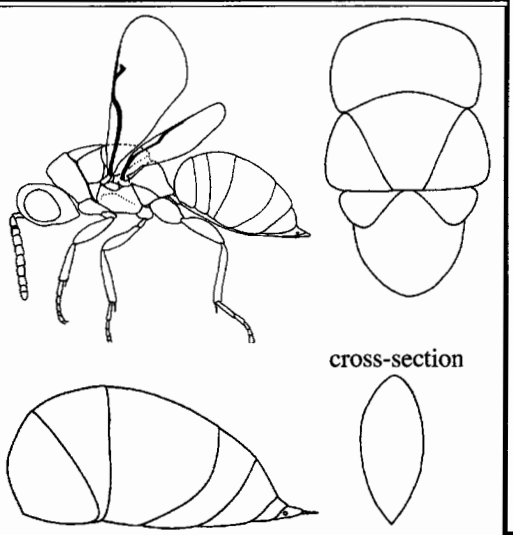
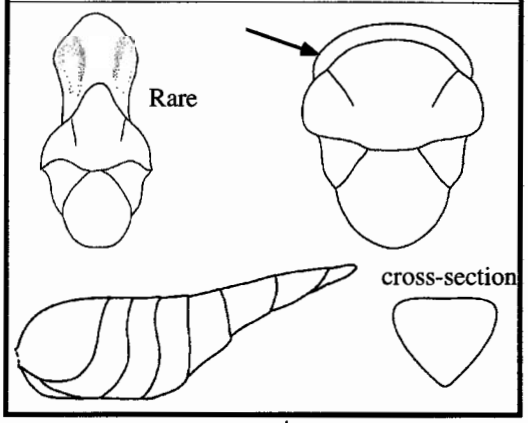
Pronotum rectangular in dorsal view, about as wide as scutum, parallel-sided, and laterally flat; body black, yellow, or mixed black and yellow, but rarely metallic (and then only faintly); metasoma usually oval in cross-section and laterally compressed.

Family Eurytomidae



Pronotum in dorsal view narrowed to a transverse strip, or not visible (if elongate, then narrower at base than apex and sides concave for reception of front femora (rare, some Cleonyminae)); body often metallic blue or green, rarely black; metasoma usually keel-shaped (triangular in cross-section) and somewhat dorsally compressed.



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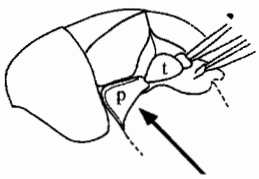
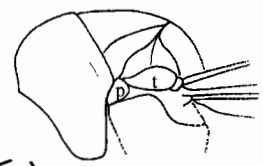
Prepectus (p) as large or larger than tegula (t).——— Prepectus smaller than tegula.

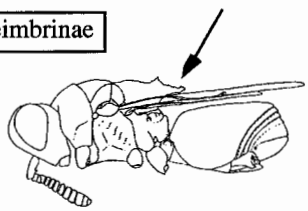
Eurytominae





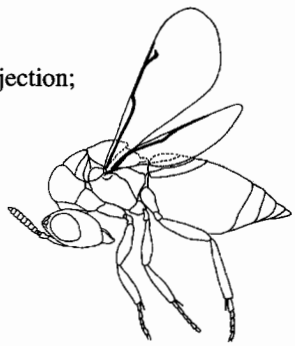
Scutellum with projection; tegula sculptured.

Heimbrinae



Scutellum without projection; tegula smooth.

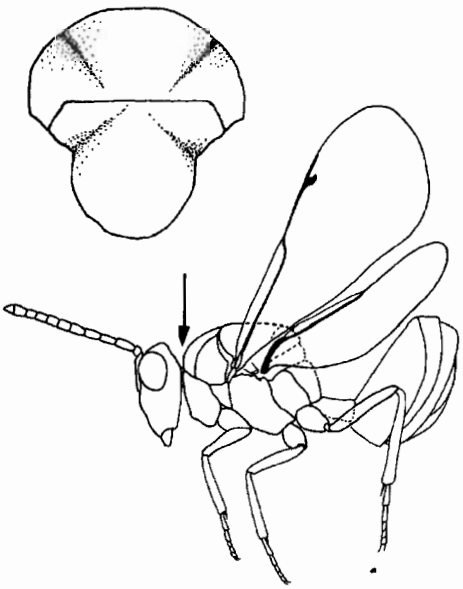
Rileyinae



From Page 28

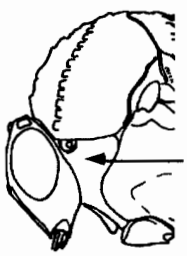
Pronotum not visible in dorsal view, covered by strongly arched scutum; metasoma "rudder-like," with MT1 obviously petiolate.

