

A REVISION OF THE SPECIES OF ENCARSIA FOERSTER (HYMENOPTERA:  
APHELINIDAE) FROM INDIA AND THE ADJACENT COUNTRIES

MOHAMMAD HAYAT

Department of Zoology, Aligarh Muslim University,  
Aligarh-202 001, India.

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**ABSTRACT.** The species of the aphelinid genus *Encarsia*, from India and the adjacent countries are revised. Seventeen species and one subspecies are described as new, and redescriptions or notes, and illustrations are provided for a majority of the known species occurring in the area. Five specific names are placed in synonymy. A total of fifty-one species are recognized from the area. A key for the identification of sixty-two Oriental species, based on females, is given. The systematic position of the genus in the higher classification of the family is briefly discussed, and tentative species-groups are outlined.

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## INTRODUCTION

The genus *Encarsia* Foerster contains primary parasitoids of scale insects and whiteflies (Homoptera: Diaspididae, Aleyrodidae). It is a large genus containing over 170 species. Some of the species (*E. perniciosi*, *E. clypealis*, *E. citrina*, *E. lahorensis*, *E. formosa*) are better known because of their usefulness in the control of economically important pest species (*Quadraspidiotus perniciosus*, *Dialeurodes citri*, *Aleurocanthus woglumi*, *Aonidiella aurantii*, *Trialeurodes vaporariorum*, etc.), and have become widely distributed because of large scale introductions in several countries. Excluding such species (some possibly representing morphologically indistinguishable siblings or host-determined races or strains) which can be recognized relatively easily, the taxonomic identities of majority of the species are not well known. This is because most of the species are known only from the originally included, and often inadequate, material which makes it almost impossible to assess intraspecific variation. For instance, of the known species, 48 were described each from a single specimen (add to this the 5 species described in this paper), 23 species described from two specimens each, 8 species from three specimens each, 4 on four specimens, and 6 on five specimens each: not at all an encouraging picture for a genus of major economic importance.

Considering the importance of the species of *Encarsia* in the biological control of insect pests and the addition of new species in the recent years, it is imperative that the earlier described species be studied not only to establish their correct identities, but to avoid the unnecessary, albeit unintentional, description of invalid synonyms also. Studies in this direction have already begun as evident from the recent papers by Viggiani (1985) on the types of the species described by Girault and my studies (not published) on the types of several earlier described species. The present paper is a step in this direction and takes care of the species from India and the adjacent countries.

Contributions to the taxonomy of *Encarsia* from the area may be said to have begun with the description of two species from Sri Lanka by Howard (in Howard & Ashmead, 1896). This was followed by descriptions of species, mainly from India, by Howard (1911), Mani (1941), Prasad (1955), Agarwal (1964), Shafee (1973, 1974), Azim & Shafee (1980), Shafee & Rizvi (1983), Hayat (1976, 1984), Subba Rao (1984), and Viggiani (1985a). A few papers also record some extralimital species from the area (Howard, 1898; Flanders, 1969; Hayat, 1981a).

The present contribution aims at providing a preliminary revision of the species of *Encarsia* from India, Pakistan, Sri Lanka and Bangladesh. It is based largely on the material collected in India by me, and that obtained from the British Museum (Natural History), London and the U.S. National Museum of Natural History, Washington D.C. I have

also examined the types of several species described from India as well as a number of extralimital species. It was, however, not considered necessary to study the types when the original descriptions are in sufficient details to permit their recognition (for instance, the species described by Silvestri, 1928, 1931a,b, and Viggiani, 1985a).

A total of 51 species, including 17 new, are recognized from the area. This number obviously represents only a part of the actual number of species likely to be present in such a large area where very little collecting has been done. This statement is supported by the fact that even in the present study several apparently good species could not be included because of the poor condition of the specimens or for other reasons (see notes on indetermined species) Therefore, the present revision is of a preliminary nature. It provides the basis for the recognition of at least morphologically distinct taxa.

The genus *Encarsia* is characterized and diagnosed, and the generic names regarded as its synonyms are discussed. Notes on the higher classification are added and a key to 62 out of the 65 (three based on males) Oriental species based on females, is given.

The material, unless stated otherwise, was collected by the author. The types and other specimens, unless otherwise noted, are retained in the author's collection.

#### MATERIAL AND METHODS

**Material:** The revision is based on the study of several hundred specimens. More than 280 slides, each containing from one to thirty specimens, and several card mounted specimens were used in this study. All the slides and some cards were serially numbered, beginning 1E. For easy location of the material, these numbers are mentioned both under the 'Material examined' section under each species and in the explanation to the figures.

**Preservation:** The specimens of *Encarsia* are best preserved as slide mounts. It may not be possible to see all the characters and measure some structures in carded specimens. However, when more specimens are available, it is preferable to have both slide mounted and carded specimens. Since body colour is likely to fade during clearing process, it might be necessary to note the colour and sculpture either from dried or freshly collected specimens. In no case should the specimens be preserved in alcohol. The smaller size of the specimens and their soft, less sclerotized bodies, make the specimens almost useless for study if preserved in alcohol for longer periods.

The method given by Noyes (1982) was followed for slide preparation. However, some of the slides available for study from other collections and those prepared before 1982 by me, contain specimens that were not properly cleared.

**Descriptive methods:** The descriptions of the species are kept as brief as possible by not repeating the generic characters and by illustrating the species adequately.

An illustrated part is not described, unless there are variations which are noted. The descriptions or redescriptions are presented in a standard sequence.

**Figures:** The female antennae (except Figs. 3-5, 90b, 231b-d, 275b) were drawn on the same scale (=magnification), and the middle tibia and ovipositor (except Figs. 10, 11) not only on the same scale but also from the same specimen in each species. This method will facilitate direct comparison of the 'size' and dimensions of these structures in all the species. This has been made possible by keeping the reduction factor same for all the figures.

#### EXPLANATION OF TERMS AND MEASUREMENTS

The terms and measurements are illustrated in Figs 1-14. Some of these, however, need further explaining.

**Antennal segments:** The number of segments in the antenna are 8 in females and 7 or 8 in the males. In both, the radicle and the anellus are not counted in the number of antennal segments.

**Antennal formula:** The antennal formulae in *Encarsia* species vary. These are : 1 (scape), 1 (pedicel), 3 (funicle segments), 3 (3-segmented clava); or 1,1,4,2; but also 1,1,2,4 or 1,1,6 (flagellum not clearly differentiated into funicle and clava). Therefore, in order to attain some uniformity in the nomenclature, the number of segments of the flagellum are expressed in 'Arabic' numerals preceded by the alphabet 'F'. Thus the first segment of flagellum (or funicle) is F1, the first segment of clava, in a species with a 3-segmented clava, is F4, and so on. The clava thus may be formed of F4-6, F5 and F6, or F3-6.

**Pedicel:** The pedicel, in side view, is rarely if at all a perfect isosceles triangle. Its dorsal length is usually greater than its ventral length (Fig. 7). Therefore, to avoid confusion and uncertainty in running a specimen through the key, I have consistently compared only the ventral length of pedicel with its width or with the lengths of other segments. Exceptionally this was not possible when the antenna was not properly mounted on the slide.

**Thorax:** Length of the thorax is its median length measured from the apex of pronotum to apex of propodeum. The width is measured at level of, but excluding, tegulae.

**Fore wing:** The length of the marginal fringe means the length of the longest seta(e) of the marginal fringe. Unless mentioned otherwise, there are only two primary setae on the submarginal vein. The usually prominent seta located at the junction of the submarginal vein and the parastigma or on the parastigma, is not counted.

**Basal cell:** It is the area between the base of the fore wing and the basal fold (in aphelinids, an imaginary line running slightly obliquely inwards from the parastigma to the posterior margin of the wing). The setae present below the parastigma are described as 'setae in basal cell'.

**Gaster:** The petiole is excluded in counting the number of segments of the gaster. The gaster has thus seven terga,

and these are numbered in Roman numerals (I-VII). The length of tergum VII is measured from its mid base to apex, and its width between the cercal plates.

**Ovipositor:** The term ovipositor, in this paper, refers to the second valvifer and the third valvula (=ovipositor sheath, gonostylus) combined.

#### ABBREVIATIONS

|       |   |
|-------|---|
| BMNH  | British Museum (Natural History), London.   |
| BPBM  | Bernice P.Bishop Museum, Honolulu, Hawaii, U.S.A.   |
| CIE   | Commonwealth Institute of Entomology, London.   |
| IARI  | Division of Entomology, Indian Agricultural Research Institute, New Delhi.                              |
| IEUN  | Istituto de Entomologia Agraria, Universita degli Studi di Napoli, Portici, Italy.                      |
| MCSG  | Museo Civico di Storia Naturale, Genova, Italy.   |
| USNM  | United States National Museum of Natural History, Washington D.C.                                       |
| ZDAMU | Department of Zoology, Aligarh Muslim University, Aligarh, India. (In individual authors' collections.) |
| ZSI   | Zoological Survey of India, Calcutta.   |

#### GENERAL ABBREVIATIONS

M        Male

F        Female

SYN.NOV. New synonym proposed in this paper

#### Genus *Encarsia* Foerster

*Encarsia* Foerster, 1878: 65. Type species: *Encarsia tricolor* Foerster, by monotypy.

*Aspidiotiphagus* Howard, 1894a: 229. Type species: *Coccophagus citrinus* Craw, by original designation. Synonymy by Viggiani & Mazzone, 1979: 44.

*Prospalta* Howard, 1894b: 6. Type species: *Coccophagus aurantii* Howard, by designation of the ICZN under its Plenary Powers, Opinion 845. Preoccupied by *Prospalta* Walker, 1857, in Lepidoptera.

*Prospaltella* Ashmead, 1904a: 126. Replacement name for *Prospalta* Howard. Synonymy by Viggiani & Mazzone, 1979: 44.

*Mimatomus* Cockerell, 1911: 464. Type species: *Mimatomus peltatus* Cockerell, by monotypy. As synonym of *Prospaltella* by Girault, 1917: 114.

*Doloresia* Mercet, 1912: 294. Type species: *Prospaltella filicornis* Mercet, by original designation. Synonymy by Mercet, 1930a: 191.

*Prospaltoides* Brethes, 1914: 12. Type species: *Prospaltoides howardi* Brethes, by original designation. As synonym of *Aspidiotiphagus* by Brethes, 1916: 429.

*Paraspidotiphagus* Alam, 1956: 359. Type species: *Aspidiotiphagus flavus* Compere, by original designation. As subgenus of *Aspidiotiphagus*.

*Aleurodophilus* DeBach & Rose, 1981: 659. Type species:

*Aleurodiphilus americanus* DeBach & Rose, by original designation. Synonymy by Hayat, 1983: 85.

*Encarsia* is a valid taxon. It was described by Foerster (1878) with *E. tricolor* Foerster as its only included species. Foerster considered the type specimen as a male, but Nowicki (1929) has conclusively shown that it is a female and that it is a senior synonym of *Prospalta conjugata* Masi (Misspelt in the literature as *conjugata*.)

*Prospaltella* was described for the species *murtfeldtiae* (originally spelt *murtfeldtii*, but emended justifiably by Peck, 1951) and that species should be the type species virtually by original designation. In the last paragraph of the article, Howard also referred another species to this genus in the following words: 'To this genus may also be referred *Coccophagus aurantii* How. ...'. However, on a submission by Nikol'skaya & Trjapitzin (1965) (see also Burks, 1966), the International Commission on Zoological Nomenclature designated *C. aurantii* as the type species of this genus. *Prospaltella* could not remain valid for long. Viggiani & Mazzone (1979) synonymized it with *Encarsia* on the ground that it is impossible to separate it from Foerster's genus on any well-defined character.

*Mimatomus* Cockerell was considered a synonym of *Prospaltella* by Girault (1917) and this synonymy was accepted by all other authors. I have seen the lectotype (designated by Viggiani) of *M. peltatus* and consider the synonymy correct. The species agrees with my concept of the genus (Hayat, 1983) except that the maxillary palps are 2-segmented. *Doloresia* was synonymized with *Encarsia* by Mercet (1930a) and that synonymy has been accepted by all the subsequent authors.

*Aleurodiphilus* was separated from *Encarsia* on the presence of a glabrous area around stigmal vein and a 2-segmented clava. These and other minor characters mentioned by DeBach & Rose (1981) were not considered of generic value and, therefore, it was placed in synonymy with *Encarsia* by Hayat (1983).

The synonymy of *Aspidiotiphagus* with *Encarsia*, proposed by Viggiani & Mazzone (1979) has not been accepted by all aphelinid taxonomists, and DeBach & Rose (1981) rejected that synonymy. These authors separated *Aspidiotiphagus* from *Encarsia* mainly on three characters: presence of a single seta on each side lobe, presence of a bare area around stigmal vein, and distinctly sculptured petiole. The genus was separated from *Aleurodiphilus* on the presence of a single seta on each side lobe, sculptured petiole, a 3-segmented or apparently 4-segmented clava, and the known species being parasitoids of diaspid scales. I consider, however, that these differences only give those species the status of a separate species-group, since all other characters overlap with majority of *Encarsia* species. The genus *Encarsia* contains species that have a sculptured petiole (see sankarani, for instance). I have, therefore, followed Viggiani & Mazzone (1979) in treating the genus

as a synonym of **Encarsia**.

The synonymy of **Encarsiella** Hayat, 1983, with **Encarsia** proposed by Shafee & Rizvi (1984) was not accepted by the author (Hayat, 1985) on the ground that it was based on literature and not on the study of relevant material. After study of several related species of this genus, I have come to the conclusion that **Encarsiella** should be regarded as a synonym of **Dirphys** Howard.

The generic name **Trichaporus** is not considered in this paper. It is sufficient to note that I agree with LaSalle & DeBach (1982) that this name must be rejected in favour of the eulophid **Galeopsomyia** Girault.

**Encarsia** is characterised as follows:

Head dorsum transverse, twice or more as wide as long, rarely less; frontovertex usually distinctly wider than dorsal eye width and usually at least as wide as long; ocellar triangle with the anterior ocellus forming a right angle or obtuse angle with the lateral ocelli; vertex with an oblique, usually relatively darker (than frontovertex) bar behind each lateral ocellus; sometimes these bars are weak; pale lines on head include ocellar lines, mediofrontal line, facial lines and ocular lines; but their visibility is directly related to the melanization of the head - a darker head shows these lines clearly whereas these are hardly discernible in a pale yellow head; malar space (gena, cheek) with a suture; head in front view distinctly wider than high; antennal toruli separated from mouth margin by less than the major diameter of a torulus; mouth fossa usually less than half the minimum width of frontovertex, rarely wider than that; mandibles with two teeth and a truncation, the teeth either sharp or blunt, or weakly developed, or rarely the mandibles with a tooth and a truncation or edentate; palps unsegmented, in some species the maxillary palps 2-segmented.

Antennae 8-segmented excluding radicle and anellus, occasionally 7-segmented in some males; scape cylindrical or slightly flattened, but never expanded beneath; relative dimensions of pedicel and flagellar segments vary much, and these are useful as key characters; flagellum in female with the distal 2 or 3, rarely 4, segments forming a more or less compact clava; flagellar segments bear rhinaria (longitudinal sensilla), more in males than in females.

Thoracic dorsum only a little convex, but usually on the flatter side; pronotum medially membranous with 6-12 setae along the collar; the seta at each posterolateral angle of pronotum conspicuously longer than the other setae; mid lobe of mesoscutum with 2-18 setae, usual number is 6-12, and these arranged in bilateral symmetry; the setae at each anterolateral side and the posterior pair of setae (in species with more than 4 setae) longer than other setae; each side lobe with 1-5 setae, usually only 3; axillae separated mesally by a distance greater than the maximum length of an axilla and each with a single seta; scutellum distinctly (at least 1.5x) wider than long, more or less biconvex lens shaped and with 4 setae and a pair of circular

pits (placoid sensilla); the anterior pair of setae always shorter than the posterior pair; metanotum a narrow transverse strip provided usually with two minute setae on each side; propodeum narrow in the middle, not much longer than metanotum, and expanded on sides with a spiracle and a pair of setae on each expanded side; mesopostphragma extends beyond apex of petiole to at least the anterior half of tergum I of gaster; mesopleura not strongly bulged (as it is in *Coccophagus*), and with a distinct suture dividing it into a mesepisternum and a mesepimeron; prepectus a single plate, ventrally larger in the middle.

Fore wings with shape and length of marginal fringe variable; costal cell at most as long as marginal vein and usually with a row of minute setae on ventral surface; submarginal vein with 2 setae, rarely with one or more than two; basal cell usually with a few setae (at most 10), rarely otherwise; there is always a strong seta at the junction of the submarginal vein and parastigma or on the parastigma; the number of setae on (outer or anterior margin of) marginal vein vary; postmarginal vein absent, rarely indicated and then very short and shaped like a spur; discal setae variable, the disc very sparsely to very densely setose; speculum (not to be confused with *linea calva* which is absent in *Encarsia*) present; also present is a row of setae along the wing margin beginning from apex of marginal vein and ending at the posterior margin at a point opposite the junction of the parastigma and submarginal vein. Hind wings narrow, with sparsely setose disc and with a row of setae extending from apex of venation to apex of wing; marginal fringe usually at least as long as width of disc. Legs not especially modified; tarsal formula 5-5-5 or 5-4-5.

Petiole transverse, generally invisible in carded specimens, and in slide mounted specimens (usually depending on the state of preservation) varies from 3x to nearly 10x as wide as long, and rarely with fine but distinct sculpture.

Gaster with seven terga; tergum VII varies considerably in length and width, from distinctly wider than long to as wide as long; apex of tergum VII always membranous and transparent white; tergum I generally without setae, terga II-IV each with a seta on each side, terga V and VI usually with double the number of setae than on tergum IV, and tergum VII with usually 4 setae; hypopygium never extends posteriorly beyond level of cercal plates, usually only to about two-thirds to three-fourths along gaster; ovipositor with the relative lengths of the second valvifer and third valvula much variable.

Male genitalia usually with the phallobase several times longer than wide, with a truncate or rounded apex and without digitae; aedeagus generally longer than phallobase; some species have a shorter phallobase with shorter aedeagus much as in some species of *Coccophagus*.

Body colour variable, the males generally darker than

the females. Though not very reliable, body melanization can be used with some degree of confidence as a key character. Fore wings vary from completely hyaline to generally infuscate below the marginal vein across the disc to posterior margin of the wing.

Species of *Encarsia* are never strongly sclerotized. The sculpture is generally invisible at lower magnification in paler forms, but appears a little raised reticulate in darker forms; frontovertex and malar space with lineolate reticulate sculpture; thoracic terga generally with hexagonal cells, those on axillae and mid lobe relatively more strong than on side lobes and the scutellum, the latter with the cells longitudinally drawn-out or longitudinally reticulate in middle; gastral terga either smooth or much more finely reticulate than mid lobe. Setae vary from colourless to dark brown.

**Diagnosis:** *Encarsia* is related to *Dirphys* Howard and *Coccophagooides* Girault. It differs from the latter genus in having the marginal vein of fore wing at least as long as costal cell, gaster with seven terga, and the hypopygium rarely reaching to level of the cercal plates. The antennae are extremely variable in *Encarsia* species. [*Coccophagooides*: marginal vein distinctly shorter than costal cell, gaster with eight terga, and hypopygium rather prominent, reaching at least to level of cercal plates, usually to apex of gaster; the antennae are always spindle shaped and apically pointed; the number of setae on scutellum vary from 4 to 6, and the thoracic dorsum is relatively much more flatter.]

*Encarsia* differs from *Dirphys* in having the antennal clava not broader or not more than one and a quarter times as broad as the preceding funicle segment and with apex rounded or pointed; mid lobe of mesoscutum usually with a few (not more than 18) setae; axillae relatively smaller and the two axillae separated mesally by a distance greater than the maximum length of an axilla; broader scutellum (at least 1.5x as wide as long) and the thorax very little convex. [*Dirphys*: antennal clava at least 1.5x as wide as the preceding segment of funicle; clava distinctly 3-segmented with the apical segment usually obliquely truncate; mid lobe usually densely setose, setae more than 25 and not arranged in bilateral symmetry; axillae large, the two axillae separated mesally by a distance less than the maximum length of an axilla; scutellum not more than 1.5x as wide as long; and thoracic dorsum convex. Also the maxillary palp is 2-segmented. The genus has the habitus strongly suggestive of *Coccophagus*.]

Species of *Coccophagus ochraceus*-Group approach *Encarsia* in the dimensions of thoracic sclerites and to some extent in the shape and venation of the fore wings; but these species at once differ from *Encarsia* species in having a continuous pronotum (not membranous in the middle), 6 setae on scutellum and at least 2 setae on each axilla, and also in having at least 5 setae on the submarginal vein.