Family Eucharitidae

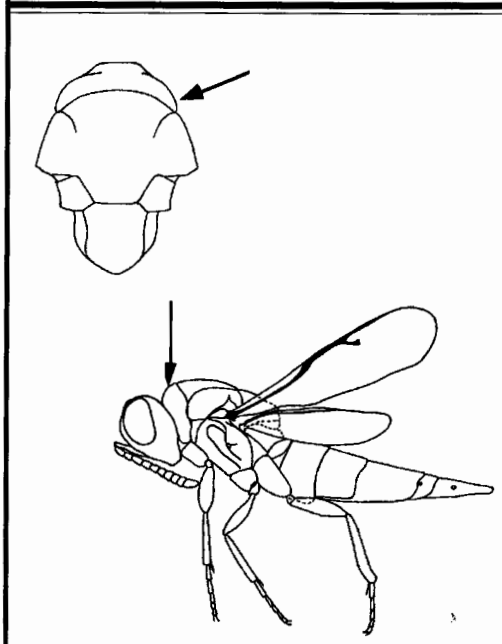


Prepectus fused to pronotum, not reaching tegula; flagellomere 1 not reduced.

Eucharitinae



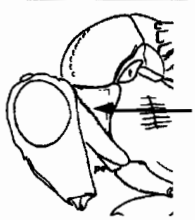
Pronotum visible in dorsal view, scutum not strongly arched; metasoma usually elongate and MT1 usually not visible (petiolate forms do occur).



To Page 30

Prepectus not fused to pronotum, reaching tegula; flagellomere1 reduced (ringlike).

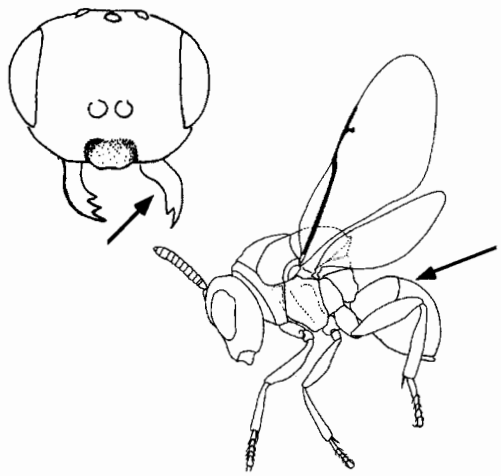
Oraseminae



From Page 29

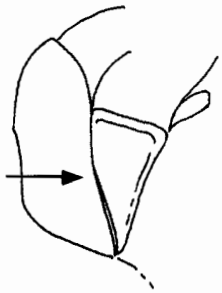
Metasoma covered by first two terga (or may appear to be covered by single tergum); body short and squat; head with well-defined clypeus and at least 1 mandible with 2 teeth.

Family Perilampidae



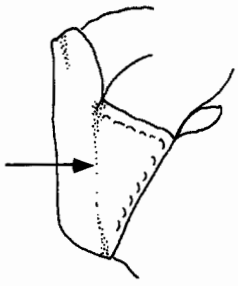
Prepectus not fused to pronotum (suture clearly visible).

Chrysolampinae



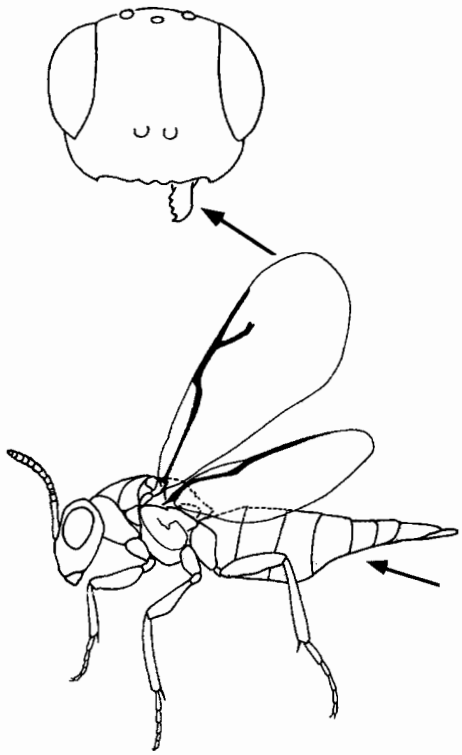
Prepectus fused to pronotum (suture absent or faintly indicated).

Perilampinae



Metasoma with 3 or more readily visible terga; body usually elongate; head variable but generally with inconspicuous clypeus and small mandibles with 3 or 4 teeth.

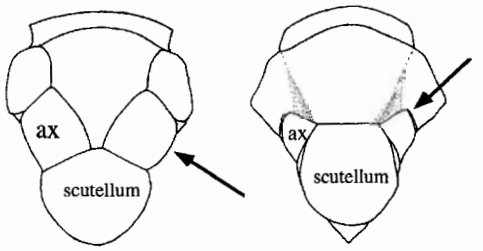
Family Pteromalidae



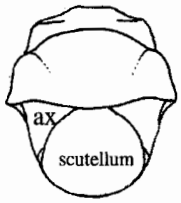
To Page 31
Subfamilies of Pteromalidae & Tetracampidae

From Page 30

Axillae (ax) advanced far forward of scutellum or cutting a sharp angle into side lobe of scutum.