**Classification:** The genus *Encarsia* is placed in the subfamily Coccophaginae (sensu De Santis, 1948; see also Hayat, 1985) and in the tribe Pteroptricini of that subfamily. The other tribe, Coccophagini, includes *Coccophagus* and related genera. However, I do not consider these tribal categories as useful since there are genera that apparently bridge the 'gap' between *Coccophagus* and *Encarsia*. I say apparently because all the genera placed in Pteroptricini have the pronotum medially membranous, whereas the pronotum is composed of a single plate in genera of Coccophagini. But there are several species in *Coccophagus* which are morphologically very similar to *Encarsia* and having the pronotum rather narrower in the middle - possibly only a 'step' behind acquiring the condition found in *Encarsia*!

The study of the male external genitalia (Viggiani & Battaglia, 1984; my unpublished study) shows that with the exception of *Coccophagus*, the genitalia have a more or less constant structure in each genus (recognized on other critaria); but an attempt to classify aphelinids solely on the basis of the supposed evolutionary modifications or structural divergence of this organ would produce a classification quite different from that based on the adult morphology.

**Species-Groups:** *Encarsia* is a complex genus. The species show both inter- and intraspecific variations, and it is sometimes difficult to separate a species from another on well-defined characters. Therefore, it is enormously difficult to propose clearly definable species-groups within the genus. Viggiani & Mazzone (1979) and Viggiani in several publications, have proposed several species-groups in the genus. These groups, as noted by them, are only of a tentative nature and subject to modifications and improvements as more information is gathered on the species. Therefore, proposal of well-defined species-groups in the genus will be possible only when the species are revised on a world basis and all the characters are analyzed. The following synopsis, of the tentative species-groups recognized among the Oriental species (extrazonal species noted in parentheses) is partly based on Viggiani & Mazzone, and on the visual appreciation of morphological characters, and hence not free from subjective overtones.

CITRINA-GROUP: *citrina*, *lounsburyi* (*africana*)

PARVELLA-GROUP: *citrofila*, *acaudaleyrodis* (*americana*),  
*pergandiella*, *basicincta*, *parvella*, *mineoi*, *nipponica*)

LONGIFASCIATA-GROUP: *longifasciata* (one indet. species  
from Saudi Arabia).

TRISTIS-GROUP: *tristis*

INARON-GROUP: *inaron*, *azimi*, *gunturensis*, *persequens*  
(*aleyrodis*, *partenopea*, *longicornis*, *lycopersici*, *lopezi*,  
*siphonini*, *coquillettii*, *margaritiventris*)

FORMOSA-GROUP: (*formosa*, *deserti*)

JAPONICA-GROUP: *brevivena* (*japonica*)

TRICOLOR-GROUP: *norani*, *flavoscutellum* (*tricolor*)

MERCETI-GROUP: *merceti*, *bennetti*

- OPULENTA-GROUP: *opulenta*, *clypealis*, *ishii*, *terebrator*, *nigrifemur*, *longicauda*, *albiscutellum*, *bangalorensis*, *?coimbatorensis*, *?smithi* (*brasiliensis*, *townsendi*)
- AURANTII-GROUP: *aurantii*, *perniciosi*, *divergens*, *pura*, *affectata*, *?smithi*, *obtusiclava* (*gigas*, *brittanica*, *intermedia*, *koebelei*, *bicolor*, *peruviana*, *quercicola*, *circumsculpturata*, *portoricensis*, *olivina*)
- ELEGANS-GROUP: *narayanani*, *bifasciafacies*, *isaaci*, *trivittata* (*elegans*)
- INQUIRENDA-GROUP: *inquirenda*, *niigatae*, *nupta*, *sankarani*, *elongata*, *?berlesei*, (*fasciata*, *diaspidicola*, *inserens*, *explorata*)
- SEPTENTRIONALIS-GROUP: *septentrionalis*
- DUORUNGA-GROUP: *duorunga*, *brevivalvula*, *?mohyuddini*
- LUTEA-GROUP: *lutea*, *indica*, *udaipuriensis*, *dialeuroporae* (*abatei*, *davidi*, *asterobemisiae*)
- PERFLAVA-GROUP: *perflava*, *leptosoma*, *macroptera*, *pseudococci*
- LAHORENSIS-GROUP: *lahorensis*, *transvena*, *confusa* (*aleurochitonis*, *bemisiae*)
- STRENUA-GROUP: *strenua*, *perstrenua*, *longivalvula*, *armata*, *muliyalii*, *dialeurodis* (*protransvena*)

**Notes on the key:** A key to the species of *Encarsia* is difficult to prepare, and it is more difficult to key out species to species-groups. This is because most of the species (unless described from and still known from only a single specimen) show intraspecific variations in several characters, especially in the relative lengths of antennal segments, length of marginal fringe, and body colour: characters that are generally used as 'key characters'. I have therefore selected the key characters with a view to make the identification of any given material easier; though this objective is attained sometimes by making the key couplets complex. It is mere coincidence if the species placed in the same couplet show some relationship or belong to the same species-group. Some of the key characters may appear either ambiguous or weak, but in such cases a given specimen can be identified to its (correct) species by running it via both the alternatives of a couplet.

The key to the Oriental species (62 including the new species described in this paper, and excluding three species based on males) is prepared partly from the original descriptions and illustrations given by the authors, and partly from my study of types and other determined material. So far as I know, this is the first ever attempt to key out the known species of *Encarsia* from the Oriental region. Needless to say that the earlier keys by Shafee (1973 for *Prospaltella*) and Azim & Shafee (1980 for *Trichaporus*) are quite incomplete even for the then known species from India. Silvestri (1928, 1931a,b) published very nicely illustrated descriptions, but these are not accompanied by identification keys.

## KEY TO THE ORIENTAL SPECIES OF ENCARSIA, FEMALES

1. Fore wing with an asetose area around stigmal vein (Fig. 18). [Species in which there is a bare, narrow strip along wing margin beginning from apex of stigmal vein and ending at about distal end of retinaculum (Fig. 85) are excluded.].....2  
 Fore wing without an asetose area around stigmal vein, the disc more or less uniformly setose (Fig. 43). [Species in which there is a bare, narrow strip along wing margin beginning from apex of stigmal vein and ending at about distal end of retinaculum, are included.].....6
- 2(1). Marginal fringe of fore wing longer than width of wing (Fig. 18). [Mid lobe of mesoscutum with 4 setae; petiole with sculpture, Fig. 23.].....3  
 Marginal fringe of fore wing shorter than width of wing (Fig. 30).....4
- 3(2). Submarginal vein of fore wing with one seta; fore wing abruptly narrowed beyond venation and with apex narrowly rounded, with an inflexion at apex of retinaculum. Cosmopolitan .....  
 .....lounsburyi (Berlese & Paoli)  
 Submarginal vein with two setae; fore wing more or less parallel-sided beyond venation and with apex broadly rounded, without an inflexion at apex of retinaculum (Fig. 18). Cosmopolitan .....  
 .....citrina (Craw)
- 4(2). Pedicel longer than F1 (Fig. 25). [Mid lobe with 4 setae (Fig. 29); body yellow with pale brown to brown pronotal collar, axillae, sides of metanotum and propodeum, tergum I of gaster and usually also VII; fore wing hyaline.] India .....  
 .....acaudaleyrodis Hayat  
 Pedicel shorter than, or subequal in length to, F1 .....5
- 5(4). F1 distinctly shorter than F2 (Fig. 32); mid lobe with 2 setae, setae on axillae and anterior pair of scutellar setae minute, inconspicuous (Fig. 35); marginal fringe of fore wing about half of wing width (Fig. 36); a dark brown patch on each side of terga I-VI of gaster (Fig. 307); fore wing hyaline  
 India .....longifasciata Subba Rao  
 Funicle segments subequal in length; mid lobe with 8 setae; marginal fringe of fore wing a little less than half of wing width; terga I-IV of gaster mostly brown; fore wing slightly infuscate in middle  
 Indo-China .....citrofila (Silvestri)
- 6(1). Ovipositor longer than middle tibia and basitarsus combined and third valvula longer than half the length of second valvifer (Figs 41, 42) and tergum VII of gaster apparently elongate, conical, not or not much wider than long (Fig. 68) .....7

- Ovipositor shorter than middle tibia and basitarsus combined (Figs 98,99); if as long as or longer, then either third valvula not more than half the length of second valvifer (Figs 74,75), or tergum VII not conical and elongate, its basal width clearly much more than its median length (Figs 8,302) ..... 18
- 7(6). Pedicel (ventral length) longer than F1(Fig.39).....8  
Pedicel subequal in length to, or shorter than, F1 (Fig.66) ..... 14
- 8(7). Gaster, except apex of tergum VII, completely brown to dark brown (Fig.301) ..... 9  
Gaster, except apex of tergum VII, not completely brown to dark brown, at least one tergum yellow (Fig.294) ..... 11
- 9(8). Clypeus with a triangular projection (tooth), the head apparently (not actually) longer in front view (Fig.37); F1 usually wider than long and less than half the length of F2; F2-4 each about twice as long as wide (Fig.39); mid lobe with 10 setae (Fig.40); marginal fringe of fore wing one-seventh to one-sixth of wing width (Fig.43); body brown to dark brown with head partly, side lobes and scutellum yellow (Fig.301); fore wing hyaline; all coxae, basal half of fore and middle femora and whole of hind femora dark brown; ovipositor slightly to distinctly exserted, nearly 2x as long as middle tibia (Figs 41,42). Indo-China, India, Pakistan, Malaysia, Mexico .....  
..... clypealis (Silvestri)
- Clypeus without such tooth and head distinctly wider than high in front view (Fig.55); other characters same or different ..... 10
- 10(9). F1 quadrate or wider than long, at most half the length of F2; marginal fringe of fore wing about one-seventh of wing width, and with 5 setae in basal cell; mid lobe with 10 setae; body brown to dark brown except yellow scutellum and side lobes; fore wing hyaline; all coxae and hind femora dark brown, rest of legs yellow; ovipositor slightly less than 2x of middle tibia (0.475:0.361mm)  
China ..... ishii (Silvestri)
- F1 at least a little longer than wide and longer than half the length of F2; marginal fringe of fore wing one-fifth to one-fourth of wing width and with 1-2 setae in basal cell; mid lobe with 10 setae; body dark brown to brown with face below eyes whitish, most of mid lobe and scutellum yellow; fore wing infuscated below marginal vein; legs yellow except hind femora and bases of tibiae which are brown; ovipositor less than 2x of middle tibia (0.266:0.209). China, India, Pakistan, Sri Lanka, Taiwan, Mexico (see couplets 28,48) .....  
..... [?] smithi (Silvestri)

- 11(8). Ovipositor distinctly longer than middle tibia and tarsus combined (Figs 47,48). [Fore wing infuscate, even if faintly, below marginal vein.] ....12  
Ovipositor at most subequal in length to middle tibia and tarsus combined (Figs 56,57); if slightly longer than fore wing hyaline .....13
- 12(11). Gaster with tergum VII and sometimes I and II, yellow; F2-4 each not less than twice as long as wide; mid lobe with 10 setae; marginal fringe of fore wing about one-seventh (may be one-fifth) of wing width; hind coxae and femora dark brown. Indo-China, India, Pakistan, Malaysia, Mexico, Jamaica, El Salvador, Barbados, Cainan. *opulenta* (Silvestri)  
Gaster with terga I-IV yellow; F2-4 each not more than twice as long as wide (Fig.46); mid lobe with 12 setae (Fig.51); legs yellow; otherwise similar to *opulenta*. India .. *terebrator* (Shafee)
- 13(11). Ovipositor longer than middle tibia and basitarsus combined (Figs 56,57); gaster with tergum I at least on sides, and terga III-VI or IV-VI dark brown, tergum VII yellow (Fig.294). India .....  
..... *longicauda*, sp. nov.  
Ovipositor as long as middle tibia and basitarsus combined (Figs 156,157); gaster with terga I and IV-VII brown to dark brown (Fig.298). India. (see couplet 58)..... *bangalorensis*, sp. nov.
- 14(7). Body yellowish or pale yellow brown; placoid sensilla on scutellum placed closer together; distance between anterior pair of scutellar setae less than that between the posterior pair (as in Fig. 267); stigmal vein with a distinct, narrow neck..15  
Body not completely yellow or yellow brown; the two placoid sensilla on scutellum widely separated; distance between anterior pair of scutellar setae same or greater than that between the posterior pair (Fig.67) .....16
- 15(14). Mid lobe of mesoscutum with 6 setae; marginal fringe of fore wing slightly longer than two-thirds of wing width; basal cell with 3-4 setae; pedicel about as long as F1; F1 and F2 each about twice as long as wide; clava 2-segmented. Pakistan .....  
(see couplets 85,88)..... *longivalvula* Viggiani  
Mid lobe with 10 setae; marginal fringe about one-sixth of wing width; basal cell with 10 setae; pedicel distinctly shorter than F1; F1 and F2 each about 2.5x as long as wide; clava 3-segmented. China (see couplet 76)..... *strenua* (Silvestri)
- 16(14). Body dark brown, scutellum brownish yellow on sides; F1 about 1.5x as long as pedicel; second valvifer 1.33x as long as third valvula, both combined at least 2x as long as middle tibia. Indonesia:Java ..... *nigrifemur* (Girault)

- At least scutellum yellow or white, or body not completely dark brown to black, or F1 subequal in length to pedicel or F2 (Fig.66) ..... 17
- 17(16). Thorax and gaster dark brown except yellow scutellum and apex of tergum VII (as in Fig.301); mid lobe with 10-12 setae (Fig.67); basal cell with 2-3 setae (Fig.70); F1 and F2 each not more than 2x as long as wide. India.....  
..... *albiscutellum longipalpa*, ssp.nov.  
Thorax and gaster brown with scutellum, propodeum and terga I-V yellow; F1 and F2 each slightly more than 2x as long as wide; mid lobe with 4 setae. [Tergum VII with 6 setae; wings damaged.] Indo-China ..... *perstrenua* (Silvestri)
- 18(6). Pedicel longer than F1 (Figs 80,90). [In marginal cases run the specimen also via the next alternative] ..... 19  
Pedicel subequal in length to, or shorter than, F1 (Figs 212,250) ..... 71
- 19(18). F1 and F2 individually **distinctly** shorter than F3, and F2 not shorter than F1 (Figs 73,86) ..... 20  
At most only F1 shorter than F3; F2 not shorter than F3 (Figs 106,125,166) ..... 36
- 20(19). Longest marginal fringe of fore wing less than half the width of wing (Fig.87); if nearly half as long as wing width then mid lobe with 8 or more setae ..... 21  
Marginal fringe of fore wing at least half the width of wing (Fig.93); if fringe slightly shorter than mid lobe with 2-6 setae. [Fore wing usually infuscate below marginal vein.] ..... 30
- 21(20). Body yellow, with indistinct pale brown markings, if any ..... 22  
Body not completely yellow ..... 24
- 22(21). Third valvula pallid as second valvifer (Fig.152). India. (see couplet 50 for further characters)....  
..... *pura*, sp.nov.  
Third valvula brown or reddish brown in contrast to pale second valvifer (Fig.107) ..... 23
- 23(22). Fore wing with 1-3 setae in basal cell; marginal fringe about one-third (sometimes nearly one-half) of wing width. Palaearctic, India, Pakistan.....  
(see couplets 41,51) ..... *lutea* (Masi)  
Fore wing without [or with one] setae in basal cell; marginal fringe nearly half as long as wing width.. Pakistan . (see couplets 41,51).....  
..... *dialeuroporae* Viggiani
- 24(21). Head and thorax largely brownish yellow; gaster white with tergum I across base dark brown. India (see couplets 54,70,95).. abnormal specimens of *azimi*  
Body colour different ..... 25
- 25(24). F1 shorter than F2 (Fig.86)..... 26

F1 and F2 subequal in length, or nearly so (Fig. 73) 29

- 26(25). Flagellar segments elongate, F1 about 2x as long as wide; fore wing 3.5x as long as wide with marginal fringe slightly less than half of wing width; basal cell without setae. [Mid lobe with 8 setae; third valvula about half the length of second valvifer; body yellowish with faint brown on occiput, pronotum, anterior part of axillae, sides of propodeum, and 2-3 segments preceding cercal plates, of gaster.] Pakistan .. *macroptera* Viggiani  
 Flagellar segments relatively less elongate; basal cell with setae; fore wing relatively broader, 3x or less as long as wide, with shorter marginal fringe ..... 27

- 27(26). Fore wing hyaline; head and thorax (described as) rusty, gaster white with base, sides and apex brown. India ..... *pseudococcii* (Agarwal)

Fore wing infuscated at least below marginal vein.. 28

- 28(27). Fore wing infuscated below submarginal and marginal veins, and with a distinct band below stigmal vein (Fig. 164); mid lobe with 8 setae (Fig. 163); ovipositor longer than middle tibia and basitarsus combined, but third valvula about one-third the length of second valvifer (Figs 161, 162). India....  
 (see couplets 47, 59) ..... *coimbatorensis*, sp. nov.

Fore wing infuscated only below marginal vein; mid lobe with 10 setae; ovipositor longer than middle tibia and basitarsus combined, and third valvula longer than half the length of second valvifer (0.095:0.171). China, India, Pakistan, Sri Lanka, Taiwan, Mexico. (see couplets 10, 48).....  
 ..... *smithi* (Silvestri)

- 29(25). F3 about 1.5x as long as pedicel and nearly 2x as long as F2 (Fig. 73); mid lobe with 10 setae; tergum VI of gaster with distinctly separated spiracular plates (Fig. 79); head and thorax yellow with pronotum, axillae, and propodeum dark brown; legs yellow with hind coxae and femora brownish. Singapore, India, Malaysia, Philippines, Indonesia, Mexico....  
 ..... *merceti* Silvestri

F3 subequal in length to pedicel, and less than 2x as long as F2; mid lobe with 6-8 setae; tergum VI of gaster normal; body brown, with head dorsum and at least posterior half of mid lobe, and scutellum yellow; axillae, propodeum and gaster dark brown. Nearctic, Palaearctic; Sri Lanka .....  
 ..... *berlesei* (Howard)

- 30(20). Head, pronotum and mid lobe (at least partly) brown to dark brown, reddish brown or black; axillae and gaster sometimes with indistinct pale infuscation, otherwise pale yellow (Fig. 300) ..... 31  
 Body differently coloured, or completely yellow or largely dark brown ..... 32

- 31(30). Mid lobe of mesoscutum nearly completely dark brown or reddish brown; F1 longer than wide and longer than half the length of F2; clava 2-segmented (Fig. 80); marginal fringe of fore wing about half of wing width, fringe distad of venation not longer than setae on outer margin of marginal vein (Fig. 84). India ..... *duorunga*, sp.nov.  
 Only anterior 'region' of mid lobe brown; F1 very slightly longer than wide and about half the length of F2, clava 3-segmented; marginal fringe about two-third of wing width; fringe distad of venation longer than setae on marginal vein. Pakistan .....  
 ..... *mohyuddini* Shafee & Rizvi
- 32(30). Body yellow to pallid. [Middle tibial spur half the length of basitarsus; ovipositor as long as middle tibia and basitarsus combined (Figs 91, 92).. India..... *perflava*, sp. nov.  
 Body not completely yellow, and not as in the first alternate of couplet 30 ..... 33
- 33(32). F1 quadrate or a little longer than wide (Fig. 3)... 34  
 F1 about a quarter longer than wide (Fig. 96) ..... 35
- 34(33). Mid lobe of mesoscutum with 4 setae. [Ovipositor slightly longer than middle tibia (0.190:0.171), and third valvula slightly less than half the length of second valvifer (0.057:0.133); body clear brown, distal part of head, mid lobe except anteriorly, scutellum, metanotum, terga II, III and posterior part of I, of gaster cream coloured; femora and proximal parts of tibiae brownish.]. .... China, Japan, Algeria ..... *inquirenda* (Silvestri)  
 Mid lobe with 2 setae (Fig. 100) ..... 35
- 35(33), F3 slightly longer than or subequal to F2; hind 34). femora dark; body brown yellow, upper part of head pallid; thorax except axillae, yellow. Japan, Taiwan. (see couplet 43) ..... *niigatae* (Nakayama)  
 F3 distinctly longer than F2 (Fig. 96); legs all pallid; body pale yellow, with a cross-band on occiput, collar of pronotum, most of axillae and pd, petiole and at least sides of tergum I, terga terga IV and V completely, and at least partly terga VI and VII of gaster, brown to dark brown (Fig. 302). [Petiole with fine sculpture (Figs 100, 302); ovipositor nearly as long as middle tibia, and third valvula about one-third the length of second valvifer (Figs 98, 99)]. India .....  
 ..... *sankarani*, sp. nov.
- 36(19). F1 quadrate or broader than long, at most half the length of pedicel; F2 and F3 each usually less than 2x as long as wide (Figs 111, 114, 135) ..... 37  
 F1 either clearly longer than broad, or longer than half the length of pedicel (Figs 125, 140a) ..... 42
- 37(36). Gaster except apex of tergum VII, brown, dark brown or black (Fig. 306) ..... 38