Axillae not extending forward of scutellum, or if slightly advanced, not cutting a sharp angle into side lobe of scutum.



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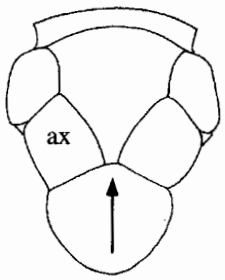
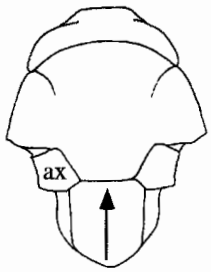
Axillae enlarged, nearly meeting medially; body covered with white, scale-like setae.

Eutrichosomatinae: Pteromalidae

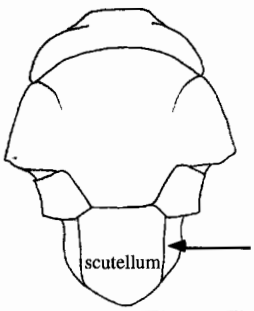


Axillae not enlarged, not close medially; body without white, scale-like setae.



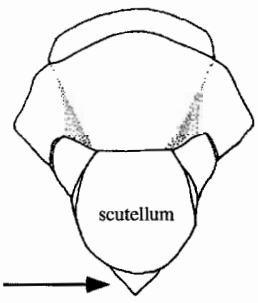
Scutellum posteriorly without triangular "projection" and with parallel dorsal grooves.

Colotrechninae: Pteromalidae



Scutellum posteriorly with triangular "projection" (actually part of the metanotum) and without apparent dorsal grooves.

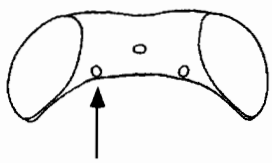
Macromesinae: Pteromalidae



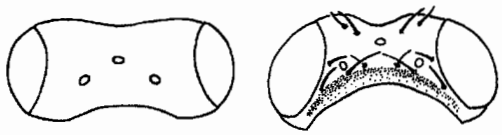
From Page 31

Head in dorsal view with posterior ocelli touching sharp occipital edge.

Eunotinae: Pteromalidae

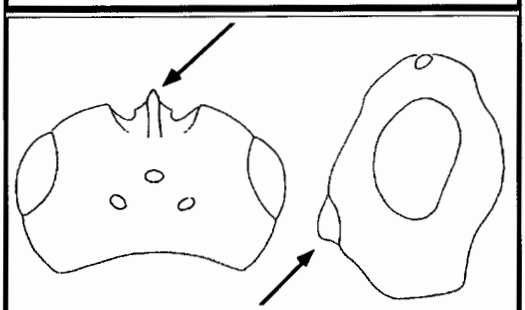


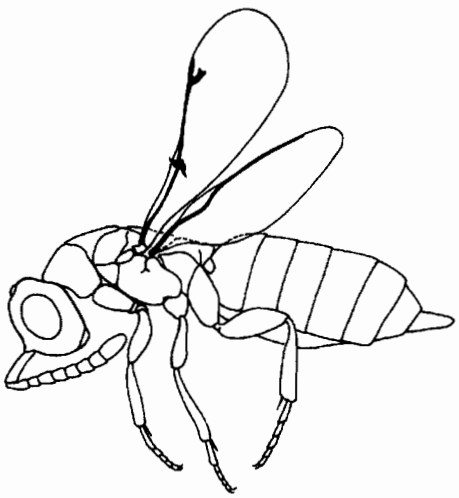
Head in dorsal view with posterior ocelli distant from rounded occipital margin; if questionably so, then head with curved black stout setae.



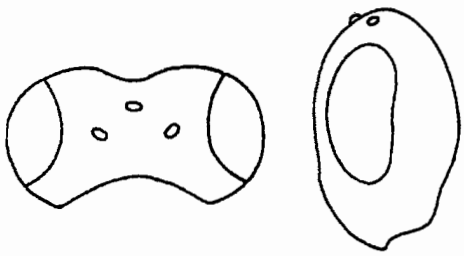
Head with projection between antennae, visible both from above and side (antennae not shown); non-metallic brown.

Cerocephalinae: Pteromalidae





Head without interantennal projection; mostly metallic or black.



To Page 33

From Page 32

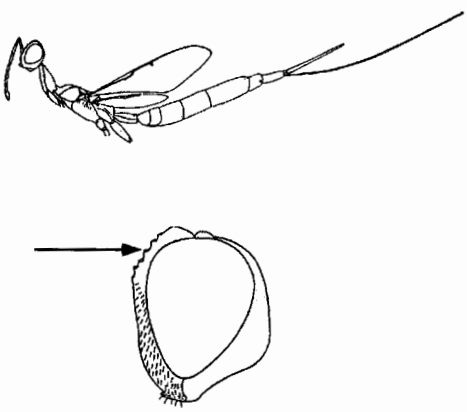
Head and thorax dorsally with black, curved stout setae (bristles); hindcoxae with fine transverse carinae.

Diparinae: Pteromalidae

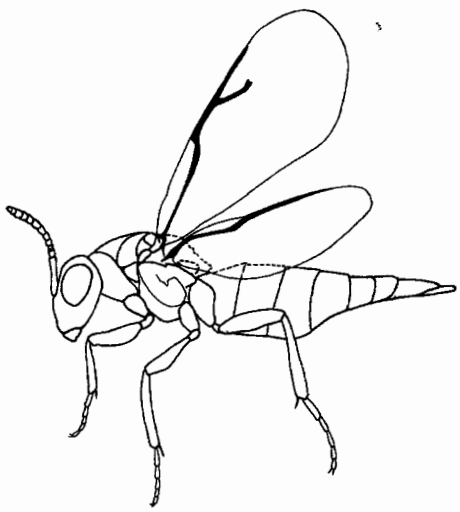
Head and thorax may have setae, but smaller, not stout or bristle-like; hindcoxae sculptured or smooth, without transverse carinae.

Body characteristically elongate (1-2 cm); head with ridged, raised areas between eye and scrobal basin. Extremely rare.

Leptofoeninae: Pteromalidae



Body less elongate (generally less than 1 cm); head without ridged, raised area between eye and scrobal basin. Common.

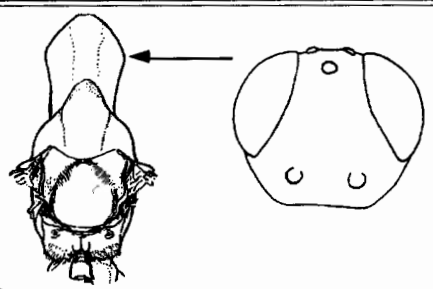


To Page 34

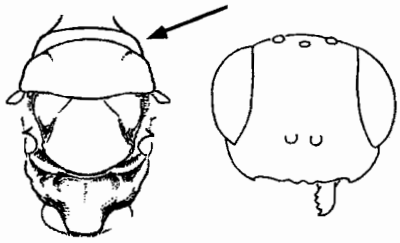
From Page 33

Inner eye margins divergent ventrally, parallel dorsally; pronotum often, though not always, longer than wide.

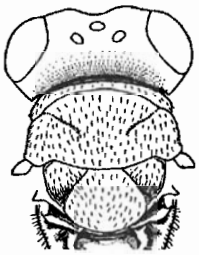
Cleonyminae: Pteromalidae



Inner eye margins essentially parallel; pronotum always wider than long.

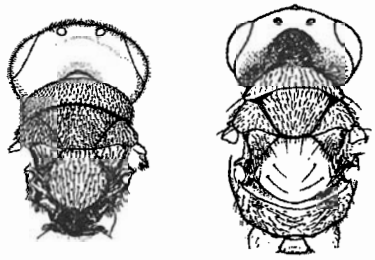


Eyes not densely setose, head and thorax occasionally so; scutellum rarely with paired bristles, but if so there are 3 or more pairs and they are inconspicuous.



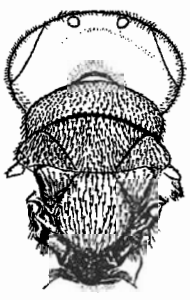
To Page 35:A

Either eyes, head, and thorax densely covered with setae, or scutellum essentially polished and with only 2 pairs of bristles. Rarely collected.



Eyes, head, and thorax densely covered with setae.

Herbertinae: Pteromalidae



Eyes bare; scutellum essentially polished and with 2 pairs of prominent bristles.

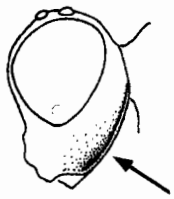
Family Tetracampidae

Although distinct from Pteromalidae, this family most readily keys here.

A
From Page 34

Sides of head ("cheeks") carinate laterally.