- Gaster not completely brown, dark brown or black.  
 [Third valvula dark brown in contrast to pale second valvifer.] ..... 39
- 38(37). Ovipositor short, not more than three-quarters the length of middle tibia and originating from segment VI (Figs 136,137); tergum VI of gaster with subtriangular spiracular plates (Fig.136). Cosmopolitan! ..... aurantii (Howard)
- Ovipositor at most only slightly shorter than middle tibia, and originating anterior to segment VI of gaster; tergum VI of gaster normal. Cosmopolitan... (see couplet 48)[smaller specimens of perniciosi]
- 39(37). Body yellow or pale, with a cross-band on occiput, pronotum, anterior margin of mid lobe, axillae, mesopleura, tergum I on sides, posterior half of II, and terga III-VI dark brown; tergum VII pale brown. China, India, U.S.A., Puerto Rico. (see couplet 56)..... elongata (Dozier)
- Body completely yellow with at most indistinct pale brown markings ..... 40
- 40(39). Third valvula longer than half the length of second valvifer; ovipositor longer than middle tibia(Figs 107,108). India ..... sp. indet.  
 [E. indica may run here, but details of ovipositor are unknown.]  
 Third valvula less than half the length of second valvifer; ovipositor about as long as middle tibia (Figs 117,118) ..... 41
- 41(40). F1 wider than long, with ventral margin longer than dorsal margin (Fig.111a). India [?]indica (Shafee)  
 F1 at least quadrate; F2 usually a little longer than F3 (Figs 114,115). [Mid lobe with 6-8 setae (Fig. 119); marginal fringe of fore wing  $0.33x$  to nearly  $0.5x$  wing width (Fig.120); pronotum, axillae, propodeum, petiole and tergum I of gaster sometimes with pale brown suffusions (Fig.309). Palaeartic; India, Pakistan (see couplets 23,51). lutea (Masi)  
 [E. dialeuroporae could also run here, but F2 and F3 subequal in length; marginal fringe about  $0.5x$  of wing width, and basal cell without or with one seta.]
- 42(36). F2 not more than  $2x$  as long as broad (Figs 140,166).  
 [In doubtful cases run the specimen via the next alternative.] ..... 43
- F2 more than  $2x$  as long as broad (Figs 131c,178)... 60
- 43(42). Mid lobe of mesoscutum with 2 setae. [Marginal fringe of fore wing at least half of wing width; gaster brown to black, except tergum VII which may be lighter in colour.] Japan, Taiwan. (see couplet 35)..... niigatae (Nakayama)  
 Mid lobe with at least 4 setae. [Marginal fringe usually less than half of wing width.] ..... 44

- 44(43). Gaster brown to dark brown, except apex of tergum VII (Fig. 305). CARE: distended gasters may appear banded alternately brown and white! ..... 45  
 Gaster, except apex of tergum VII, not completely brown to dark brown (Figs 299, 304). [Antennal clava, unless mentioned otherwise, 3-segmented.]. 49
- 45(44). Face above toruli with one or two brownish cross-bands between eyes (Figs 171, 176) ..... 46  
 Face either without such cross-bands, or face or frontovertex brownish ..... 47
- 46(45). Face with one brownish cross-band above toruli (Fig. 171); middle tibial spur at least three-quarters the length of basitarsus (Fig. 174). India. (see couplet 62) ..... narayanani Agarwal  
 Face with two brownish cross-bands (Fig. 176); middle tibial spur not longer than two-thirds the length of basitarsus (Fig. 180). India (see couplet 62).... ..... bifasciafacies, sp. nov.
- 47(45). Fore wing infuscated below submarginal and marginal veins, and with a distinct band below stigmal vein (Fig. 164). India (see couplets 28, 59) ..... coimbatorensis, sp. nov.  
 Fore wing infuscated only below marginal vein (Fig. 143) ..... 48
- 48(47). Head dorsum brown, face below eyes whitish; marginal fringe of fore wing one-fifth to one-fourth of wing width; ovipositor longer than middle tibia and third valvula longer than half the length of second valvifer. China, India, Pakistan, Sri Lanka, Taiwan, Mexico. (see couplets 10, 28).....  
 ..... smithi (Silvestri)  
 Head dorsum yellow or darker yellow, face brownish and usually with a brown cross-band above toruli (Fig. 145); marginal fringe of fore wing at least one-fourth of wing width; ovipositor about as long as middle tibia and third valvula less than the length of second valvifer (Figs 141, 142). ..... Cosmopolitan (see couplet 38)... perniciosi (Tower)
- 49(44). Body completely yellow or pallid, only occasionally with faint brown markings ..... 50  
 Body not completely yellow or pallid ..... 52
- 50(49). Third valvula pale as second valvifer, and about half the length of second valvifer; ovipositor distinctly shorter than middle tibia (Figs 152, 153). [Fore wing as in Fig. 151.]. India (see couplet 22) .....  
 ..... pura, sp. nov.  
 Third valvula reddish brown to dark brown in contrast to the pale second valvifer, and about one-third the length of second valvifer; ovipositor about as long as middle tibia (Figs 117, 118) ..... 51
- 51(50). F3 quadrate, shorter than F2; marginal fringe of fore wing about one-third of wing width; basal cell with

- 1-2 setae. Palaeartic; India, Pakistan (see couplets 23,41) ..... *lutea* (Masi)
- F3 slightly longer than wide and subequal in length to F2; marginal fringe about half of wing width; basal cell without setae. Pakistan (see couplets 23,41) ..... *dialeuroporae* Viggiani
- 52(49). F1 relatively longer, about 1.5x as long as wide (Fig.185) ..... 53
- F1 shorter, at most only a little longer than wide... (Fig.166) ..... 55
- 53(52). Thorax (usually also the head) more or less completely dark brown or reddish brown, or middle tibial spur not longer than half the length of basitarsus. .... 54
- Thorax not completely dark or reddish brown, scutellum and most of mid lobe yellow, or middle tibial spur longer than half the length of basitarsus... 55
- 54(53). Gaster yellow to white with tergum I narrowly at base brown; hind coxae largely pallid. India (see couplets 24,70,95)..... *azimi* Hayat
- Same as *azimi* except mesothorax dark brown with pale lines as in Fig.299; hind coxae dark brown. India (see couplet 70) ..... *gunturensis* (Azim & Shafee)
- 55(52). Mid lobe with 4 setae; marginal fringe of fore wing 53). longer than half of wing width. Philippines .....  
..... *nupta* (Silvestri)
- Mid lobe with at least 6 setae; marginal fringe shorter than half of wing width ..... 56
- 56(55). F1 quadrate or broader than long, about half of F2 (Fig.121). [For additional characters, see couplet 39.] ..... *elongata* (Dozier)
- F1 at least a little longer than wide, or longer than half the length of F2 (Figs 155,160)..... 57
- 57(56). Ovipositor shorter than or about as long as middle tibia, and third valvula (which is dark in contrast to pale second valvifer) longer than half the length of second valvifer (Figs 128,132). India.... (see couplet 65) ..... *udaipuriensis* (Shafee)
- Either ovipositor longer than middle tibia, or third valvula shorter than half the length of second valvifer (Figs 156,157,162) ..... 58
- 58(57). Third valvula distinctly longer than half the length of second valvifer (Fig.156); fore wing hyaline with slight infuscation in basal third. India.... (see couplet 13) ..... *bangalorensis*, sp. nov.
- Third valvula less than half the length of second valvifer (Fig.167); fore wing infuscate otherwise... ..... 59
- 59(58). Apex of clava oblique (Fig.166); fore wing faintly infuscate below marginal vein and with a distinct spot around stigmal vein (Fig.170); gaster with two dark brown cross-bands (Fig.304). India .....  
..... *obtusiclava*, sp. nov.

Clava normal, with apex normally rounded (Fig.160); fore wing infuscate below marginal and submarginal veins and with a distinct band below stigmal vein (Fig.164); gaster brownish with terga II and III except sides, yellow. India (see couplets 28,47)....  
..... *coimbatorensis*, sp. nov.

- 60(42). Gaster brown to dark brown to black except occasionally the base narrowly and apex of tergum VII (as in Fig.305) ..... 61  
 Gaster, except base and apex, not completely brown to dark brown or black ..... 64
- 61(60). Frontovertex yellow and face with one or two brownish cross-bands above toruli (Figs 171,176) ..... 62  
 Either frontovertex or face brown to dark brown; face without such cross-bands above toruli ..... 63
- 62(61). Face with one cross-band above toruli (Fig.171); middle tibial spur at least three-quarters the length of basitarsus (Fig.174). India (see couplet 46)....  
..... *narayananii* Agarwal  
 Face with two cross-bands above toruli (Fig.176); middle tibial spur not longer than two-third the length of basitarsus (Fig.180). India (see couplet 46) ..... *bifasciafacies*, sp. nov.
- 63(61). Ovipositor as long as middle tibia; third valvula longer than half the length of second valvifer (0.076:0.114); mid lobe with 10 setae; fore wing hyaline with marginal fringe about one-fourth of wing width; stigmal vein with a narrow neck. India, Indonesia, Malaysia, Singapore, Cuba .....  
..... *divergens* (Silvestri)  
 Ovipositor longer than middle tibia (0.342:0.285); third valvula shorter than half of second valvifer (0.095:0.247); mid lobe with 8 setae; fore wing faintly infuscate below marginal vein, with fringe about one-fifth of wing width; stigmal vein rather thick with indication of a postmarginal vein.....  
 China, Taiwan ..... *affectata* (Silvestri)
- 64(60). Head, pronotum and most of mid lobe dark brown; gaster yellow brown with brownish on sides; axillae light brown (as in Fig.300); ovipositor longer than middle tibia; third valvula about one-fourth the length of second valvifer. (Figs 239,240). India.....  
..... *brevivalvula*, sp. nov.  
 Body colour different or relative lengths of ovipositor and middle tibia different ..... 65
- 65(64). Third valvula brown to black in contrast to pale second valvifer, and longer than half the length of the latter (Fig.128). India (see couplet 57)....  
..... *udaipuricensis* (Shafeei)  
 Either third valvula and second valvifer dark, or both pale ..... 66
- 66(65). Body yellow or paler with at most some pale brown markings ..... 67

- Body not completely yellow or pallid. [Tergum I of gaster narrowly brownish at base.] ..... 68
- 67(66). F1 very slightly shorter than F2 (Fig.250); placoid sensilla on scutellum closely placed, distance between anterior pair of scutellar setae less than that between posterior pair (Fig.249); marginal fringe of fore wing about one-third (sometimes nearly half) of wing width (Figs 255,256). Hawaii, Japan, Ethiopian, Oriental (see couplets 89,94)....  
..... *transvena* (Timberlake)
- F1 distinctly shorter than F2 (Fig.243); placoid sensilla distantly placed, distance between anterior pair of scutellar setae about equal to that between posterior pair (Fig.247); marginal fringe about one-fourth of wing width (Fig.246). India.... (see couplet 94) ..... *confusa*, sp. nov.
- 68(66). Head and thorax largely brown to dark brown (Fig.299)  
..... 69
- Head and thorax largely yellowish or yellow brown.. 70
- 69(68). Middle tibial spur slightly shorter than basitarsus (Fig.200); flagellar segments relatively longer than in the following species (Fig.199). India.....  
..... *brevivena*, sp. nov.
- Middle tibial spur about half (or less) the length of basitarsus (Fig.187) ..... 70
- 70(68, F1 usually less than 2x as long as wide, F2-4 genera-  
69). Ily less elongate than in the following species and apparently decreasing in length distad (Fig.185); coxae and hind femora brown to dark brown. India... (see couplet 54) ..... *gunturensis* (Azim & Shafee)
- F1 usually at least 2x as long as wide, F2-4 subequal in length or apparently increasing in length distad (Fig.193); only hind coxae partly brown. India (see couplets 24,54,95) ..... *azimi Hayat*
- 71(18). F1 longer than F2 and the latter longer than F3 (Fig. 204); fore wing infuscate throughout; setae on outer margin of marginal vein not longer than width of the vein (Fig.209); ovipositor distinctly shorter than middle tibia (Figs 206,207); body dark brown with most of head, mid lobe except anteriorly side lobes and scutellum yellow or yellow brown.... India, Indonesia, Philippines, Bangladesh .....  
..... *tristis* (Zehntner)
- All characters, except body colour in some species, different ..... 72
- 72(71). F1 distinctly longer than pedicel (Figs 212,220,231d, 258). [F1-3 or F1-4 each usually more than 2x as long as wide.] ..... 73
- Pedicel and F1 subequal in length (Figs 243,250)... 83
- 73(72). Body yellow or pale except in *dialeurodis* (Fig.303)  
..... 74
- Body not completely yellow and not as in Fig.303.  
[Clava 2-segmented, unless mentioned otherwise].. 78

- 74(73). F1 clearly longer than F2 (Fig. 258) ..... 75  
 F1 shorter than or subequal in length to F2 (Fig. 264)  
 ..... 76
- 75(74). Mid lobe of mesoscutum with 4 setae, anterior pair of setae on scutellum minute (Fig. 261); F4 shorter than both F3 and F5 (Fig. 258); ovipositor slightly shorter than middle tibia (Figs 259, 260); placoid sensilla on scutellum distantly placed; distance between anterior pair of scutellar setae greater than that between posterior pair (Fig. 261); tergum VII of gaster broader than long. Pakistan, India...  
 ..... *lahorensis* (Howard)
- Mid lobe with 8 setae; scutellar setae of normal lengths; F4 longer than both F3 and F5; placoid sensilla placed close together; distance between anterior pair of scutellar setae less than that between posterior pair; ovipositor more than 2x as long as middle tibia (0.475:0.209), but third valvula less than half the length of second valvifer (0.095:0.380); tergum VII apparently longer, conical. Indo-China ..... *armata* (Silvestri)
- 76(74). Marginal fringe of fore wing about one-sixth of wing width; mandibles edentate; tergum VII with 6 setae; stigmal vein with a narrow neck; third valvula half the length of second valvifer (0.171:0.342). China (see couplet 15) ..... *strenua* (Silvestri)  
 Marginal fringe longer, at least one-fourth of wing width; mandibles with two teeth and a truncation; tergum VII with 4 setae; stigmal vein with a narrow but curved neck (straight in *strenua*); third valvula less than half the length of second valvifer. 77
- 77(76). Body yellow; tergum VII of gaster conical (Fig. 268); F1 subequal to or only a little shorter than F2 (Fig. 264); third valvula two-fifth of second valvifer and about 2x of middle basitarsus (Figs 265, 266); fore wing at least 3x as long as wide with stigmal vein 'normal' (Fig. 269). India, Thailand. (see couplets 85, 89) ..... *muliyalis* Mani  
 Body yellow with brownish bands on petiole and tergum I and a spot in distal half of gaster (Fig. 303); tergum VII broader than long; third valvula about one-fourth the length of second valvifer and as long as middle basitarsus (Figs 278, 279); fore wing about 2.5x as long as wide, stigmal vein with a curved neck (Fig. 280). Pakistan (see couplet 96)...  
 ..... *dialeurodis*, sp. nov.
- 78(73). Middle tibial spur longer than half the length of basitarsus (Fig. 216) ..... 79  
 Middle tibial spur not longer than half the length of basitarsus (Fig. 234) ..... 82
- 79(78). Head, pronotum and mid lobe dark brown to black (Fig. 297), gaster sometimes infuscate brown especially

- on sides; setae on submarginal vein conspicuously longer than in other species (Fig. 218); fore wing hyaline; ovipositor about as long as middle tibia (Figs 216, 217). India, Pakistan .....  
..... *septentrionalis*, sp. nov.
- Body colour and other characters different ..... 80
- 80(79). Antennal clava 3-segmented (Fig. 220). [Body golden yellow with pronotum, mid lobe anteriorly, axillae, propodeum, and terga I, VI and VII of gaster brown to dark brown; sides of gaster and other terga with pale brown bands.] India ..... *norani*, sp. nov.
- Clava 2-segmented (Fig. 226) ..... 81
- 81(80). Body yellow to orange yellow, with pronotum in middle, axillae partly, propodeum, petiole, spots on terga III and IV and cross-bands on V and VII brown (Fig. 308); fore wing with an infuscated band below stigmal vein (Fig. 286). India, Pakistan (see couplet 97) ..... *bennetti* Hayat
- Body differently coloured; fore wing if infuscated then not as in the above species ..... 82
- 82(78). Gaster dark brown to black; head and thorax not  
81). completely dark brown; middle tibial spur slightly longer than half of basitarsus (Fig. 228); distance between anterior pair of scutellar setae equal to that between posterior pair (Fig. 229); ovipositor slightly longer than middle tibia (Figs 227, 228)... India ..... *isaaci* Mani
- Gaster white to yellow or pale testaceous, with base, sides and terga V and VI usually brown; middle tibial spur at most half the length of basitarsus (Figs 234, 237); distance between anterior pair of scutellar setae greater than that between posterior pair (Fig. 235); ovipositor distinctly shorter than middle tibia (Figs 233, 234). Palaearctic; India ..... [*aleyrodis* (Mercet)] *inaron* (Walker)
- 83(72). F1 and F2 individually distinctly shorter than F3 (Fig. 270). [Body largely or completely yellow]... 84
- At most only F1 shorter than F3 (Fig. 287) ..... 86
- 84(83). Ovipositor shorter than middle tibia and basitarsus combined (Figs 271, 272); placoid sensilla on scutellum distantly placed; distance between anterior pair of scutellar setae about same as that between posterior pair (Fig. 273). [Basal cell with 2 setae (Fig. 274); tergum VII of gaster broader than long.] India ..... *leptosoma*, sp. nov.
- Ovipositor longer than middle tibia and basitarsus combined (Figs 265, 266). [In *mulyali*, placoid sensilla closely placed, distance between anterior pair of setae less than that between posterior pair (Fig. 267)] ..... 85
- 85(84). Antennal clava apparently 3-segmented (Fig. 264); basal cell with 9-12 setae (Fig. 269); mid lobe with 8-10 setae; third valvula two-fifth the length of

- second valvifer (Fig. 265). [Tergum VII of gaster conical (Fig. 268). India, Thailand (see couplet 77, 89). ..... *muliayali* Mani
- Clava apparently 2-segmented; basal cell with 3-4 setae; mid lobe with 6 setae; third valvula longer than half the length of second valvifer. Pakistan (see couplets 15, 88) *longivalvula* Viggiani
- 86(83). F1 and F2 subequal in length (Fig. 264) ..... 87  
F1 shorter than F2 (Fig. 275) ..... 93
- 87(86). Body yellow, at most with faint brown markings ..... 88  
Body not completely yellow ..... 90
- 88(87). Basal cell with 3-4 setae; clava apparently 2-segmented; mid lobe with 6 setae; third valvula longer than half the length of second valvifer (4:6).....  
Pakistan (see couplets 15, 85) *longivalvula* Viggiani  
Basal cell with at least 6 setae, usually more; clava apparently 3-segmented; mid lobe with 8-10 setae; third valvula less than half the length of second valvifer ..... 89
- 89(88). Basal cell usually with 6-10 setae (Figs 255, 256); third valvula about one-third the length of second valvifer (Figs 253, 254); tergum VII of gaster much broader than long. Hawaii, Japan, Ethiopian, Oriental (see couplets 67, 94) ... *transvena* (Timberlake)  
Basal cell usually with 9-12 setae (Fig. 269); third valvula about two-fifth the length of second valvifer (Fig. 265); tergum VII of gaster conical, about a third wider than long (Fig. 268). India, Thailand (see couplets 77, 85) ..... *muliayali* Mani
- 90(87). Gaster dark brown; F1 as wide as pedicel. [Mid lobe with 8 setae; marginal fringe of fore wing about one-fifth the wing width; third valvula about one-fourth the length of second valvifer; head mostly yellow, thorax yellow with pronotal collar and anterior third of mid lobe brownish; wings hyaline; legs pallid.] Indonesia ... *flavoscutellum* Zehntner  
Gaster not completely dark brown; F1 narrower than pedicel ..... 91
- 91(90). Head and thorax largely yellow brown; terga I-IV of gaster mostly brown; fore wing with a small asetose area around stigmal vein. Indo-China (see couplet 5) ..... *citrofila* (Silvestri)  
Head or thorax, or both, largely or completely brown, dark brown or black ..... 92
- 92(91). Legs pallid; middle basitarsus as long as segments 2-5 combined; middle tibial spur half the length of basitarsus; third valvula longer than half the length of second valvifer (0.076:0.114); distance between anterior pair of scutellar setae about same as that between posterior pair; gaster pallid with sides of terga I-IV and terga V-VII brownish; mid lobe and scutellum dark with pale lines as in *gunturensis*. Philippines ..... *persequens* Silvestri

Legs of same colour or hind coxae at least partly brown; middle basitarsus as long as segments 2-5 combined or longer; middle tibial spur usually less than half the length of basitarsus; third valvula less than half the length of second valvifer; distance between anterior pair of scutellar setae greater than that between posterior pair; gaster usually with base, sides and terga V and VI brown; mid lobe and scutellum usually without such pale lines but pale lines discernible in cleared specimens. Palaeoarctic; India (see couplet 82).....  
..... [?partenopea Masi], inaron (Walker)

93(86). Body yellow, at most with some pale brown markings. 94  
Body not yellow, partly or completely dark brown...95

94(93). F1 only slightly shorter than F2 (Fig. 250); marginal fringe of fore wing at least about one-third of wing width (Fig. 255); placoid sensilla on scutellum placed close together; distance between anterior pair of scutellar setae less than that between posterior pair (Figs 248, 249). Hawaii, Japan, Ethiopian, Oriental (see couplets 67, 89) .....

..... transvena (Timberlake)  
F1 distinctly shorter than F2 (Fig. 243); marginal fringe about one-fourth of wing width (Fig. 246); placoid sensilla widely separated; distance between anterior pair of scutellar setae same or greater than that between posterior pair (Fig. 247). India. (see couplet 67) ..... confusa, sp. nov.

95(93). Thorax (alsomost of head) yellow brown to reddish brown; gaster yellow with base brownish. India.....  
(see couplets 24, 54, 70) ..... azimi Hayat  
Body yellow with distinct brownish spots and bands. 96

96(95). Clava 3-segmented (Fig. 275); basal cell with 6-10 setae (Fig. 280); ovipositor longer than middle tibia, and third valvula about one-fourth the length of second valvifer (Figs 278, 279); body yellow with brown bands on petiole, and tergum I of gaster and a spot in distal half of gaster (Fig. 303)] Pakistan (see couplet 77) .....

..... dialeurodis, sp. nov.  
Clava 2-segmented (Fig. 281); basal cell with 1-4 setae ..... 97

97(96). Mouth fossa about one-fourth the width of frons (Fig. 282); fore wing with a distinct infuscate band below stigmal vein (Fig. 286); gaster with lateral spots on terga III and IV and cross bands on V and VII brown (Fig. 308). India, Pakistan (see couplet 81) ..... bennetti Hayat  
Mouth fossa less than half of width of frons (Fig. 288); fore wing hyaline, faintly infuscate below marginal vein; gaster with cross-bands on terga I and IV-VI dark brown (Fig. 295) India .....

..... trivittata, sp. nov.

## DESCRIPTIONS OF SPECIES

1. *Encarsia citrina* (Craw) (Figs 15-24)

*Coccophagus citrinus* Craw, 1891: 25, 28. Female. U.S.A., San Gabriel Valley (Neotype, USNM). Neotype selected and designated by DeBach & Rose, 1981: 671.

*Aspidiotiphagus citrinus* (Craw): Howard, 1894a: 229; 1898: 134. Howard & Ashmead, 1896: 635. Ayyar, 1925: 251. Compere, 1936: 295. Mani, 1938: 122. Pruthi & Mani, 1940: 27; 1945: 3. Peck, 1963: 288-292, yellow and red scale aggregates. Ferriere, 1965: 149. Nikol'skaya & Jasnoch, 1966: 259. Kaul & Saraswat, 1974: 189. Gordh, 1979: 900. De Santis, 1979a: 330.

*Encarsia citrina* (Craw): Viggiani & Mazzone, 1979: 47. Hayat, 1986: 161.

Mercet (1930), De Santis (1948) and Ferriere (1965) should be consulted for synonyms.

**Female:** Length variable, normally about 0.50mm. Body brown to dark brown; head mostly pallid to yellow or light yellow brown, with dark brown postocellar bars; mouth margin malar space and occiput from level of foramen downwards, brownish; most of mid lobe of mesoscutum, scutellum and metanotum pale yellow; rest of thoracic dorsum, pleura and venter brown to dark brown; gaster brown to dark brown, distal one or two terga pale brown with apex of tergum VII hyaline; third valvula dark brown. Antennae pale yellow, lightly suffused brown on flagellum distally. Fore wings distinctly infuscate below marginal vein, otherwise hyaline. Legs pallid, lightly infuscate brown; hind coxae brown to dark brown; hind femora brown in basal half or so.

Dimensions of body parts as in figures; eyes with fine minute setae. Antennae as in Figs 15 and 16; lengths of flagellar segments vary from slightly to distinctly longer than wide; F3 quadrate to slightly longer than wide, but distinctly shorter than F4.

Thorax as in Fig. 23; mid lobe with 4 setae and each side lobe with one seta. Wings as in Figs 18 and 19; the proximal seta on submarginal vein of fore wing minute, sometimes difficult to detect; basal cell with 2 setae; marginal vein with 3-6, usually 4 or 5 setae. Middle tibia and tarsus as in Fig. 22; hind tibia subequal to middle tibia (40-43:40-44).

Petiole with a distinct sculpture (Fig. 23); petiole plus gaster (if not shrunken or otherwise distorted) 1.5x as long as thorax; terga I-VI with wide-meshed reticulations on sides, smooth in middle; terga II-VII with the usual number of setae; ovipositor not exserted; third valvula longer than half the length of second valvifer (Figs 21, 24). [Ovipositor at least a little longer than middle tibia (45-48:40-44); relative lengths of ovipositor and middle tibia as in Figs 21 and 22.]

**Male:** Unknown.

**Host:** *Aulacaspis tubercularis*; *Duplachionaspis graminis*; *Lepidosaphes (=Cornuaspis) beckii*; *Quadraspidiotus perniciosus*; indet. scales.

**Distribution:** India: Himachal Pradesh, Jammu & Kashmir, Karnataka. Sri Lanka. [Cosmopolitan]

**Material examined:** INDIA: KARNATAKA: Bangalore, CIBC, 2F (slide Nos. 224E, 225E), ex *Aulacaspis tubercularis*, No. 10CIE 16393 (BMNH). JAMMU & KASHMIR: Shivpora, 1F (185E), 18.ix. 1963, ex San Jose scale, (B.M.Rao) (USNM). KARNATAKA: Coorg District, Chetalli, 4F (200E), 24.iv.1984, ex *Lepidosaphes beckii*, (S.P.Singh).

I have also seen in the BMNH in 1981, 2F, SRI LANKA: Peradeniya, 24.vi.1913, ex *Chionaspis graminis*.

**Extralimital material examined:** KENYA: Kiambu, 6F, CIBC 1983, ex scale on coffee, (det. B.R.Subba Rao); KENYA: 5F, CIE.16608. No. AC1, ex scale (det. M.Hayat) (BMNH)

**Comments:** This is the type species of the genus *Aspidiottiphagus* which is considered here as correctly synonymized with *Encarsia* by Viggiani & Mazzzone (1979).

The species is well known and has been redescribed several times (see citations given above) and more recently DeBach & Rose (1981) provided a history of the species. Compere (1936, 1961) pointed out the existence of host specific strains, and indicated the possibility of *australiensis* being a synonym of *citrina*. I have seen the type (Queensland Museum, Brisbane) and other specimens determined as *australiensis* by Girault and consider it indistinguishable from *citrina*. I have also seen specimens originating in China (ex *Unaspis citri*) received from Dr Ian Galloway, Australia.

The species shows variation in the dimensions of antennal segments (two antennae are illustrated in Figs 15, 16) and body colour (Compere, 1936), but there is no doubt that only a single morph is involved.

*E. citrina* and two other species (*lounsburyi*, *africana*) form a distinct group - *citrina-group* - which can be distinguished from other groups mainly by the shape of the fore wings, longer marginal fringe, presence of an asetose area around the stigmal vein, and petiole with fine sculpture. This group is related to *parvella-group* of species, and it is often difficult to separate the two (See comments given under the following species). I have not studied the types of *flava*, *fusca* and *latipennis* and can not comment on their correct placement.

## 2. *Encarsia acaudaleyrodis* Hayat (Figs 25-31)

*Encarsia acaudaleyrodis* Hayat, 1976: 158. Female. Male. India, Sardar Samand (ZSI). Hayat, 1986: 160.

**Female:** Length, 0.47-0.63mm Body yellow, paler on face, sides and venter of thorax and gaster; mouth margin reddish brown; occiput with a faint brown spot on each side of foramen; pronotal collar except in middle, sides of metanotum, and propodeum except in middle and distad of spiracles, brownish; mid lobe yellow to anteriorly dusky; gaster

yellow with tergum I brownish, other terga, especially tergum VII, faintly dusky. Antennae pallid, clava yellow brown. Wings hyaline. Legs pallid.

Head dorsum transverse, nearly 3x as wide as long; frontovertex about 2x as wide as long; POL equal to OOL; mouth fossa about two-fifth the width of frontovertex at anterior ocellus. Antennae as in Figs 25 and 26; F1 subequal to or slightly shorter than F2; F3 subequal to or even distinctly shorter than F4.

Thorax as in Fig.29; each side lobe with 2 setae. Fore wings as in Fig.30. Hind wings about 8x as long as wide; marginal fringe at least about 1.5x of wing width.

Petiole plus gaster about as long as head plus thorax; terga II-VII with the usual number of setae. [Relative lengths of second valvifer, third valvula, middle tibia and basitarsus as in Figs 27 and 28.]

**Male:** Length, 0.45-0.52mm Similar to female except colour and antennae. Head with brownish bands on sides of foramen; pronotum, mid lobe except posteriorly, dark brown; gaster dark brown, last two terga sometimes brownish yellow. Antennae as in Fig.31.

**Host:** *Acaudaleyrodes rhachipora*.

**Distribution:** India: Delhi, Rajasthan.

**Material examined:** INDIA: RAJASTHAN: Sardar Samand, several specimens on slides 176E and 177E and in alcohol, i. 1974, ex *A. rhachipora* on *Prosopis juliflora*; Jodhpur, 16F, 2M (280E), 1976, same data. DELHI: IARI area, 1F (262E), 28.x.1979 (Z.Boucek) (BMNH).

**Comments:** The species was described in details by Hayat (1976) and a habitus drawing was given by him in 1983.

*E. acaudaleyrodis* appears related to *americana* (DeBach & Rose), *basicincta* Gahan and *mineoi* Viggiani. In *mineoi*, body is completely yellow except for dark clypeus; flagellar segments longer; middle tibial spur half the length of basitarsus; and ovipositor at most slightly longer than middle tibia. *E. americana* has a pale yellow body; basitarsus of middle leg not longer than the following three segments combined or about 0.25 of middle tibia; spur about half as long as basitarsus; ovipositor shorter than middle tibia and basitarsus combined; and third valvula nearly as long as second valvifer. In *basicincta* the gaster has a distinctly dark brown cross-band at base; fore wings narrow with longer marginal fringe; flagellar segments relatively shorter (F1 hardly longer than wide); and ovipositor about as in *americana*.

The species is placed in **parvella-group**.

### 3. *Encarsia longifasciata* Subba Rao (Figs 32-36, 307)

*Encarsia longifasciata* Subba Rao, 1984: 260. Female. India, Bangalore (BMNH) [examined]. Hayat, 1986: 162.

**Female:** Head dark brown with the usual pale lines; pronotum and mid lobe except dusky sides and posterior margin, axillae, sides of propodeum, prepectus and mesopleura, dark

brown; each side lobe with a light brown spot; gaster with brownish patches on each side of terga I-VI; rest of body pale yellow to white. Antennae pale yellow with the clava distally lightly infuscate. Wings hyaline. Legs pallid.

Head in front view about 1.5x as wide as high (not 2.5x); eyes conspicuously setose, the setae thicker; setae on frontovertex dark and long. Antennae as in Fig. 32; pedicel appears a little shorter than F1; F2 distinctly longer than F1; clava 2-segmented.

Thorax as in Figs 35 and 307; mid lobe with fine, longitudinal reticulations on sides, otherwise smooth; axillae with hexagonal cells; anterior pair of scutellar setae minute, not longer than half the length of the seta on each axilla; setae on scutellum pale, difficult to see in balsam; setae on pronotum, mid lobe and side lobes brownish. Fore wings as in Fig. 36. Hind wings with marginal fringe about 1.5x as long as wing width.

Gaster as in Fig. 307; terga I-VII with 1+1, 1+1, 1+1, 1+1, 2+2, 1+1, and 4 (pale) setae. [Relative lengths of second valvifer, third valvula, middle tibia and tarsus as in Figs 33 and 34.]

**Male:** Unknown.

**Host:** Indet. blackfly on *Murraya* sp.

**Distribution:** India: Karnataka.

**Comments:** The holotype and the paratype were examined. The species is very distinctive by its colour, details of structure and setation. In the redescription given above some errors that crept in the original description given by Subba Rao, are corrected.

Subba Rao (1984) placed this species in coryli-group, but I regard it as forming a separate group - longifasciata-group - which also contains another species from Saudi Arabia, being described elsewhere by me.

#### 4. *Encarsia clypealis* (Silvestri) (Figs 37-45, 301)

**Prospaltella clypealis** Silvestri, 1928: 28. Female. Indo-China, Coxon (Tonkino) (IEUN). Krishnamurti & Usman, 1954: 339. Flanders, 1969: 467-480. De Santis, 1979a: 333. Husain & Agarwal, 1982: 161.

**Encarsia clypealis** (Silvestri): Viggiani & Mazzone, 1979: 45. Hayat, 1986: 161.

The species is well-known, and can be identified easily through the original description and illustrations given by Silvestri. Therefore, it is briefly redescribed here.

**Female:** Length, 0.80-0.92mm Body dark brown to nearly black with the usual pale lines on head; side lobes largely, scutellum, metanotum and apex of tergum VII of gaster yellow to nearly white; third valvulae at least in distal half dark brown to black. Antennae yellow, largely infuscate brown on scape and pedicel. Wings hyaline. Legs whitish or pale yellow; coxae, hind femora, basal half to two-thirds of fore and middle femora, dark brown; hind tibiae in about basal third pale brown; fore and middle tibiae sometimes

light yellow brown in basal half or so.

Dimensions of body parts as in Figs 35-44 and 301. The distinguishing characters are the relatively longer (in front view) head and narrow frontovertex; presence of a tooth on clypeus; elongated tergum VII of gaster; shorter F1; hyaline wings; and longer ovipositor.

**Male:** Similar to female except scutellum also brown to dark brown. Antennae (Fig.45) similar to those of *opulenta*; F1 and F2 united to form a large oval structure. The other characters separating these two species are the relatively narrower frontovertex and the presence of a tooth on clypeus in *clypealis*, and a broader frontovertex and absence of tooth on clypeus in *opulenta*.

**Hosts:** *Aleurocanthus inceratus*; *A. woglumi*; *Aleyrodes* sp.; indet. aleyrodids in citrus and *Murraya*; (?)*Lepidosaphes beckii*.

**Distribution:** India: Andhra Pradesh, Assam, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh. Pakistan. [Indo-China. Malaysia. Mexico.]

**Material examined:** INDIA: KARNATAKA: Vijayapura, 4F (209E), ex *A. woglumi* on citrus; 2F, 1M (210E, 211E), 6.i.1984, ex citrus blackfly, CIE.15815; 7F, 1M (on cards 258E), same data, (BMNH); Bangalore, 1F (on card 187E), xi.1955, ex aleyrodid on citrus, C.S.No.20A; 2F, 2M (186E, 188E), ix.1955, ex aleyrodid on citrus, C.S.No.20A (both det. B.D. Burks) (USNM). ANDHRA PRADESH: Ponnur, 6F on cards, 7F, on slides (36E-39E), i.1967, ex aleyrodids on *Citrus limonum*; Guntur, 2F (40E), i.1967, ex aleyrodids on *Murraya koenigii*. KARNATAKA: Coorg District, Chettalli, 3F (199E), 24.iv.1984, ex (?)*Lepidosaphes beckii*, (S.P. Singh).

**Comments:** The species can be identified by the illustrations given here and the key characters. Flanders (1969) gave a detail history of collection of this species in India and its importation into Mexico for the control of the citrus blackfly, *A. woglumi*.

The species is placed here in *opulenta*-group.

##### 5. *Encarsia opulenta* (Silvestri)

*Prospaltella opulenta* Silvestri, 1928: 30. Female. Male. China, Van phu (Tonkino) (IEUN). Flanders, 1969: 467-480. De Santis, 1979a: 335.

*Encarsia opulenta* (Silvestri): Viggiani & Mazzone, 1979: 45. Hayat, 1986: 162.

**Hosts:** *Aleurocanthus woglumi* [Type material reared from *A. inceratus*] Silvestri (1928) records *Ablerus macrochaeta* Silvestri, as a hyperparasite of *opulenta*.

**Distribution:** India: '...between Delhi and Himalayan mountains' (Flanders, 1969). Pakistan. [Indo-China. Malaysia. Mexico. Barbados. Jamaica. Caiman.]

**Comments:** The species was described in detail by Silvestri (1928). I have not seen any material from India that agrees exactly with that description; but Flanders (1969)

gave a history of its collection in India and importation into Mexico. The species is placed in the key on the basis of the original description and also on the figure given by Grissell (1979).

I have seen 3 females and one male from the Bahamas (BMNH) bred from *A. woglumi*, that agree fairly well with the figure given by Grissell. Study of some indetermined specimens and some closely related species shows that *brasiliensis* is very close to *opulenta*, and the two may be synonymous. In *brasiliensis*, terga IV-VI or V and VI are brown and flagellar segments are relatively shorter (F2-F6 each less than 2x as long as wide), whereas in *opulenta* terga III-VI are brown to dark brown and flagellar segments are relatively longer. It may, however, be remarked that the colour of gaster may not be a very reliable character in this group of species. I have seen specimens (194E, USNM) representing probably a single species, but with basal two to four terga and tergum VII yellow to brown. (See under *terebrator* for further comments.)

6. *Encarsia terebrator* (Shafee) (Figs 46-51)

*Prospaltella terebrator* Shafee, 1974: 36. Female. Male. India, Guntur (Shafee's coll., ZDAMU). [Paratype female examined]

*Encarsia terebrator* (Shafee): Hayat, 1986: 163.

The following brief redescription is based partly on the paratype examined by me and on the original description.

**Female:** Head and thorax yellow; pronotum except yellow distal two-fifth of collar, dark brown; anterior margin of mid lobe, axillae and propodeum, brown; petiole pale brown; gaster (described as) brownish, except basal four terga which are yellow; third valvulae and distal third or so of second valvifers dark brown. Fore wings with more or less distinct infuscation below marginal vein. Legs pallid.

Head in front view as in Fig.50. Antennae as in Fig.46; F2 2x as long as wide; F4 partially separated from F5 so that the clava may appear 2-segmented.

Thorax as in Fig.51; each side lobe and axilla with 3 and 1 setae respectively (not 2 and 2 setae shown by Shafee in Fig.8). Fore wings about 2.5x as long as wide; marginal fringe one-eighth to one-seventh of wing width; details of venation and setae as in Fig.49.

Gaster as long as head plus thorax. [Relative lengths of second valvifer, third valvula, middle tibia and tarsus as in Figs 47 and 48.]

**Male:** I have not seen the males of this species, and Shafee (1974; Fig.11) illustrated only the antenna. That figure shows F1 longer than pedicel, F1-3 nearly subequal in length and a 3-segmented clava.

**Host:** Indet. aleyrodids.

**Distribution:** India: Andhra Pradesh.

**Comments:** The paratype female examined by me is dissected and mounted on two slides. The holotype and other paratypes

were not available to me.