Asaphinae: Pteromalidae

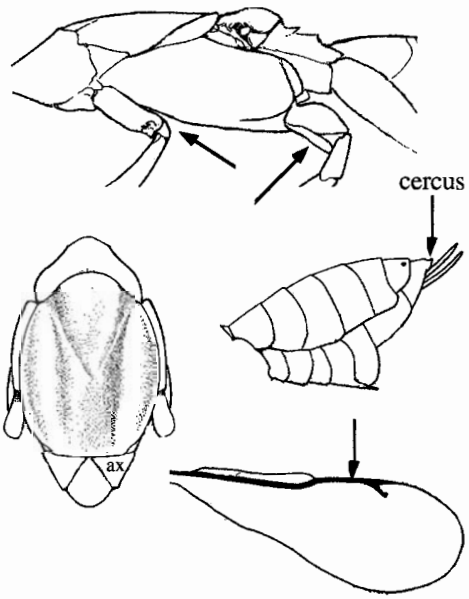


Sides of head rounded laterally.

Pteromalinae/Miscogasterinae: Pteromalidae

B
From Page 24

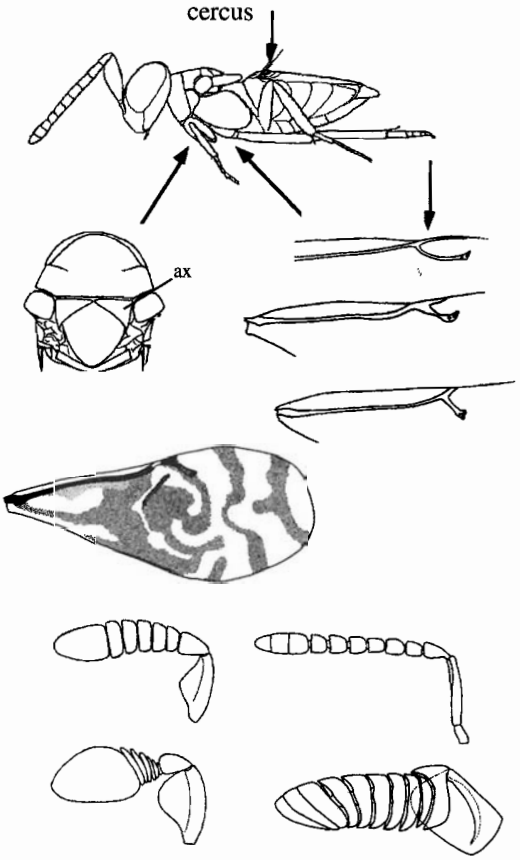
Fore & midcoxae separated (midcoxa posterior to midpoint of mesopleuron; if questionable, then prepectus is inflated); axillae (ax) usually not meeting medially (if so, at least as long as wide); marginal vein longer than stigmal or postmarginal vein; cercus at apex of metasoma.



To Page 36

Fore & midcoxae nearly touching (midcoxa anterior to middle of mesopleuron); axillae (ax) meeting medially, wider than long; marginal vein usually shorter than stigmal or postmarginal vein; cercus anterior to apex of metasoma.

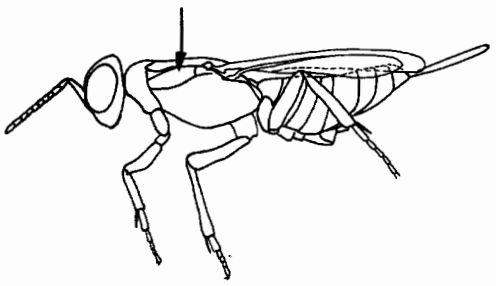
Family Encyrtidae



From Page 35

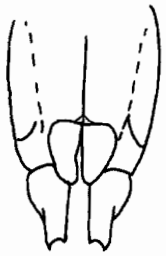
Notauli rarely visible, rarely meeting; prepectus flat and not projecting forward.

Family Eupelmidae

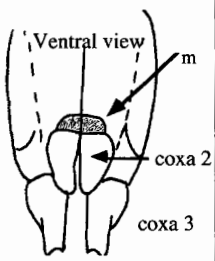


Without membranous area anterior to mid coxal insertion.

Neanastatinae

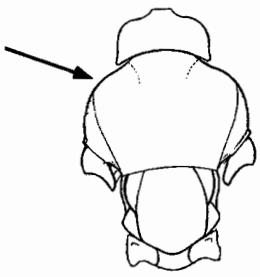


With membranous area (m) anterior to midcoxal insertion.



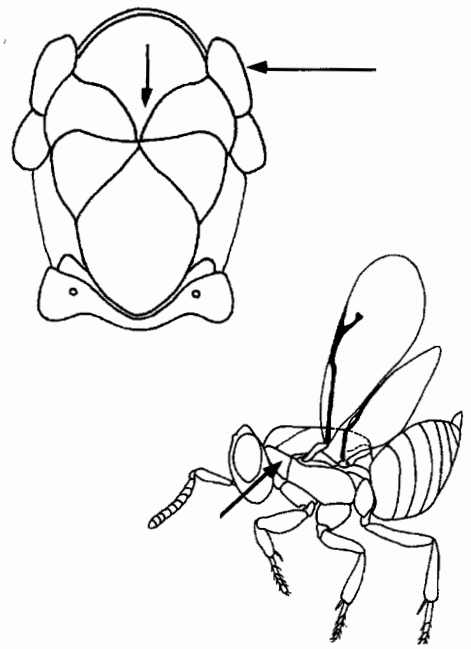
Scutum wider than pronotum, with anterolateral shoulders produced. Pronotum not divided medially nor with longitudinal white line. Both sexes.