The species is apparently very close to if not the same as *brasiliensis* or *opulenta*. It differs from the former (as illustrated by Grissell, 1979) in only one character of doubtful specific value, namely, brownish tergum VII of gaster. It differs from *opulenta* in having basal four terga of gaster yellow. In *brasiliensis* terga III-IV and VII are yellow and in *opulenta* basal two terga are yellow. The relative lengths of the ovipositor and middle tibia are unknown to me for the former species, but these are about the same in *terebrator* and *opulenta*: lengths of second valvifer, third valvula, middle tibia and basitarsus, in microns; 380:285:304:76 in *opulenta* holotype, and 320:220:255:65, in paratype of *terebrator*. It is therefore not possible to comment with any certainty on the validity of this species without study of the holotype.

### 7. *Encarsia longicauda*, sp. nov. (Figs 9,54-59,294)

**Female:** Length, 0.55-0.87mm; holotype, 0.82mm Body (Fig. 294) pale to golden yellow; a faint brown spot in center of mouth margin and face above toruli sometimes with an indefinite pale brown cross-band; most of occiput, pronotum, anterior margin of mid lobe, propodeum, mesopleura, petiole, a cross-band at base or whole of tergum I, most of tergum III, terga IV-VI, and at least distal half of third valvulae brown to dark brown; sometimes only tergum II yellow; tergum VII always pale yellow to white. Antennae pale yellow, F4-6 yellow brown. Wings hyaline. Legs pallid with hind coxae occasionally partly brown.

Head in front view as in Fig.55; eyes distinctly setose. Antennae as in Fig.54.

Thorax as in Fig.294; mid lobe usually with 8 setae, rarely 10. Fore wings as in Fig.58; basalcell with 1-3 setae, usually only 2; marginal vein with 7-9 setae; marginal fringe one-fifth to slightly less than one-fourth of wing width. Hind wings about 7x as long as wide; marginal fringe slightly shorter to as long as wing width.

Petiole plus gaster longer than thorax (Fig.294); terga II-VII with the usual number of setae. [Ovipositor from slightly shorter to a little longer than the combined lengths of middle tibia and tarsus: 20:24, 23:23, 22:21, 23:25, 24:25; Figs 56 and 57.]

**Male:** Length, 0.50-0.62mm Body brown to dark brown; frontovertex and face yellow; mid lobe varying from brown to brown with sides and posterior third yellow; scutellum brown or pale brown. Antennae as in Fig.59; F1 slightly to distinctly broader than F2 and about as long as wide to slightly longer than wide, but always shorter than F2; F5 and F6 partially separated.

**Host:** Indet. aleyrodids.

**Distribution:** India: Rajasthan, Tamil Nadu.

**Holotype:** Female (276E, with one paratype under a separate coverslip): INDIA: TAMIL NADU: Sri Rangam, ii.1967,

ex aleyrodids. Paratypes: 32F, 22M (33E, 115E, 116E, 269E, 276E, 277E), and 6F, 5M, on cards, with the same data as holotype. RAJASTHAN: Arnajee, 1F (273E) and 1F on card, 24.xi.1976.

Material not designated as types: Several female and male specimens in alcohol, with the same data as holotype. TAMIL NADU: Shencottah, 1M (35E), iii.1967, ex aleyrodid.

**Comments:** This new species was initially confused with *brasiliensis* and *terebrator*. Though very close to those species, *longicauda* differs in the relative lengths of the ovipositor and middle tibia, hyaline wings, longer marginal fringe of fore wings and to some extent in the colour of the gaster. The species is placed in *opulenta*-group.

**Etymology:** Latin: *longus*=long; *cauda*=tail; and refers to the long tergum VII of gaster and long ovipositor.

#### 8. *Encarsia albiscutellum longipalpa*, subsp. nov. (Figs 64-71)

**Female:** Length, 0.70-0.87mm; specimens with distended gasters measure about 1.0mm. Body dark brown to nearly blackish brown; frontovertex ocellar triangle, brown or yellow suffused with brown; scutellum and apex of tergum VII of gaster white; third valvulae dark brown to black. Antennae yellow, with scape, pedicel and F4-6 infuscate brown. Wings hyaline, with some yellow tinge below marginal vein in some wings. Legs pallid to white; middle coxae brown; hind coxae dark brown; fore coxae in some specimens appear infuscate at base.

Frontovertex about 2x of dorsal eye width; mouth fossa nearly half of frontovertex (ca 5.25:12); eyes with pale brown setae; setae on frontovertex dark brown. Antennae as in Fig.66; F1 subequal in length to at most a quarter longer than pedicel; F4 partially separated from F5.

Thorax as in Fig.67; mid lobe usually with 10 setae, occasionally 9, 11 or 12 setae; each side lobe with 4 setae. Fore wings as in Fig.70; basal cell with 2-4 setae; marginal vein with 9-10 setae; marginal fringe slightly longer than one-sixth to slightly longer than one-fifth of wing width. Hind wings not more than 6x as long as wide (38-45:6.5-8); marginal fringe slightly to distinctly shorter than wing width (6.5:5.5, 8:5). Hind tibia slightly shorter than middle tibia (13.5-16:14.5-17).

Petiole plus gaster distinctly longer than thorax, the ratios vary depending on the condition of the gaster (24.5:17, 36:20.5); tergum VII rarely with 5 setae, otherwise terga II-VII with the usual number of setae; ovipositor extends from base of gaster and exserted at apex, the exserted part depending on the condition of the gaster, varies from one-sixth to one-fifth the length of gaster; third valvula longer than half the length of second valvifer (10.5-12:17-21). [Relative lengths of ovipositor and middle tibia as in Figs 68 and 69.]

**Male:** Length, 0.62-0.72mm. Differs from the female in having the scutellum brown to dark brown and hind femora

and base of hind tibiae brown. Antennae as in Fig. 71. Maxillary palp long (Fig. 65, right side drawing).

**Hosts:** *Aleurolobus* sp.; [with] *Nipaecoccus* sp.

**Distribution:** India: Tamil Nadu, Uttar Pradesh.

**Holotype:** Female (42E): INDIA: UTTAR PRADESH: Aligarh, iii.1966, ex *Aleurolobus* sp. on *Eugenia jambolana*.

**Paratypes:** 1F (41E), with same data as holotype; Aligarh, 5F, 2M (43E-46E, 49E) and 2F, 1M on a card, x.1965, rest of data as for holotype; 1F (101E), i-iv.1981; 1F on card, 14. iv.1980. TAMIL NADU: Kancheepuram, 1F (47E, 48E), ii.1967, with *Nipaecoccus* sp. on *Casuarina equisetifolia*.

**Comments:** The above listed specimens are here described as a subspecies of the Australian species *E. albiscutellum* (Girault) because the differences noted in the Indian specimens do not appear to be sufficient to place them in a separate species. The new subspecies differs from *albiscutellum* in having 10-12 setae on mid lobe, 2-4 setae in basal cell of fore wings, hyaline fore wing, and middle tibial spur somewhat shorter than basitarsus. The original description of Girault's species was based on a single female. Girault (1915) also described a 'variety' (*schilleri*) and stated that it differs from the typical form in having the caudal femora not as dusky as in *albiscutellum* and fore wings only obscurely dusky below the marginal vein. A third specimen is said to differ in having the fore wings less distinctly infuscated. Thus it is apparent that *albiscutellum* shows some variation in wing infuscation. I have, therefore, regarded the Indian specimens as representing a form slightly different from the typical specimen, and have considered it necessary to recognize this form under a different name. It is, however, very likely that study of larger series of specimens from Australia may prove the new subspecies to be a different species, or more likely, a variant of *albiscutellum*.

*E. a. longipalpa* appears very close to *E. nigrifemur* (Girault) (from Java; types seen), but the javanese species has the scutellum dark brown, coxae of all legs and hind femora dark brown, fore and middle femora partly brown, third valvulae about four-fifths the length of second valvifer, and flagellar segments distinctly longer (1.5x) than pedicel

**Etymology:** Latin: *longus*=long + *palm*; and refers to the relatively long maxillary palp in the males of this subspecies.

#### 9. *Encarsia bangalorensis*, sp. nov. (Figs 155-159, 298)

**Female:** Length, approx. 0.70mm Frontovertex (Fig. 298) brown with dusky or yellow brown on sides of ocelli; face, malar space and occiput dark brown; pronotum, axillae and propodeum dark brown; mid lobe anteriorly dark brown, gradually becoming brownish yellow posteriorly; side lobes pale yellow brown; scutellum and metanotum yellow; pleura mostly and petiole dark brown; gaster with tergum I brown especially on sides, terga II and III yellow, IV-VII dark brown;

third valvulae blackish. Antennae yellow, distal segments of flagellum dusky. Fore wings subhyaline, faintly infuscate in basal third. Legs pallid, only hind coxae in basal half pale brown.

Head in front view broader than high (17.75:13); POL about equal to OOL; mouth fossa less than half of fronto-vertex width (10:23); eyes with prominent setae. Antennae as in Fig.155.

Thorax as in Fig.298. Fore and hind wings as in Figs 158, 159; left fore wing with 8 setae on marginal vein. Hind tibia subequal in length to middle tibia (29:31).

Petiole plus gaster slightly longer than head plus thorax (Fig.298); third valvula about two-third the length of second valvifer. [Relative lengths of ovipositor and middle tibia as in Figs 156 and 157.]

**Male:** Unknown.

**Host:** Unknown.

**Distribution:** India: Karnataka.

**Holotype:** Female (257E): INDIA: KARNATAKA: Bangalore, 19-23.ix.1979 (J.S.Noyes) BM 1979-518 (BMNH).

**Comments:** *E. bangalorensis* appears close to *smithi*, but differs in the relative lengths of F1 and F2, subhyaline wings and pale yellow legs, and different body colour.

The species is placed in opulenta-group.

**Etymology:** The specific name is derived from the name of the collection locality of the holotype.

#### 10. *Encarsia coimbatorensis*, sp. nov. (Figs 160-164)

**Female:** Length, 0.67mm. Frontovertex orange yellow; face above toruli brownish; mouth margin and malar space behind sutures dark brown; occiput yellow with a brownish band on sides of foramen; mesoscutum and scutellum yellow; rest of thorax including sides and venter, dark brown and a little shiny; terga I, IV-VII dark brown, sides of II and III brown; apex of VII yellow; venter of gaster in distal half dark brown. Antennae pale yellow. Fore wings infuscate from base to apex of venation, with a dark infuscated band below stigmal vein and in distal half of basal cell (Fig.164). Legs pallid to white.

Frontovertex at anterior ocellus, slightly more than half of head width (ca 43:70); POL slightly less than OOL(6:7); mouth fossa nearly half the width of frontovertex (20:43); mandibles with two sharply pointed teeth and a small, receded tooth. Antennae as in Fig.160.

Thorax as in Fig.163. Fore wings as in Fig.164; basal cell with 2-3 setae; marginal vein with 8 setae. Hind wings about 7.5x as long as wide; marginal fringe 1.5x as long as wing width. Hind tibia equal in length to middle tibia.

Petiole plus gaster (distended) longer than thorax (24.5:16); tergum VII about 1.25x as wide as long; terga II-VI with 2+2, 2+2, 2+2, 3+2+3, 2+2+2, 4 setae. [Exserted part of ovipositor in dried specimen:middle basitarsus, 0.047: 0.044mm; lengths of ovipositor and middle tibia as in Figs 161 and 162.]

**Male:** Unknown.

**Host:** Unknown.

**Distribution:** India: Tamil Nadu.

**Holotype:** Female (254E): INDIA: TAMIL NADU: Coimbatore, 27.ix.1979 (J.S.Noyes) (BMNH).

**Comments:** The new species is quite distinct and can be recognized by the body colour, wing infuscation, longer tergum VII of gaster and shorter third valvulae. It is, however, difficult to indicate with certainty the relationship of this species; but the habitus suggests that it may belong to opulenta-group.

**Etymology:** The specific name is derived from the collection locality name.

#### 11. *Encarsia smithi* (Silvestri)

*Prospaltella smithi* Silvestri, 1926: 179. Female. Male. China, Canton (IEUN). Silvestri, 1928: 20. Pruthi & Samuel, 1942: 35-37. Samuel, 1950: 248-250. Krishnamurti & Usman, 1954: 339. Flanders, 1969: 467-480. De Santis, 1979a: 336.

*Encarsia smithi* (Silvestri): Viggiani & Mazzone, 1979: 45. Hayat, 1986: 163.

**Hosts:** *Aleurocanthus woglumi*; '*A. hussini*'; [?] *Bemisia tabaci*. [*A. spiniferus*]

**Distribution:** India: Bihar, Karnataka, Maharashtra, 'North India'. Pakistan. Sri Lanka. [China. Taiwan. Japan. Mexico.]

**Material examined:** INDIA: MAHARASHTRA: Poona, 3F (195E), 15.i.1950, ex *A. hussini*, (H.D.Smith) Id. Lot 50-1191 (det. A.B.Gahan) (USNM).

**Comments:** The species is known to me from the original description and from 3 females (USNM) from India determined by A.B.Gahan; these apparently from among the material reported upon by Flanders (1969). Silvestri's description (1926, repeated in 1928) is sufficiently detailed to permit its identification. Further, Prof. G. Viggiani provided the following measurements (in mm) from the type: ovipositor length, 0.266; third valvula, 0.095; middle tibia, 0.209; and middle basitarsus, 0.038. The three females from the USNM collection are badly mounted along with a female (determined by me) of *narayanani*, and it is impossible to measure ovipositor and tibial lengths accurately; but the former appears slightly shorter than middle tibia and basitarsus combined, the third valvula about 0.5 of second valvifer, and tergum VII of gaster about as in opulenta-group of species. Because of these differences in the original description and the specimens studied by me, the species is placed in three different couplets in the key.

*E. smithi* appears close to *townsendi* (Howard, 1907), but Howard's species has F1 wider than long; flagellar segments relatively shorter; mid lobe with 8 setae; frontovertex orange; facebrown; and terga VI and VII pale brown. *E.smithi* can be confused with *narayanani*, but that species has a 2-

segmented clava, different proportions of ovipositor and middle tibia; and a distinct brownish band on face.

The species is placed tentatively in **opulenta-group** but it may belong to **aurantii-group**, or require a separate group as done by Viggiani & Mazzzone (1979).

## 12. *Encarsia merceti* Silvestri (Figs 72-79)

*Encarsia merceti* Silvestri, 1926: 187. Female. Singapore (IEUN). Silvestri, 1928: 40. Flanders, 1969: 467-480. De Santis, 1979a: 329. Hayat, 1986: 162.

**Female:** Length, 0.50-0.62mm. Frontovertex orange yellow with brown especially in ocellar triangle; face above toruli pale yellow, sides of toruli and to mouth margin, malar space and occiput from level of foramen downwards, dark brown or pale yellow with only mouth margin dark brown; occiput above pale yellow; pronotal collar brown; rest of pronotum, petiole and gaster except orange yellow apex of tergum VII, dark brown; prepectus brown; pleura dark brown; mid lobe anteriorly orange brown to brown with sides and apical third yellow; axillae yellow to dark brown; scutellum yellow to white; propodeum dark brown or with pale yellow in middle; third valvulae pallid. Antennal scape and F3-5 pale yellow with brown suffusions; F1 and F6 dark brown; pedicel and F2 brown. Fore wings lightly to distinctly infuscate below marginal vein. Legs pallid, hind coxae and femora dark brown; middle femora and basal third of hind tibiae pale brown.

Head in front view as in Fig. 72. Antennae as in Fig. 73.

Thorax about as wide as long; mid lobe 1.5x as long as scutellum (42:28); scutellum over 1.75x as wide as long (49:28); mid lobe and each side lobe with 10 and 3 setae; the seta on axilla located in anterior fourth near its mesal margin; distance between anterior pair of scutellar setae equal to or slightly more than that between posterior pair, the latter originating in distal two-third of scutellum, not from apex; each placoid sensilla near anterior seta. Fore wings about 2.5x as long as wide (38:15.5); marginal fringe about 0.25 of wing width; venation and setae as in Fig. 77; marginal vein with 6-8 setae. Hind wings about 8x as long as wide, fringe slightly longer than wing width. Hind tibia nearly as long as middle tibia.

Gastral terga with the usual number of setae; tergum VI with spiracle bearing areas separated from the middle plate (as in *aurantii*) (Fig. 79). [Relative lengths of ovipositor and middle tibia as in Figs 74 and 75.]

**Male:** Length, 0.57mm. Similar to female except as follows: body extensively dark brown with frons and occiput above brown with orange tinge and scutellum dusky, orange along posterior margin. Scape pallid; pedicel and F1 brown; F2-5 yellow brown. Wings hyaline. Mesothoracic sclerites with irregular hexagonal cells which are clearly visible (in female sculpture is visible only in the dark areas). Antenna (Fig. 76) with F1 with a distinct projection on ventro-

lateral aspect. Fore wing about 2.3x as long as wide; marginal fringe slightly shorter than 0.25 of wing width; disc with a small asetose area around stigmal vein (Fig. 78).

**Hosts:** *Aleurocanthus woglumi*; indet. aleyrodids.

**Distribution:** India: 'vicinity of Assam', 'Delhi to the Himalaya mountains'. [Indonesia. Malaysia. Philippines. Singapore. Mexico.]

**Material examined:** INDIA: ASSAM: Gauhati, 6F (282E), iiii. 1950 (H.D.Smith) Lot No. 50-15467 (USNM); Jorhat, 13F, (283E) Spring 1950 (H.Smith) Lot No. 50-7503 (USNM); North Lakhimpur 1F, 2M (274E, 275E), 24.v.1986, ex indet. aleyrodids (S.Singh)

**Comments:** The two males bred along with a single female from N.Lakhimpur, are apparently conspecific with *merceti*, and can be distinguished from males of all other species by the presence of a 'truely' 5-segmented flagellum, and other characters noted above.

This species was placed in *smithi*-group by Viggiani & Mazzone (1979), but as I am not sure about the true identity of *smithi*, *merceti* is placed here in a separate group—*merceti*-group. This group also includes *bennetti*, and is characterized by having a broader mouth fossa and large mandibles with a distinct ventral tooth.

### 13. *Encarsia bennetti* Hayat (Figs 281-286, 308)

*Encarsia bennetti* Hayat, 1984: 399. Female. India, Nagpur (BMNH). Hayat, 1986: 160.

**Female:** Length, 0.56-0.78mm Body white to orange dorsally and white ventrally; occiput with a brownish band on each side of foramen; frontovertex orange; mouth margin brown; light brown to brown as follows: center and a spot on each posterolateral corner of pronotum, anterior margin of mid lobe narrowly, axillae in anterior half, most of propodeum, petiole, and lateral spots or bands on terga III and IV and cross-bands on V and VII; in some tergum IV with a cross-band, or terga III and IV mainly yellow; mesopleura in posterior half or so washed with brown; prepectus in middle dark brown; ovipositor sheaths white to reddish. Antennae pale yellow; clava, especially F6, brown. Fore wings with an infuscated band below stigmal vein across disc, and a pale infuscation below parastigma. Legs white or nearly so except apices of femora and bases tibiae of hind legs,

Head in front view as in Fig. 282; mouth fossa about 0.75 of frontovertex width; mandibles with a large ventral tooth, a small middle tooth and a short truncation. Antennae as in Fig. 281; F1 as long as to slightly longer than pedicel and from shorter to as long as F2.

Thorax as in Figs 285 and 308. Fore wings as in Fig. 286. Hind wings 7x as long as wide; marginal fringe slightly longer than wing width.

Petiole plus gaster slightly longer than thorax; tergum VII about 2x as wide as long; tergum VI with 6 setae. [Relative lengths of ovipositor and middle tibia as in Figs 283 and 284.]

**Male:** Unknown.

**Hosts:** *Aleurocanthus woglumi*; indet. aleyrodids.

**Distribution:** India: Maharashtra, Uttar Pradesh. Pakistan.

**Material examined:** (Some paratypes and other specimens listed by Hayat, 1984, are on slides 93E-98E). INDIA: MAHARASHTRA: Nagpur, 5F (226E), 14.viii.1984, ex *A. woglumi*, A.16256 No.1 (det. B.R. Subba Rao). PAKISTAN: Rawalpindi, 2F (240E), 4.xii.1979, ex *A. woglumi*, CIBC 4663; Multan, 5F (241E), 26.ii.1980, ex *A. woglumi*, No.4657, (BMNH).

**Comments:** It is not possible to indicate with certainty the relationship of this species, but the general habitus and head dimensions, large mandibles, suggest that it is close to *merceti* (inspite of colour differences), and is therefore placed in *merceti*-group.

#### 14. *Encarsia berlesei* (Howard)

*Prospalta berlesei* Howard, 1906: 291. Female. U.S.A., Washington D.C. (USNM).