Calosotinae



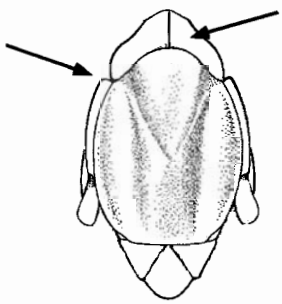
Notauli often meeting medially; prepectus inflated and projecting forward laterad of pronutum.

Family Tanaostigmatidae



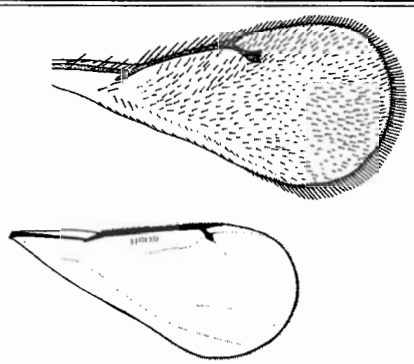
Scutum not much wider than pronotum, with anterolateral shoulders indistinct. Pronotum usually divided medially or with longitudinal white line. Females.

Eupelminae

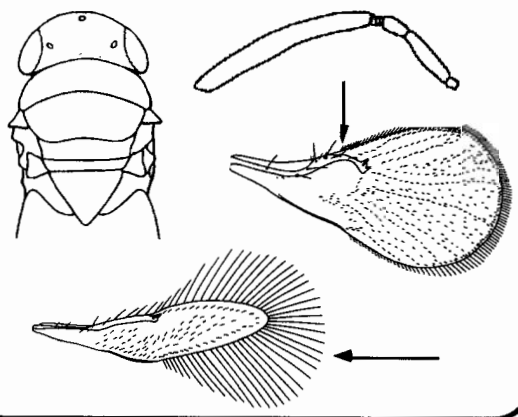


From Page 22

Generally 1 mm or more in length; body often metallic or dark in color; metasoma narrowly joined at propodeum (petiole may or may not be apparent); tarsi always 4-segmented; postmarginal vein present or absent.



Generally 1 mm or less in length; body usually pale yellow to white, sometimes with dark markings or wholly dark, but not metallic; metasoma broadly joined to propodeum; postmarginal vein absent; tarsi usually 3 or 5-segmented (if 4-segmented, then club large and undivided or wing fringed with long setae, or only middle tarsi 4-segmented).



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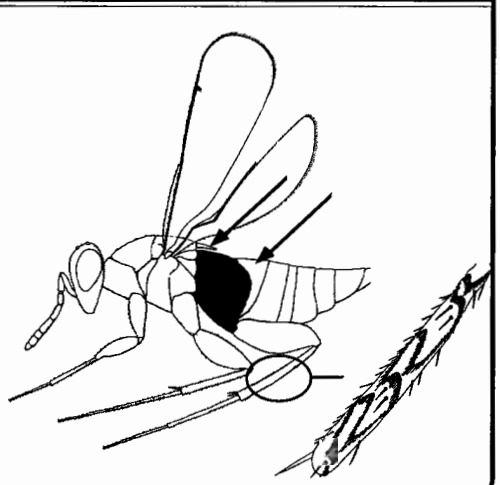
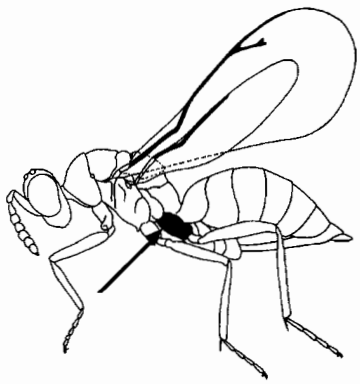
Hindcoxa greatly enlarged; posterior scutellum (actually metanotum)with triangular, usually translucent flap overhanging propodeum; hindtibia with irregular, linear, or diamond-shaped patterns of setae; habitus as shown.

Family Elasmidae



Hindcoxa "normal"; posterior scutellum without overhanging triangular flap; hindtibia without irregular patterns of setae.