*Prospaltella berlesei* (Howard): Howard, 1908: 283. Pruthi & Mani, 1945: 12-13. De Santis, 1948: 241. Peck, 1963: 277. De Santis, 1979a: 332. Grissell, 1979: 4, Fig.

*Encarsia berlesei* (Howard): Viggiani & Mazzone, 1979: 47. Hayat, 1986: 160.

**Host:** *Pinnaspis strachani*.

**Distribution:** Sri Lanka. [Cosmopolitan!]

**Comments:** I have not seen any specimen of *berlesei* from the area. It was recorded from Sri Lanka (see Pruthi & Mani, 1945). The species is placed in the key on the basis of the illustration given by Grissell (1979). Further, Dr M.E. Schauff (USNM) provided the following measurements (in microns) from the types: lengths, of middle tibia, 200; middle basitarsus, 37; ovipositor, 261; third valvula, 83.

Girault (1935:p.3) proposed a (new) specific name *Coccophagus aethiopis* (Girault considered *Prospaltella* a synonym of *Coccophagus*; see Girault, 1915) for the material reported under the name *P. berlesei* by Silvestri (1931a) considering that Silvestri misidentified the material. This may be so; but I do not consider *aethiopis* a valid name because it was not accompanied by designation of a 'type'.

*E. berlesei* together with *inquirenda*, *diaspidicola* and related species was placed in *berlesei*-group by Viggiani & Mazzone (1979). However, I have considered it more appropriate to propose a separate group - **inquirenda-group** - to include the species placed by those authors in *leucaspidis* and *berlesei-groups*, with *berlesei* as a doubtful member of this group. It is also very likely that *berlesei* may prove to be close to species of *aurantii*-group.

#### 15. *Encarsia duorunga*, sp. nov. (Figs 80-85, 300)

**Female:** Length, 0.45-0.57mm Body golden yellow, in cleared specimens nearly white, with dark brown head and mid lobe and blackish pronotum; head with the usual pale lines;

occiput with small pale areas above foramen, and face paler; propleura brownish; axillae, mesopleura above, sides of propodeum, petiole, a band across base, and sides of gaster up to cercal plates, sometimes suffused with pale brown; in the holotype terga II-VI distinctly suffused pale brown (Fig.300). Antennae pale yellow with brown F6. Wings hyaline with a light infuscation below submarginal vein of fore wing. Legs pallid; hind coxae pale brown in basal third in one specimen.

Structural details as in Fig.300; POL slightly less than OOL; mouth fossa:frontovertex width, 14.5-15:36-38; frontovertex with dark brown setae; eyes with distinct, colourless setae. Antennae as in Fig.80; F1 slightly to distinctly shorter than F2 which is shorter than F3.

Fore wings as in Figs 84,85; basal cell with 3-6 setae; marginal vein with 5-7 setae; marginal fringe 0.5 or more of wing width (5.5:11.75;5.5:9.25). Hind wings about 8x as long as wide; marginal fringe slightly less than 2x of wing width (5:3). Relative lengths of middle tibia, basitarsus and spur (Fig.82): 43-51:13.5-16.5:8-10; hind tibia subequal in length to middle tibia (43-53:43-51).

Gastral terga with the usual number of setae (5 setae on tergum V in holotype); second valvifer at least a little longer than 2x of third valvula (39-46:16-20). [Ovipositor at least as long as middle tibia and basitarsus combined, usually longer; Figs 81 and 82.]

**Male:** Unknown.

**Host:** Unknown.

**Distribution:** India: Uttar Pradesh.

**Holotype:** Female (268E): INDIA: UTTAR PRADESH: Aligarh, 10.x.1986. **Paratypes:** Aligarh, 3F (86E,87E), x.1980; 3F (126E,128E,130E), 9.xii.1980; 1F (107E), 26.xi.1983.

1F (171E, Aligarh, 25.xi.1983) is doubtfully assigned to this species as the antennae were lost during mounting.

**Comments:** The species is related to another new species, *brevivalvula*, and possibly also *mohyuddini*, in body colour, and to the former species in antennal and wing characters. It differs from both the species by the characters given in the key.

*E. duorunga* together with *brevivalvula* is placed in a separate group - *duorunga*-group.

**Etymology:** The specific name is derived from Hindustani, duo=two, rung=colour; and refers to the dark and yellow colour of the body.

#### 16. *Encarsia brevivalvula*, sp. nov. (Figs 238-242)

**Female:** Length, 0.73mm Head dark brown with the usual pale lines and dark postocellar bars; pronotum and mid lobe except posterior fourth or so, dark brown; axillae, pleura, sides of propodeum and sides of gaster up to cercal plates, brownish; ovipositor pallid; dorsum of gaster faintly suffused brown, other wise body pale yellow. Antennae pale yellow

brown, F6 brownish. Wings hyaline. Legs pallid with femora and tibiae indistinctly suffused pale brown.

Head with normal dimensions; POL less than OOL (approx. 12:15); mouth fossa about one-third of frontovertex width at anterior ocellus (18:55); eyes with fine setae. Antennae as in Fig. 238 (flagellum tilted slightly upwards in the slide mounted holotype).

Thorax as in Fig. 241. Fore wings nearly 3x as long as wide (38:13); basal part of fore wing as in Fig. 242; left wing with 7 setae on marginal vein; marginal fringe slightly more than 0.25 of wing width. Hind wings nearly 9x as long as wide; fringe more than 1.5x of wing width (6:3.75). Middle and hind tibiae subequal in lengths (14:15).

Petiole plus gaster (distended) longer than thorax (28:16); tergum VII about 1.75x as wide as long; terga V and VI with 2+2+2 and 2+3+2 setae; third valvula about 0.25 of second valvifer. [Relative lengths of ovipositor, middle tibia and tarsus as in Figs 239 and 240.]

**Male:** Unknown.

**Host:** Unknown.

**Distribution:** India: Uttar Pradesh.

**Holotype:** Female (151E): INDIA: UTTAR PRADESH: Aligarh, 18.x.1985.

**Comments:** The new species appears close to *duorunga* because of a more or less similar body colour, and carded specimens of one species may be easily confused for the other. It can be distinguished from *duorunga* by several characters, notably the shorter marginal fringe, shorter third valvulae, longer ovipositor, F2 longer than both F1 and F3 separately, and an apparently 3-segmented clava. The species is placed in *duorunga*-group.

**Etymology:** Latin: brevis=short, small + valvula; and refers to the short third valvulae in this species.

#### 17. *Encarsia mohyuddini* Shafee & Rizvi

*Encarsia mohyuddini* Shafee & Rizvi, 1983: 157. Female. Pakistan, Charsadda (Shafee's coll., ZDAMU).

**Host:** *Bemisia tabaci*.

**Distribution:** Pakistan.

**Comments:** Types were not available to me for study. On the basis of the original description and figures, the species appears distinct and can be identified from the characters given in the key.

The species is placed tentatively in *duorunga*-group. It is, however, not possible to make any further comments either on its identity or on its relationship without study of the types.

#### 18. *Encarsia pseudococci* (Agarwal) (Figs 86-88)

*Prospaltella pseudococci* Agarwal, 1964: 279. Female. Male. India, Aligarh (Agarwal's coll., ZDAMU) [examined]

**Encarsia pseudococci** (Agarwal): Hayat, 1986: 163.

The species appears distinctive and can be recognized by the following combination of characters:

**Female:** Head, thorax and gaster described as 'dirty brown' 'rusty' and 'brownish at base, apex and on sides, whitish in the middle'. (The type appears yellow, possibly because of fading due to long preservation in alcohol). Wings hyaline. Legs yellow.

Antennae as in Fig.86. Thorax normal, but it is not possible to see clearly the setae. Fore and hind wings as in Figs 87, 88; submarginal with 2 setae, not 3 as mentioned by Agarwal. Other details not possible to see in the teneral holotype.

**Male:** Darker in colour than female, gaster probably dark brown, but appears pale after long preservation in alcohol. Antennae (Agarwal, 1964: Fig.14B) 8-segmented.

**Host:** [?] *Rastrococcus iceryoides*.

**Distribution:** India: Uttar Pradesh.

**Comments:** The holotype female and the 'allotype' male are in alcohol in a vial, with parts mounted on two slides. The female is rather teneral and it is impossible to be sure whether the original description of colour and thoracic setae is correct or not. The species, however, appears to be a valid taxon, and differs from other species known to me. *E. pseudococci* is placed here in perflava-group.

#### 19. *Encarsia perflava*, sp. nov. (Figs 89-95)

**Female:** Length, thorax plus gaster, 0.42-0.57mm(heads detached). Body pale yellow, appears white in cleared specimens; ocellar area and mouth margin pale brown; tips of mandibles reddish. Antennae pale yellow; F6 pale brown. Wings hyaline. Legs paler than body.

POL appears about half of OOL in slide mounted heads; mouth fossa:frontovertex width, 14-15:38-41; setae on head pale, those between toruli and mouth margin as in Fig.89; eyes with colourless setae. Antennae as in Fig.90a-c; F1 0.66 to 0.75 of pedicel, shorter than F2; F3 (compared to that of *pseudococci* and *duorunga*) rather distinctly longer than F2.

Thorax as in Fig.95. Fore wings as in Fig.93; basal cell with 2-4, and marginal vein with 6-7 setae; marginal fringe from slightly longer than 0.5 to nearly 0.66 of wing width. Hind wings about 9x as long as wide, fringe slightly less than 2x of wing width. Relative lengths (in 4 specimens) of middle tibia, basitarsus and spur, 39-50:13-18:8-9; hind tibia:middle tibia, 40-54:39-50.

Petiole plus gaster (distended) longer than thorax (17-24:11.5-14); tergum VII about 1.5x as wide as long; second valvifer about 2x of third valvula (36-45:17-21). [Relative lengths of ovipositor and middle tibia as in Figs 91 and 92.]

**Male:** Unknown.

**Host:** One specimen bred from an indet. aleyrodid.

**Distribution:** India: Uttar Pradesh.

**Holotype:** Female (102E): INDIA: UTTAR PRADESH: Aligarh, i-iv.1981. **Paratypes:** 2F (104E, 110E) with same data as the holotype; Aligarh, 1F (108E), 26.xi.1983; 1F (125E), viii.1967, ex aleyrodid on *Dalbergia sissoo*.

**Comments:** *E. perflava* appears related to *pseudococci*, but differs by the completely yellow coloured body, fore wing shape and length of marginal fringe, and slightly different antennal dimensions. From *leptosoma*, sp. nov., it differs by having the pedicel longer than F1, the latter shorter than F2; mid lobe usually with 8 setae; disc of fore wing relatively sparsely setose, fringe distad of venation longer; longer middle basitarsus; shorter spur; and yellow body colour.

A separate group, *perflava*-group, is proposed here for *perflava*, *pseudococci*, and *leptosoma*. The species of this group are related to those of *duorunga*-group, but differ in having relatively slender, elongate habitus and in body colour.

**Etymology:** Latin: per-all over, through; *flavus*=yellow, golden; and refers to the completely yellow body colour.

#### 20. *Encarsia macroptera* Viggiani

*Encarsia macroptera* Viggiani, 1985a: 87. Female. Pakistan, Peshawar (IEUN).

**Host:** *Aleurolobus barodensis*.

**Distribution:** Pakistan.

**Comments:** The original description is sufficient to recognize the species. It appears related to *muliayali*, but differs in body colour (not completely yellow), F1 shorter than pedicel and F2 separately, basal cell without setae, and relatively shorter ovipositor. It is, however, more close to species of *perflava*-group, especially *leptosoma*, sp. nov., and the slight differences noticed may eventually prove to be variations.

Viggiani (1985a) placed this species near *ochai*=*muliayali*, but on a balance of characters I place it in *perflava*-group.

#### 21. *Encarsia leptosoma*, sp. nov. (Figs 263, 270-274, 296)

**Female:** Length, 0.65-0.80mm Body pale yellow; a cross-band on occiput at level of foramen and collar of pronotum pale brown; a narrow band across base of tergum I, a band each on terga V and VI or only on V, appear very pale brown and hardly discernible; axillae pale brown on sides (Fig. 296). Antennae pale yellow with yellow brown F6. Wings hyaline. Legs paler than body. Setae on body and wings colourless.

Frontovertex width:head width, 8.5-9.5:16-17; POL:OOL, 9.5:13; head in front view distinctly wider than high(11.5:15); mouth fossa:frontovertex width, 18-21:43-46; eyes with colourless setae. Antennae as in Fig. 270; none of the flag-

llar segments less than 2x as long as wide; F5 usually somewhat longer than F6.

Thorax as in Figs 273, 296; mid lobe longer, slightly less than 2x of scutellum, with 8-10 setae. Fore wings as in Fig. 274; marginal vein with 6-8 setae. Hind wings about 9.5x as long as wide; marginal fringe slightly less than 2x of wing width (6:3.5). Hind tibia about as long as middle tibia.

Petiole plus gaster distinctly longer than thorax (24-28:15-17; shrunken gasters, 16-20); tergum VII 1.5x as wide as long; third valvula slightly less than 0.5 of second valvifer (19-20:42-43). [Relative lengths of ovipositor and middle tibia as in Figs 271 and 272.]

**Male:** Length, 0.60mm Only a single male was available and the gaster is slightly distorted. It appears similar to female except for body colour and the antennae (Fig. 263).

Body pale yellow with the following parts brown to dark brown: the band on occiput broader than in female; pronotum, anterior margin of mid lobe, axillae, mesopleura above, propodeum on sides, and whole gaster. Wings hyaline but discal setae pale brown.

**Host:** Indet. aleyrodids.

**Distribution:** India: Maharashtra, Punjab, Uttar Pradesh. Pakistan.

**Holotype:** Female (63E, with 7 paratypes, holotype distinctly marked): INDIA: PUNJAB: Mukerian, viii.1968, ex aleyrodids on *Saccharum officinarum*. **Paratypes:** 9F (61E-63E), with same data as holotype. UTTAR PRADESH: Shahjahanpur, 1F(64E), xi.1969, ex aleyrodid on *S. officinarum*. MAHARASHTRA: Nandgaon, 1F, 1M (97E), x.1967, ex aleyrodids on *Ziziphus* sp.

Material not designated as types: PAKISTAN: CIBC Faisalabad, 2F (250E), 8.x.1979, ex aleyrodid pupae on sugarcane leaf, (BMNH).

**Comments:** Because of similar habitus and more or less similar colour, *E. leptosoma* is placed in *perflava*-group. It differs from *macroptera*, to which it appears closely related (if not conspecific), in having the pedice1, F1 and F2 subequal in length and each shorter than F3, and presence of 2 setae in basal cell. It differs from *perflava* in these characters and in having longer mid lobe, shorter marginal fringe of fore wing, densely setose (setae pale) disc of fore wing and middle tibial spur about a third shorter than basitarsus.

**Etymology:** Greek: *leptos*=thin, slim; *soma*=body; and refers to the general habitus of this species.

## 22. *Encarsia sankarani*, sp. nov. (Figs 96-104, 302)

**Female:** Length, approx. 0.6-0.7mm Head pale lemon yellow to golden yellow, with brown postocellar bars; occiput above foramen with brownish tinge, and a distinct dark brown cross band at level of foramen; malar space with brown suffusions; thorax and gaster (Fig. 302) pallid to white, with the following parts brown to dark brown: pronotal collar especially on sides, axillae and tegulae dark brown;

propodeum dark brown with pale brown areas proximad of spiracles and in middle; pleura and sterna infuscate brown; petiole largely, tergum I at least across base, posterior half to whole of IV and whole of V, brown to dark brown; VI brown, paler in middle; VII pale brown basally, becoming yellow or yellow brown apically; the bands on IV and V sometimes interrupted in middle by yellow, that on VI may be broadly be broadly interrupted in middle or may consist of four dark brown patches; sometimes VI and VII mainly yellow with pale brown sides; venter of gaster pallid; ovipositor yellow. Antennal scape pallid, light brown along margins; pedicel and flagellum pale brown to (distally) brownish with dark brown setae. Fore wings infuscate lightly below venation. Legs pallid with only hind coxae in basal fourth to third (sometimes) brownish.

Head in front view as in Fig. 97; eyes with pale setae; mouth fossa about two-fifth of frontovertex width. Antennae as in Figs 96, 104; F1 very slightly to 1.5x as long as wide and shorter than F2.

Thorax as in Figs 100 and 302 (the differences in the two figures are due to the condition of preservation); mid lobe and each side lobe with 2 setae each. Fore wings as in Figs 101, 103; marginal vein with 6-7 setae; marginal fringe 0.66 to slightly shorter than wing width. Hind wings as in Fig. 102; marginal fringe from slightly less to slightly more than 2x of wing width. Hind tibia shorter than middle tibia (53:58).

Petiole plus gaster at least a little longer than thorax; petiole with fine sculpture on sides, the reticulations fade mesally. [Relative lengths of ovipositor and middle tibia as in Figs 98 and 99.]

**Male:** Unknown.

**Host:** *Fiorinia theae*.

**Distribution:** India: Assam.

**Holotype:** Female (236E, with 5F paratypes and 1F of *E. elongata*; holotype distinctly marked): INDIA: ASSAM: i. 1976, ex *Fiorinia theae*, 8457 (BMNH). **Paratypes:** 5F (236E), with the same data as holotype; Jorhat, 9F (190E), i. 1975, ex *F. theae*, (T.Sankaran); 7F (192E, 193E), ex *F. theae*, (T.Sankaran). INDIA (presumably the same locality): 8F (191E), i. 1976, ex *F. theae*, (T.Sankaran) (USNM).

**Comments:** *E. sankarani*, sp. nov. is closely related to *inquirenda*, *niigatae* (considered a synonym of *diaspidicola* by Gahan, 1925, but a valid species by Vigianini & Mazzone, 1979) and *fasciata*. It differs from the first two species by the characters given in the key [There are some differences between the original description of *niigatae* given by Nakayama (1921) and that given by Silvestri (1931a)]. In *fasciata*, mid lobe with 4-6 setae; F2 and F3 usually sub-equal in length; and F1-2 with rhinaria (see Grissell, 1979, for a habitus drawing of this species.)

It may, however, be noted that the identities of both *fasciata* and *niigatae* must be established first to be sure

about the validity of *sankarani*.

The species is placed in inquirenda-group.

**Etymology:** The species is named for Dr T. Sankaran, formerly of the CIBC, Indian Station, Bangalore.

### 23. *Encarsia elongata* (Dozier) (Figs 121-124)

[*Prospaltella aurantii* (Howard): Silvestri, 1931a: 149.  
Female. China. Misidentification according to Girault,  
1935]

[*Coccophagus herndoni* Girault, 1935: 3. Specific name  
proposed for material considered misidentified as  
*P. aurantii* by Silvestri]

*Prospaltella elongata* Dozier, 1937: 128. Female. U.S.A.,  
New Orleans (USNM) [examined]

**Female:** Length, approx. 0.75mm Head golden yellow with an irregular brownish cross-band on face above toruli and another cross-band on occiput at level of foramen; thorax pale yellow with pronotum, anterior margin of mid lobe narrowly, tegulae, axillae, and propodeum except mesal third brown to dark brown; propleura brown; prepectus dark brown; petiole brown; gaster dark brown with terga I and II except sides, and VII pale yellow to white; third valvulae blackish in contrast to paler second valvifers. Antennae dusky; F6 brownish. Fore wings infuscated below marginal vein, otherwise hyaline. Legs pallid with only hind coxae in basal two-third dark brown.

Frontovertex width about half of head width; POL nearly equal to OOL; mouth fossa about half of frontovertex width; eyes with fine but distinct, pale setae. Antennae as in Fig.121.

Thorax slightly longer than wide (19:18); mid lobe with 8 setae; each side lobe with 2 setae; the seta on axilla located in the middle, near its mesal margin; distance between anterior pair of scutellar setae a little more than that between posterior pair; placoid sensilla located near origin of anterior setae. Fore wings as in Fig.124. Hind wings about 9x as long as wide; marginal fringe 1.25x as long as wing width. Hind tibia about as long as middle tibia (54:57).

Petiole plus gaster slightly longer than thorax (22:19); tergum VI with 1+1+2+1+1 setae; tergum VII nearly 2x as wide as long; third valvula less than 0.5 of second valvifer. [Relative lengths of ovipositor and middle tibia as in Figs 122 and 123.]

**Male:** Unknown from India.

**Hosts:** *Fiorinia theae*. [*Aonidiella aurantii*; *Chrysomphalus aonidum*; *Lepidosaphes gloveri*.]

**Distribution:** India: Assam. [U.S.A. Puerto Rico. China.]

**Material examined:** INDIA: ASSAM: 1F (236E), i.1976, ex *Fiorinia theae*, 8457 (BMNH).

**Comments:** The single specimen identified here as *elongata* differs from the types in having a brownish cross-band on face and shorter marginal fringe. In the types the fringe

length varies from 0.4 to 0.5 of wing width.) But these differences are not considered here of specific value.

De Santis (1979b) places *elongata* in synonymy with *herndoni* (Girault). However, this can not be accepted. Girault (1935) proposed the (new) specific name, *Coccophagus herndoni* for the material recorded under the name *aurantii* by Silvestri (1931a), which he considered (probably correctly; see Compere, 1961) misidentified. However, I do not consider *herndoni* a valid name because it was not accompanied by selection and designation of a type.

The species is here placed in *inquirenda*-group.

**24. *Encarsia indica* (Shafee), COMB. NOV. [incertae sedis]  
(Figs 110, 111a)**

*Prospaltella indica* Shafee, 1973: 255. Female. India, Pondicherry (Shafee's coll., ZDAMU) [examined]

The following characters are noted from the holotype, but see notes given under comments.

**Female:** Body yellow; wings hyaline; legs pale yellow. Antennae as in Fig. 111a. Fore wing as in Fig. 110. Middle tibial spur about as long as basitarsus. Otherwise head and thorax as in *lutea*-group of species.

**Male:** Unknown.

**Host:** Indet. aleyrodid.

**Distribution:** India: Pondicherry.

**Comments:** The species was described from a single female. It is dissected and mounted on a slide. The gaster is distorted and it is not possible to see the ovipositor. However, on antennal dimensions and details of the fore wing, it appears different from *lutea* with which it was (erroneously) synonymized by Hayat (1981a). It is now removed from the synonymy of that species, but because of lack of details of the ovipositor, *indica* is regarded as of doubtful validity. Further comments follow: *E. indica* may prove to be a senior synonym of *davidi* Viggiani & Mazzone (1980b) and possibly also *abatei* Viggiani (1982), the differences being very slight, except that the relative lengths of the second valvifer and third valvula are unknown for *indica*. It differs from *lutea* (except characters of the ovipositor) in having F1 distinctly wider than long and fore wings relatively broader with shorter marginal fringe.

The species belongs to *lutea*-group, but its validity remains an unsettled problem.

**25. *Encarsia lutea* (Masi) (Figs 111b, 112-120, 309)**

*Prospaltella lutea* Masi, 1910: 25. Female. Italy (MCSG)

*Encarsia lutea* (Masi): Viggiani & Mazzone, 1979: 46; 1980b: 51. Hayat, 1981a: 466; 1986: 162.

**Female:** Length, 0.50-0.57 mm. Body yellow, with at most the mouth margin, pronotal collar, axillae partly, petiole and tergum I of gaster narrowly at base, pale brown; third valvulae distinctly reddish or dark brown. Setae on body

pallid, difficult to see at lower magnification in uncleared specimens. Antennae and legs pallid. Wings hyaline.

Head normal, with a broad frontovertex; mouth fossa less than 0.5 of frontovertex width (approx.3:8); mandibles with two teeth and a truncation (Fig.113); eyes with fine, pale setae. Antennae with relative dimensions of pedicel and flagellar segments variable; F1 usually quadrate and not more than 0.5 of pedicel (Figs 111b,116), but may be a little broader than long (slide 228E) to a little longer than broad (247E); F2 from slightly shorter (Fig.116) to as long as wide (106E; Fig.114) or slightly longer than F3 (Fig.115); F3 a little longer than wide, rarely quadrate (285E; Fig.111b); clava (=F4-6; but in some specimens F4 appears separate from F5) at most as long as pedicel and F1 to F3 combined (7.25:7.75; 8.5:9.5; 8:8).

Thorax as in Fig.119; mid lobe usually with 8 setae. Fore wings (Fig.120) 2.66 to nearly 3x as long as wide; basal cell with 1, rarely 2, setae; marginal vein with 5-7 setae; marginal fringe 0.33 to nearly 0.5 of wing width (5:11.5; 5:10). Hind wings 8.5-9.5x as long as wide; fringe longer than 1.5x of wing width (5-6:3). Middle tibial spur slightly shorter than basitarsus (Fig.117); hind tibia subequal in length to middle tibia.

Petiole plus gaster slightly longer than thorax (16-20: 11.5-15); third valvulae only a little longer than 0.33 of second valvifers (10:35, 11:31, 13:34). [Ovipositor not longer than middle tibia (Figs 117,118); 9.5-11:10.5-11.]

**Male:** Length, 0.45-0.54mm Darker than female; a cross-band on, or largely the, occiput; mid lobe anteriorly; axillae; sides of propodeum; petiole; pleura; and venter of thorax brown; pronotum and gaster except pallid last tergum, dark brown. Antennae about as in Fig.112; pedicel usually as long as F1, rarely slightly longer; F1 and F2 (in some F3 also) form a compact structure; F5 and F6 not clearly separated.

**Hosts:** *Bemisia tabaci*; indet. aleyrodids.

**Distribution:** India: Bihar, Uttar Pradesh. Pakistan. [Palaearctic.]

**Material examined:** (Material reported by Hayat, 1981a, is on slides 12E-16E,131E, and in alcohol.): INDIA: UTTAR PRADESH: Aligarh, 7F (106E,122E,141E, 146E,154E,285E), on different dates in 1981-1987. PAKISTAN: Dattar, 3F (228E), 17.vii.1976, ex *B. tabaci* on cotton, CIBC 4150, CIE 9067 (BMNH); Lahore, 3F (247E), 6.vi.1979, ex pupae of aleyrodids on *Dalbergia sissoo*, 4600 CIE 11348 (BMNH).

The following specimens, apparently conspecific with *lutea*, are rather badly mounted: INDIA: BIHAR: Pusa, 12F,9M (232E,233E), 20.ix.1928, ex *Bemisia* sp. on cotton, No.9(BMNH)

**Comments:** Two species (*dialeuroporae*, *asterobemisiae*) are here considered close to *lutea*. The specimens referred to this species by me (1981a) agree well with the redescription and figures given by Viggiani & Mazzone (1980b:Fig.I), except that in the Indian specimens F2 is usually a little

shorter than F3 and basal cell with one, rarely two, setae. As noted above, there is variation in the relative lengths of antennal segments and marginal fringe. Thus a specimen may appear close to *asterobemisiae* in antennal dimensions, but has longer fringe; and some appear close to *lutea*. The male antennae in *lutea* (also in *asterobemisiae*, *davidi*, *abatei*) have the F1-3 large and partly fused to form a compact elongate-oval structure, but F3 may be somewhat narrower than F2, and rather distinctly so in *dialeuroporae* and some males here referred to *lutea*.

It is thus apparent that if too much importance is given to the relative dimensions of flagellar segments, then some of the specimens listed above would appear conspecific with *dialeuroporae*, some with *lutea*, and would require the descriptions of at least two new species for material Nos. 247E and 285E. However, on a balance of characters, I regard all the above specimens as conspecific with *lutea*; but would suggest that a study of the *lutea*-group of species be made on a world basis to solve the problem of 'species' in this group.

#### 26. *Encarsia dialeuroporae* Viggiani

*Encarsia dialeuroporae* Viggiani, 1985a: 84. Female. Male. Pakistan, Peshawar (IEUN).

Host: *Dialeuropora decempunctata*.

Distribution: Pakistan.

Comments: The species was described in detail by Viggiani (1985a). It is said to differ from *lutea* by the absence of setae in basal cell of fore wing, and in the male by having the pedicel shorter than F1. Other differences pertaining to flagellar segments and length of marginal fringe appear to be too variable to form differentiating characters between these two species. (For further comments, see under *lutea* and *indica*.)

#### 27. *Encarsia udaipuriensis* (Shafee) (Figs 125-133)

*Prospaltella citri* Agarwal, 1964: 276. Female. India, Aligarh (Agarwal's coll., ZDAMU) [examined]. Preoccupied by *P. citri* Ishii, 1938. SYN. NOV.

*Prospaltella udaipuriensis* Shafee, 1973: 256. Female. India, Udaipur (Shafee's coll., ZDAMU) [parts examined]

*Prospaltella agarwali* Hayat, 1974: 181. Replacement name for *P. citri* Agarwal. SYN. NOV.

*Encarsia agarwali* (Hayat): Hayat, 1986: 160.

*Encarsia udaipuriensis* (Shafee): Hayat, 1986: 164.

Female: Length, 0.52-0.80mm Body pale yellow; mouth margin in middle reddish brown; pronotal collar, anterior margin of mid lobe narrowly, propodeum except pale middle, petiole, tergum I of gaster across base, terga V and VI or only VI, brown to dark brown; apex of VII white; third valvulae reddish to dark brown. Antennae yellow; scape basally white; F4-6 suffused with brown. Wings hyaline. Legs pale yellow, paler than thorax. One specimen has a triangular

brown patch on mid lobe, brown axillae, dark brown mesopleura, and brown on sides of terga III and IV of gaster. Setae transparent, but visible in balsam in cleared specimens.

Frontovertex two-fifth of head width or 3x of dorsal eye width; POL greater than OOL (20:16); postocellar bars distinct; head in front view wider than high (21:15); mouth fossa only slightly less than 0.5 of frontovertex width; mouth margin deeply concave in middle; eyes with fine, transparent setae. Antennae as in Figs 125 and 131; F1 from slightly longer than wide to 1.75x as long as wide, but shorter than F2 which is slightly less than 2x to 2.5x as long as wide; F3 usually a little shorter than F2; clava apparently 3-segmented, but F4 appears at least partly separated from F5.

Thorax as in Fig.130. Fore wing and venation as in Figs 126 and 129; basal cell with 2-4 setae; marginal vein with 7-9 setae; marginal fringe 0.20 to 0.25 of wing width. Hind wings about 7x as long as wide; fringe slightly longer than wing width. Hind tibia usually slightly shorter than middle tibia.

Petiole plus gaster a quarter longer than thorax; ovipositor not exserted (unless gaster distorted); third valvula longer than 0.5 of second valvifer. [Relative lengths of ovipositor and middle tibia, 53-64:59-75; Figs 127,128, 132 and 133.]

Male: Unknown.

Hosts: *Aleurolobus barodensis*; *Aleyrodes* sp.; [?] *Planococcus citri*; [?] *Kerria lacca*; [?] *Emmalocera depressella*, eggs.

Distribution: India: Bihar, Rajasthan, Uttar Pradesh.

Material examined: INDIA: BIHAR: Pusa, 1F (234E), ix.1935, ex eggs of *E. depressella*, (BMNH). UTTAR PRADESH: Aligarh, 16F (27E-31E, 113E, 157E), 4F on cards, xii.1965, ex *A. barodensis* on *Saccharum officinarum*; 1F (32E), xii.1965, [with] *K. lacca* on *Acacia arabica*; 1F (140E), iv-vii.1980.

Comments: *P. citri*: I have seen one female (holotype) dissected and mounted on three slides bearing Agarwal's collection number '5D'. There is also another female (in alcohol) that agrees with the slide mounted parts and with the data given in the original description. Since the original description was based on a single female and the figures given by Agarwal were drawn from the slide mounted parts, the second specimen though undoubtedly forming part of the original material, can not obviously be regarded as the type. The original description is erroneous in stating that the maxillary palps are 2-segmented, each axilla with 2 setae and submarginal vein with 4 long setae. These are normal as noted from the type.

*P. udaipuriensis*: I have seen parts (broken parts of thorax, legs, antennae, wings, ovipositor and outer plates) of the holotype mounted on a slide. The gaster and head are on a second slide (not available to me). The species is undoubtedly only a larger specimen of *citri*, and hence the

slight differences in dimensions of antennal segments and other parts. Though actually a junior synonym of *citri*, *udaipuriensis* is the available name for this species as the replacement name, *agarwali*, proposed by Hayat (1974) was published a few months later than the description of *udaipuriensis*.

The species belongs to *lutea*-group, and differs from all the other species of that group by the longer flagellar segments, shorter marginal fringe of fore wings, and body colour. However, smaller specimens may appear close to *abatei* Viggiani (1982b) except for proportions of the ovipositor and middle tibia.

The identity of the specimens referred to *citri* Agarwal by Shafee (1973) needs checking. Those specimens were not available to me, but the figures given by that author suggest that those specimens probably belong to *opulenta*-group.

#### 28. *Encarsia aurantii* (Howard) (Figs 134-139, 306)

*Coccophagus aurantii* Howard, 1894a: 231. Female. U.S.A., San Gabriel (USNM).

*Prospalta aurantii* (Howard): Howard, 1894b: 7.

*Prospaltella aurantii* (Howard): Howard, 1908:293. Compere, 1936 : 493. Peck, 1963: 275. De Santis, 1979a: 332. Gordh, 1979: 907.

*Encarsia aurantii* (Howard): Viggiani & Mazzone, 1979: 44, 47. Hayat, 1986: 160.

**Female:** Length, 0.40-0.58mm Body brown to dark brown with yellow (lemon or golden) to slightly orange on fronto-vertex; mid lobe mainly yellow, anterior margin or anterior half or so brown; scutellum pallid; tergum VII orange brown to brown; third valvulae pallid (Fig.306). Antennae pallid, very lightly infuscate on F6. Fore wings infuscate below marginal vein (not shown in Fig.139), otherwise hyaline. Legs pallid with hind coxae dark brown and hind femora sometimes light infuscate brown.

Antennae as in Fig.135; rarely (abnormally) F3 longer than wide; clava clearly 3-segmented.

Thorax as in Figs 138, 306. Fore wings (Fig.139) from 2.66x to nearly 3x as long as wide; basal cell with 4-5 setae; marginal vein with 7-8 setae; marginal fringe 0.33-0.40 of wing width. Hind wings about 8x as long as wide; fringe 1.5x of wing width. Hind tibia slightly shorter than middle tibia (45-49:48-53).

Petiole plus gaster at least as long as thorax; tergum VII with 6 setae; tergum VI with separated spiracular plates (Fig.136); ovipositor short, originates from tergum VI, and shortly exserted at apex. [Relative lengths (in microns): ovipositor, 100-110; third valvula, 40-47; middle tibia, 163-180; basitarsus, 40-44 (Figs 136,137); in the type specimen the corresponding measurements are, 107, 42, 169, 31, as provided by Dr M.E.Schauff (USNM).]

**Male:** Unknown.

**Hosts:** *Aonidiella orientalis*; *Hemiberlesia lataniae*; *Lindingaspis fusca*; *Pinnaspis strachani*.

**Distribution:** India: Andhra Pradesh, Karnataka, Sri Lanka.

**Material examined:** INDIA: KARNATAKA: Bangalore, CIBC, Lab. culture, 23F (219E-222E) plus numerous females in alcohol, ex *A. orientalis*. ANDHRA PRADESH: Chittoor, 2F (223E), 29.ii. 1983, ex [?] mango leaf gall midge, CIE No.15628, (BMNH). KARNATAKA: Bangalore, 8F (2F on slide 92E in Hayat coll.), iii.1983, ex *A. orientalis*, CIBC, Code A; 14F, same data except on *Agave americana*; Bangalore, Kodigeheelli, 10F, 22.ix.1982, ex *A. orientalis* on *Canthium parviflorum*; Vasan-thapura, 3F, 10.ix.1982, same host on *Polygonum glabrum*; 2F, on *Parthenium hysterophorus*; Mysore, 1F, 9.x.1982, ex *H. lataniae* on indet. plant; Mandya, 1F, 29.ix.1982, ex *L. fusca* on *Tamarindus indica*, (all det. M.Hayat) (CIBC, Bangalore).

**Comments:** The species is probably widely distributed and, therefore, the literature is rather extensive (see for instance, Peck, 1963). That the earlier records were based on even morphologically similar forms need to be checked by taking up studies on a world basis. It is very likely that extreme variants of *berlesei* and *perniciosi* may be mistaken for *aurantii*. In such cases, the reliable characters for recognition of *aurantii* are the short ovipositor that originates from about the distal third (from tergum VI or base of VII, as seen through the derm) of gaster, broader outer plates of ovipositor, and the clearly separated spiracular plates of tergum VI.

Viggiani & Mazzone (1979) proposed *aurantii*-group for this and some other species. It is, however, felt that further studies may lead to the transfer of other species (see synopsis on page 11) to other groups, leaving *aurantii* as a species sola of this group.

#### 29. *Encarsia perniciosi* (Tower) (Figs 1,140-148,305)

*Prospaltella perniciosi* Tower, 1913: 125. Female. Male. U.S.A., Amherst (Mass. State Coll. Amherst). Peck, 1963: 280-282, San Jose and Red Scale races. Ferriere, 1965:160. Nikol'skaya & Jasnoch, 1966: 281. De Santis, 1979a: 335. Gordh, 1979: 908.

*Encarsia perniciosi* (Tower): Hayat, 1981a: 466; 1986:163.

**Female:** Length, 0.47-0.80mm Body (Fig.305) dark brown to nearly black, brown in faded specimens; frontovertex and upper part of occiput lemon to pale orange yellow; post-ocellar bars dark; face dusky, usually with a brown cross-band above toruli (Fig.145); side lobes expanded parts, pale; anterior 0.25 to nearly 0.5 of mid lobe pale brown; scutellum yellow to white; tergum VII of gaster orange brown to brown with white apex; third valvulae dark brown; venter varying from pallid to dark brown. Antennae yellow brown; pedicel brown; radicle and scape in basal third or so pallid. Fore wings infuscated below marginal vein, otherwise hyaline. Legs pallid to white; base of fore coxa, base of fore femur, basal 0.66 of fore tibia, suffused with brown; middle coxa and basal 0.5 of femur pale brown; hind coxa and femur dark brown; hind tibia in about basal 0.5 brown.

Head dorsum as in Fig.1; eyes with pale setae; head in front view nearly one-third broader than high (9:7); mouth fossa nearly 0.5 of frontovertex width. Antennae as in Figs 140, 146; normal dimensions as in Fig.140a, but smaller specimens have F1 quadrate and F2 relatively shorter (Fig. 140b), otherwise F1 may vary from quadrate (Fig.146) to distinctly longer than wide (Fig.140c); F2 usually slightly longer than F3; clava apparently 3-segmented, but F4 may be partially separated from F5.

Thorax as in Figs 144, 305. Fore wings 2.5x to 2.66x as long as wide; basal cell with 2-4 setae; marginal vein with 6-9 setae; marginal fringe from slightly longer than one-sixth (Fig.148) to two-fifth of wing width, but normally 0.25-0.33 of wing width. Hind wings about 7x as long as wide; fringe a fifth longer than wing width. Hind tibia subequal in length to middle tibia (55:58).

Petiole plus gaster a little longer than thorax (15-22:12-18); third valvula less than 0.5 of second valvifer. [Relative lengths of ovipositor and middle tibia as in Figs 141 and 142.]

**Male:** Similar to female except generally smaller size, hyaline or indistinctly lightly infuscate fore wings, and different conformation of antennal segments (Fig.147). Pedicel shorter than F1 which is a little wider; distal two segments of flagellum partially separated.

**Hosts:** *Quadraspidiotus perniciosus*; indet. diaspids, probably the same species.

**Distribution:** India: Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh. [Widely distributed, nearly cosmopolitan.]

**Material examined:** (The material recorded by Hayat, 1981a, is on slides 10E, 11E, 124E and 161E): INDIA: JAMMU & KASHMIR: 2F, 2M (212E), A.124; Lalmandi-Srinagar, 3F (213E), CIE 15416; Srinagar, 7F (216E, 218E), A.123; Baba Raza, Sopore, 2F, 1M (217E), 3.iv.1984, on *Salix*; INDIA: CIE.12448, 7F, 4M (214E, 215E); all on San Jose scale (BMNH).

**Comments:** *E. perniciosi* is a widely distributed and well known species. Although consisting of host-determined races or strains (see Peck, 1963), there is apparently no morphological distinctions of specific value apart from the 'normal' variations expected in such a widely distributed species.

The species was introduced into India from California in 1958 and later also the Russian and Chinese strains (see Narayanan, et al, 1967:230-231) were released in the Kashmir valley, Himachal Pradesh, Punjab and the Kumaon region of Uttar Pradesh, for control of the San Jose scale.

The species is placed in aurantii-group.

### 30. *Encarsia pura*, sp. nov. (Figs 149-154)

**Female:** Length, approx. 0.70mm Body completely pale golden yellow, venter pale yellow to nearly white; anterior margin of mid lobe very narrowly brown. Scape paler than

pedicel and flagellum. Wings hyaline. Legs pallid.