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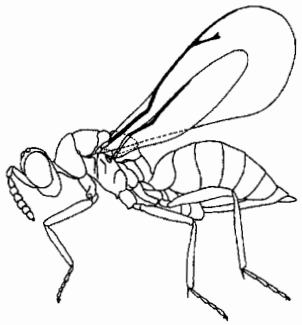
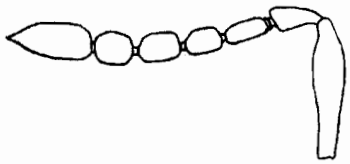
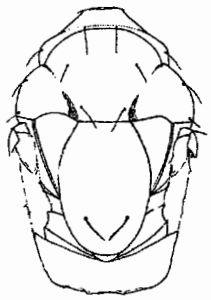
From Page 37

Family Eulophidae







Scutellum with 1 pair of setae; submarginal vein with 2 setae; face usually with scrobal and facial grooves.

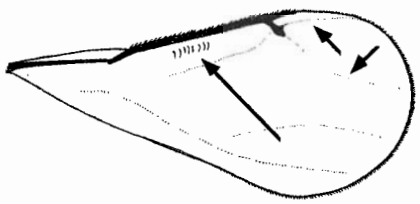
Entedoninae

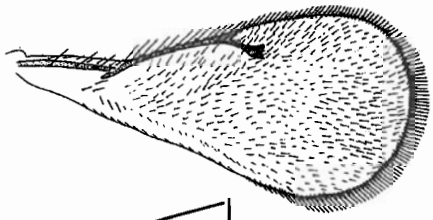
Scutellum with 2 pairs of setae (rarely 3 or more); submarginal vein with 3 or more setae (rarely with 1 or 2); face usually without distinct grooves.

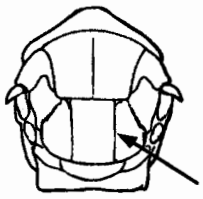
Forewing with bare area posterior to marginal vein with single row of ventral setae; usually with 2 or 3 "lines of setae" radiating from stigmal vein.

Euderinae

Forewing usually evenly setose posterior to marginal vein, without row of setae; rarely with any "lines of setae" radiating from stigmal, but when present usually only 1line.



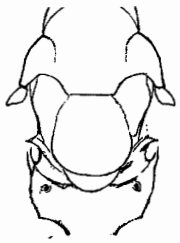




Postmarginal vein usually absent; scutellum generally with paired submedian grooves which divide the scutellum into three distinct pieces.

Tetrastichinae

Postmarginal vein present; scutellum without submedian grooves, rarely with lateral grooves, when present at extreme lateral margins.



Eulophinae

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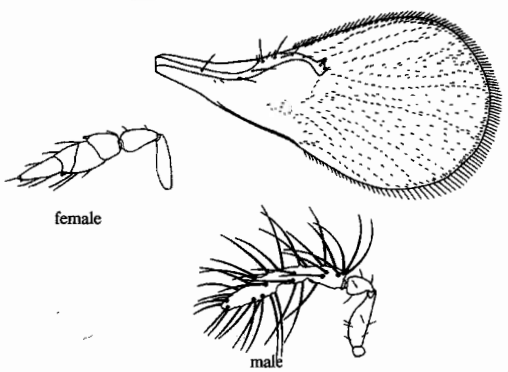
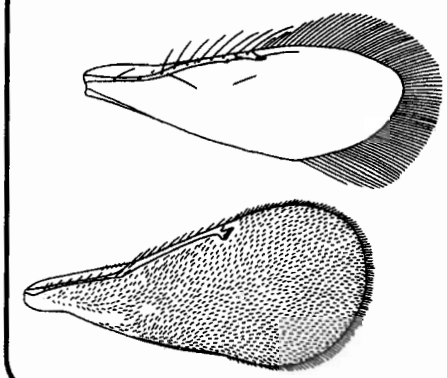
Tarsi 3-segmented; setae on wings often arranged in rows; stigmal vein usually elongate; antennae short and with few funicular segments recognizable, male with elongate antennal "setae."

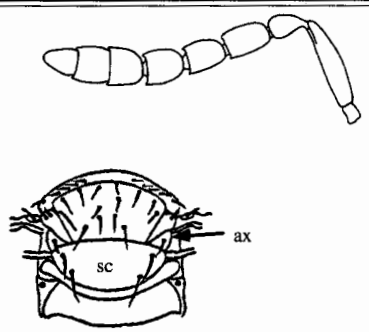
Family Trichogrammatidae



Tarsi 4 or 5-segmented; setae on wings mostly absent, evenly covering wings, or with only a few bare spots or rows present; stigmal vein short and not noticeably divergent from wing margin; antennae variable, but usually with recognizable funicle segments (if not, then with large undivided club).



Propodeum without median triangular area; scutellum (sc) not transverse (anterior, posterior sides not parallel); axillae (ax) distinct from scutellum, rarely meeting medially; club of antenna almost always segmented (a few spp. here have antennae like signiphorids).



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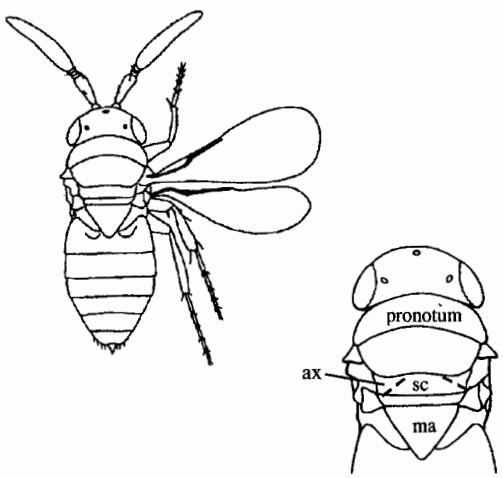
Propodeum with triangular median area (ma); scutellum (sc) transverse (parallel sided); axillae either united with scutellum or widely separated; club of antenna elongate and unsegmented.

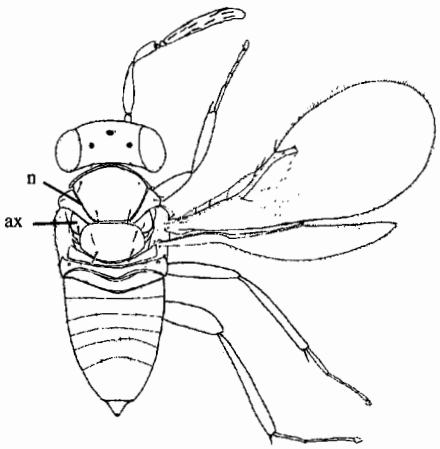
Family Signiphoridae

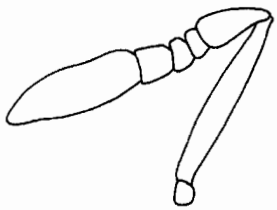


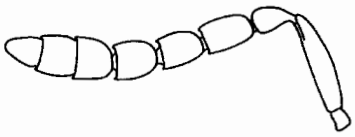
From Page 39

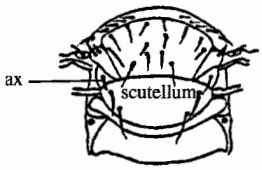
Axillae (ax) not meeting medially, generally widely separated; notauli (n) present; (antennal club in *Eretmocerus* large and undivided, tarsi 4-segmented).

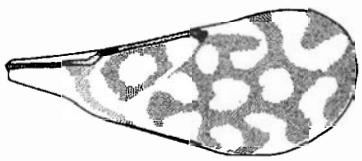
Family Aphelinidae

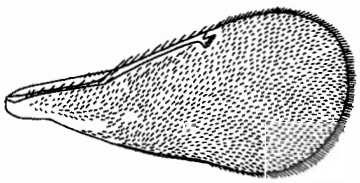


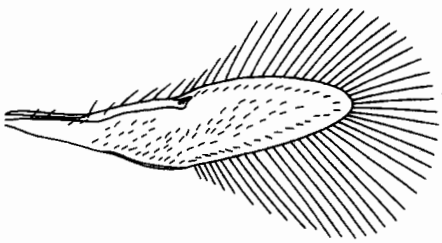












FAMILY SYSTEMATICS

In the ensuing family write-ups we have used the following standard sequence for organizing information:

INTRODUCTION: A generalized statement as to the overall current state of knowledge about the family. Depending upon available literature this may refer to the Nearctic, Neotropical, or world fauna. The higher classifications used are based upon what we consider a consensus of current thought.

STATISTICS: The approximate number of world genera and species is given as well as figures for the Nearctic (essentially United States northward) and Neotropical (Mexico southward) Regions. World data is taken from Noyes (1990a), Nearctic data from the 1979 Hymenoptera catalog, and Neotropical figures from De Santis' works (see "Literature Resources," p. 9). These figures are by no means fixed, nor necessarily exact. They are the best estimates currently available and are intended to give the reader some idea of the relative diversity of the group. The figures may represent only one-fifth the total chalcidoid fauna.

BIOLOGY: In most cases the known hosts for the family are outlined. Unusual hosts and/or biologies are discussed where data indicate divergence from a behavior expected for the group. For example, many hundreds of Eulophidae parasitize Lepidoptera, whereas a few attack mites or thrips or are aquatic.

DISTINGUISHING CHARACTERS: The best characters for separating closely related (or similar appearing) families are given. These characters, as well as problems involved with identification, are discussed at more length than is possible in the key. This serves both as a check against tentative identifications made with the key as well as a shortcut for those who may have reason to believe that a particular specimen is a member of a particular family. In general, except Pteromalidae, we do not discuss subfamily level characters in the text, but show them in the key.

COLLECTING: Likely habitats or hosts are suggested based primarily on personal collecting experiences throughout the United States and parts of Canada The section on biology also points out the sort of hosts one should collect to rear certain types of chalcidoids.

DISTRIBUTION: A general summary of distribution is given, especially with reference to groups of restricted habit.