Head nearly as wide as thorax; POL equal to OOL; mouth fossa less than 0.5 of frontovertex width (5:12.5); eyes with colourless setae, setae shorter than diameter of ommatidia; mandibles as in Fig.150. Antennae as in Fig.149; F1 quadrate to slightly longer than wide, from distinctly shorter to nearly as long as F2; F3 apparently somewhat longer than F2.

Thorax as in Fig.154; only two setae visible on each side lobe. Fore wings as in Fig.151; basal cell with 3-5 setae. Hind wings 7x as long as wide, fringe 0.2 longer than wing width. Hind tibia nearly as long as middle tibia.

Petiole plus gaster slightly longer than thorax(24:21); tergum VI with 6 setae. [Relative lengths of ovipositor and middle tibia as in Figs 152 and 153.]

**Male:** Unknown.

**Host:** [with] *Rastrococcus iceryoides*, but the actual host must be some diaspid which was overlooked.

**Distribution:** India: Maharashtra.

**Holotype:** Female (58E), 1 Female **Paratype** (59E): INDIA: MAHARASHTRA: Kolhapur, x.1967, with *R. iceryoides*.

**Comments:** The species appears close to *perniciosi* and related species inspite of the yellow colour of the body, relatively broader fore wings and shorter ovipositor. It differs from *perniciosi* in these characters and by the hyaline wings.

**Etymology:** Latin: *purus*=clear, unadorned; and refers to the uniformly (yellow) coloured body.

### 31. *Encarsia obtusiclava*, sp. nov. (Figs 13,165-170,184,304)

**Female:** Length, 0.60-0.87mm Frontovertex golden to orange yellow; occiput with a dark brown cross-band at level of foramen, yellow to pale yellow above this band and nearly white below this band; face, especially below toruli pallid to nearly white; thorax and gaster yellow, paler than fronto vertex, with pronotal collar on sides and in middle, anterior margin of mid lobe, propodeum proximad of spiracles, and petiole brown to dark brown; a cross-band on tergum V and most of tergum VII dark brown; ovipositor white. Antennal scape pallid to white; pedicel and flagellum yellow brown; F6 brown. Fore wings with a brownish spot on stigmal vein and with a faint infuscation below marginal vein. Legs pallid to white; hind knees pale brown.

Frontovertex width:head width, 8.5:15; POL:OOL, 11:7; head in front view broader than high (15:11); mouth fossa less than 0.5 of frontovertex width (16:37); eyes with pale, but distinct setae; mandibles with a distinct ventral tooth, a middle tooth and a dorsal truncation. Antennae as in Fig.166; F4 partially separated from F5; apex of clava obtuse, but not obliquely truncate.

Thorax as in Figs 169, 304; mid lobe with 10 setae, rarely 11 or 13 (6+5,5+6,6+7), setae pale. Fore wings as in Fig.170; marginal vein with 7-10 setae; disc sparsely

setose with a narrow bare strip along wing margin. Hind wing about 7x as long as wide; marginal fringe slightly longer than wing width. Hind tibia shorter than middle tibia (49: 54-56).

Petiole plus gaster (Fig.304) usually subequal in length to thorax; terga II-VII with the usual number of setae; setae on terga II-IV and VI pale in colour. [Ovipositor slightly shorter to as long as middle tibia and basitarsus combined (Figs 167,168); relative lengths: second valvifer, 47-48; third valvula, 17-19; middle tibia, 54-56; basitarsus, 15-16.]

**Male:** Length, approx. 0.63mm Darker in colour than female with orange yellow frontovertex; face very slightly shiny, pale brown, whitish below toruli; occiput largely dark brown; thorax and gaster dark brown; mid lobe on sides and narrowly along posterior margin, and scutellum infuscate brown; side lobes yellow brown; metanotum and apex of last tergum of gaster pale. Scape pallid to white; pedicel and flagellum yellow. Wings hyaline, the spot on stigmal vein paler than in female. Legs white; hind coxae in basal half or so dark brown. Antennae as in Fig.184.

**Hosts:** *Aulacaspis tubercularis*; indet. diaspids on mango, probably the same species.

**Distribution:** India: Karnataka, Uttar Pradesh.

**Holotype:** Female (26E), 5F, 6M (24E,25E,117E,118E,179E)  
**paratypes:** INDIA: UTTAR PRADESH: Sitapur, xi.1969, ex indet. diaspids on *Mangifera indica*.

Additional material studied, but not designated as types: INDIA: KARNATAKA: Hessaraghatta, CIBC Bangalore, CIE.16393, No.13; 3F (235E), 12.ix.1984, ex *A. tubercularis* on *M. indica*, (BMNH).

**Comments:** The species is quite distinct by the body colour, the shape of the antennal clava, sparsely setose disc and infuscation of the fore wings. It is placed here in *aurantii*-group.

**Etymology:** The specific name refers to the 'obtuse' apex of the antennal clava.

### 32. *Encarsia divergens* (Silvestri)

*Prospaltella divergens* Silvestri, 1926: 182. Female. Singapore (IEUN). Silvestri, 1928: 24. Flanders, 1969: 467-480. De Santis, 1979a: 334.

*Encarsia divergens* (Silvestri): Viggiani & Mazzone, 1979: 45. Hayat, 1986: 161.

**Hosts:** *Aleurocanthus* species including *A. woglumi*.

**Distribution:** India: 'vicinity of Assam'. [Singapore. Malaysia. Indonesia. Mexico.]

**Comments:** I have not seen any specimens of this species. It was reported (Flanders, 1969) that specimens were collected by Smith from Assam. The species, however, can be recognized through the illustrated description given by Silvestri (1926, repeated in 1928), and is placed in the key

on the basis of that description.

Viggiani & Mazzone (1979) place *divergens*, *merceti*, *ishii*, *clypealis* and *smithi* in *smithi*-group. In the present work *divergens* is placed in *aurantii*-group. (See also notes given under *smithi*.)

### 33. *Encarsia narayananani* Agarwal (Figs 171-175)

*Encarsia narayananani* Agarwal, 1964: 283. Female. India, Aligarh (Agarwal's coll., ZDAMU) [examined]. Hayat, 1986: 162.

The species can be recognized from the following brief redescription and the illustrations.

**Female:** Frontovertex lemon yellow; mouth margin brownish; face with a brownish band above toruli (Fig.171); pronotum, anterior margin of mid lobe, sutures, pale brown; axillae especially on sides, and sides of propodeum brown; rest of thoracic dorsum lemon yellow; gaster except pale apex of tergum VII, dark brown; third valvulae mostly brownish. Antennal radicle and scape in basal third white; rest of scape, pedicel and flagellum yellow with F6 brownish yellow. Fore wing with a distinct infuscation below marginal vein (Fig.173). Legs pallid.

Head and antennae as in Figs 171 and 172; maxillary palp unsegmented (not 2-segmented as described by Agarwal). Mid lobe with 10 setae; each side lobe with not more than 3 setae; the seta on each axilla originates in anterior third of the axilla. Fore wings as in Fig.173; submarginal vein with 2 setae (not 3 setae). Hind wings 8x as long as wide; marginal fringe about 0.33x longer than wing width. Middle tibia as in Fig.174. Ovipositor as in Fig.175.

**Male:** Unknown.

**Hosts:** A. [Aleyrodes!] *hussini*; [?] *Rastrococcus iceryoides*.

**Distribution:** India: Maharashtra, Uttar Pradesh.

**Material examined:** INDIA: MAHARASHTRA: Poona, 1F (195E), 15.i.1950, ex A. *hussini*, (H.D.Smith) Id. Lot 50-1191 (USNM)

**Comments:** The original description was based on a single female. It was dissected and mounted on 3 slides (unlabelled). I have no doubt that these slide mounted parts are of the holotype since Agarwal drew all the figures from these parts. I have now labelled the slides.

I have also seen only a single female specimen that agrees fairly well with the holotype of *narayananani*. This specimen is on a slide along with 3 females of *smithi*. Gahan correctly noted on the slide that there are two species there, but did not indicate which one is *smithi*. However, on the basis of other evidences, one female is determined as *narayananani*.

E. *narayananani* is extremely close to *bifasciafacies*, sp. nov. and a superficial examination may not reveal the differences. E. *narayananani* differs from the latter species by the characters given in the key. The species is placed here in *elegans*-group.

**34. Encarsia bifasciafacies, sp. nov. (Figs 8, 176-183)**

**Female:** Length, 0.50-0.75mm Head white to pale yellow especially on face below toruli; face with two dark brown cross-bands above toruli; postocellar bars dark; occiput with a dark brown to black band at level of foramen; pronotum, axillae, propodeum except in middle and mesopleura above, dark brown to nearly black; anterior margin to nearly anterior half of mid lobe, brown to dark brown; side lobes pale orange yellow; rest of mid lobe and scutellum white; venter of thorax yellow; petiole and gaster except apex of tergum VII, dark brown to black and a little shiny; third valvulae white to a little infuscate brown on outer margins. Antennae yellow; scape white with brown dorsal surface; F5 yellow to pale brown; F6 dark infuscate brown. Fore wings with a distinct infuscation below marginal vein, otherwise wings hyaline. Legs pale yellow to white with at most pale brown suffusions on femora.

Head dimensions as in Fig. 176. Antennae as in Fig. 178; relative lengths of pedicel, F1 and F2: 10-11, 7-7.5 and 15-17; F2 usually longer than F3 and more than 2x as long as wide; rarely F2 about 2x as long as wide, and exceptionally (183E) a little shorter than F3 (13.5:14.5).

Thorax as in Figs 8 and 181; mid lobe with 10-12 setae. Fore wings (Fig. 182) as in *narayananii* (Fig. 173); basal cell with 5-7 setae; marginal vein with 7-9 setae; marginal fringe about 0.25 of wing width or slightly longer. Hind tibia usually a little shorter than middle tibia (11-13: 11.5-14).

Petiole plus gaster as in Fig. 8, usually about 1.5x as long as thorax; terga II-VII with usual number of setae; the distance between the middle pair of setae on tergum V less than that between the middle pair of setae on VI; third valvula less than 0.5 of second valvifer. [Relative lengths of ovipositor and middle tibia (Figs 179, 180) 13.5-17:11.5-14.5]

**Male:** Similar to female except for smaller size (about 0.5mm); yellow head without the two cross-bands on face; antennae (Fig. 183) with F1 always longer than pedicel, but usually shorter or at most as long as (but always wider than), F2.

**Hosts:** *Aleurolobus* sp. near *niloticus*; *A. niloticus*; *Siphoninus* sp.; indet. aleyrodids; [with *Aonidiella orientalis* and *Chloropulvinaria* sp.]

**Distribution:** India: Bihar, Delhi, Uttar Pradesh. Pakistan.

**Holotype:** Female (284E): INDIA: UTTAR PRADESH: Aligarh, 23.vi.1984 (M.Hayat & S.S.Islam). **Paratypes:** 2F, with the same data as holotype and on the same slide, but under a separate coverslip. Aligarh, Sasni, 32F, 8M (1E, 2E, 4E, 5E, 114E, 163E, 181E), vii.1968, ex *Aleurolobus* sp. near *niloticus* on *Dalbergia sissoo*; 1F, 5M (3E), vii.1968, with *A. orientalis* on *Ficus glomerata*; 15F (160E, 181E), vii.1968, with *Chloropulvinaria* sp. Aligarh, 5F, 1M (180E), 24.vi.1984; 1F (138E), iv.1985.

The following material from the BMNH was studied, but not designated as types: INDIA: BIHAR: Pusa, 1F (231E), 5.v.1928, ex *Siphoninus* sp. on pomegranate, No.6 (K.S.Lamba). DELHI: IARI area, 3F (on cards, 259E), 5.x.1979, (Z.Boucek); 1F (on card, 260E), 15.x.1979 (Z.Boucek). PAKISTAN: Charsadda, 3F (244E), ex *A. niloticus* on *D. sissoo*, CIBC 4798; CIBC Islamabad [loc. probably Charsadda], 6F (242E, 243E), v.1979, ex pupae of aleurodids on *D. sissoo*, No.4585.

**Comments:** This species was initially confused with *narayanani* with which it agrees in several characters including a similar habitus. However, it differs from Agarwal's species (as well as *divergens* and *affectata*) by the characters given in the key. The species is placed in *elegans*-group.

**Etymology:** Latin: *bis*=two; *fascia*=band, streak of cloud; *facies*=face, looks; and refers to the two bands on face.

### 35. *Encarsia trivittata*, sp. nov. (Figs 287-293, 295)

**Female:** Length, 0.66-0.90mm Body lemon to golden yellow (whitish after clearing and mounting on slide) except as follows: mouth margin pale brown; a cross-band on occiput at level of foramen, pronotal collar, anterior margin of mid lobe, axillae anteriorly, propodeum except sides, mesopleura above, petiole, a narrow band across base of tergum I, and cross-bands on terga IV-VI (or IV and V, or V and VI) brown to dark brown (Fig. 295); ovipositor pallid. Antennal scape white; pedicel yellow brown; flagellum yellow with F6 brown. Fore wings faintly infuscate below marginal vein (not shown in the figure). Legs pallid.

Head in front view as in Fig. 288; eyes with pale setae. Antennae as in Fig. 287; F1 usually a little longer than pedicel and at least 2x as long as wide, and distinctly shorter than F2; clava 2-segmented.

Thorax as in Figs 293 and 295; mid lobe usually with 4 setae. Fore wings (Fig. 291) about 2.5x as long as wide; basal cell with 2-4 setae; marginal vein with 6-9 setae, these from only slightly to distinctly longer than width of the vein; marginal fringe short, slightly longer than one-sixth to slightly shorter than one-fifth of wing width. Hind wings about 6x as long as wide; disc with three irregular rows of setae; marginal fringe slightly shorter to about as long as wing width. Hind tibia shorter than middle tibia (61-65:71-74).

Petiole plus gaster (in the available specimens, either shrunken or distended) about a quarter longer than thorax; tergum VII in holotype has 5 setae, otherwise number of setae normal. [Relative lengths of second valvifer, third valvula, middle tibia, basitarsus, and spur (Figs 289, 290): 66-68:25-27:71-74:18-20:15-16.]

**Male:** Unknown.

**Host:** *Aleurolobus* sp.

**Distribution:** India: Uttar Pradesh.

**Holotype:** Female (148E): INDIA: UTTAR PRADESH: Aligarh,

18.x.1985. Paratypes: 1F (149E) with the same data as holotype. Aligarh, 5F (66E, 68E-70E), x.1965; 3F (67E, one with head missing), iii.1966, ex *Aleurolobus* sp. on *Eugenia jambolana*.

**Comments:** The species is quite distinct from all the known species of the genus (see key to species). It is tentatively placed in *elegans*-group.

**Etymology:** Latin: tres=three; vittatus=wearing a narrow band; and refers to the three cross-bands on gaster.

### 36. *Encarsia isaaci* Mani (Figs 225-230)

*Encarsia isaaci* Mani, 1941: 34. Female. India, Cuttack (IARI) [examined]. Mahmood, 1955: 32-33. Hayat, 1986: 161.

**Female:** Frontovertex orange yellow with some brown in ocellar triangle; face below frons with a dark brown to black cross-band; mouth margin and malar space dark brown; occiput pale yellow in upper third, dark brown in lower two-thirds; apical half of mandible reddish brown; mid lobe except dark brown anterior 0.25-0.33 or a wedge-shaped mark (Fig.229), side lobes, scutellum and metanotum pale yellow to nearly white; propodeum pale in middle; pronotum, rest of thorax, petiole and gaster dark brown; prepectus brown; tergum VII brown with hyaline apex; at least distal half of second valvifer dark brown; third valvula brown with apical fourth white. Antennal scape in distal 0.75-0.66 and pedicel brown; rest of scape white; F1-5 yellow brown and F6 dark brown. Fore wings lightly infuscate below marginal vein (not shown in figure): parastigma and stigmal vein hyaline, other veins brown. Legs pale yellow to white, with pale brown suffusions on fore femora and tibiae; middle coxae pale brown; hind coxae pallid to dark brown with pallid apices.

Head in front view only slightly wider than high (21:18); frontovertex about half of head width; mouth fossa slightly more than 0.5 of frontovertex (6:10.5); mandibles as in Fig. 225; setae on frontovertex dark brown; eyes densely setose, each seta at least as long as diameter of an ommatidium. Antennae as in Fig.226; relative lengths of pedicel and funicle segments: pedicel, 11-12.5; F1, 16-17; F2, 15-19; F3, 15-17.5; F4, 14-15.5.

Thorax as in Fig.229. Fore wings (Fig.230) about 2.66x as long as wide; basal cell with 5-6 setae; marginal vein with 10-12 setae; marginal fringe 0.20-0.25 of wing width; in one specimen the right fore wing has a well-developed, spur-like postmarginal vein which is about 0.5 of stigmal vein. Hind wings about 8x as long as wide; fringe slightly longer than wing width. Lengths of middle tibia, basitarsus and spur: 79-82, 29-30, 17-18; in one specimen, 89:31:19; length of hind tibia, 75-83.

Gaster with the usual number of setae; tergum VII in holotype slightly more than 1.5x as wide as long; third valvulae less than 0.5 of second valvifers (23-24:61-66). [Relative lengths of ovipositor and middle tibia as in Figs

227 and 228; the ovipositor at least slightly longer than middle tibia, and middle basitarsus longer than third valvula (29-30:23-24).]

**Male:** Unknown.

**Hosts:** *Aleurolobus barodensis*; *Neomaskellia bergii*; indet aleyrodids.

**Distribution:** India: Andhra Pradesh, Orissa, Tamil Nadu, Uttar Pradesh.

**Material examined:** INDIA: ANDHRA PRADESH: Ponnur, 4F (50E, 174E), i.1967, ex aleyrodids on *Saccharum officinarum*. TAMIL NADU: Villupuram, 3F (51E, 175E), ii.1967, ex aleyrodid on *S. officinarum*.

**Comments:** The holotype female is on a slide. The head is detached from body, otherwise it is a fairly well preserved specimen. The species has been reported from Uttar Pradesh (Mahmood, 1955), and also once (Pruthi, 1941, Sci. Rept Agric. Res. Inst. New Delhi, 1939-40: 102-114) as a parasite of *N. bergii*.

The species is placed tentatively in *elegans*-group, as it appears most close to species of that group. It differs from species of that group by having F1 longer than Pedicel, longer middle basitarsus, and relatively larger size.

### 37. *Encarsia gunturensis* (Azim & Shafee) (Figs 185-192, 299)

*Trichaporus gunturensis* Azim & Shafee, 1980: 337. Female.

Male. India, Guntur, Budampadu (Shafee's coll., ZDAMU). [paratype examined]

**Encarsia gunturensis** (Azim & Shafee): Hayat, 1986: 161.

**Female:** Length, 0.45-0.62mm Head pale yellow with pale brown suffusions; postocellar bars dark brown; mouth margin, malar space and occiput below, dark brown or reddish brown; thorax dark to reddish brown, with side lobes, metanotum, and sometimes narrow lines on mid lobe and scutellum (lightly stippled areas in Fig.299) pale to yellow brown; propodeum, petiole, tergum I narrowly across base, and sides of terga I-VI, brown to dark brown; and terga V and VI partly or completely pale brown to brown; rest of gaster pallid to nearly white. Antennae pallid with distal half or so of scape on dorsal surface, pedicel, F5 and F6 pale brown. Wings hyaline or subhyaline, with a light infuscation below submarginal vein. Legs pallid; hind coxae dark brown; fore and middle coxae brown; hind femora may be lightly infuscate brown. Setae on head and thorax brown to dark brown, clearly visible in balsam.

Frontovertex about 1.5x as wide as long (not twice as long as wide as given in the original description), and broader than 0.5 of head width; mouth fossa less than one-third of frontovertex width (Fig.190); eyes with fine, pale setae; maxillary palp unsegmented (not 2-segmented). Antenna as in Fig.185; F1 shorter than both pedicel and F2 and less than 2x as long as wide; F2 from nearly 2x to 2.5x as long as wide, generally a little longer than F3; F2-4 may be subequal in length.

Thorax as in Figs 191 and 299; mid lobe with 8-10 setae;

setae on dorsum longer including the pair on each side of propodeal spiracle. Fore wings (Fig.188, also in paratype) about 2.5x as long as wide; basal cell with 4-6 setae; marginal vein with 6-7 setae; marginal fringe slightly more than 0.25 to about 0.33 of wing width. Hind wings about 7x as long as wide; marginal fringe 1.5x of wing width. Middle and hind legs with the basitarsi longer (Fig.187); middle tibial spur less than 0.5 of basitarsus; hind tibia subequal in length to middle tibia.

Petiole plus gaster (if not shrunken or distended) about as long as head plus thorax; setae on terga I-VII appear variable, but at least 2 on each side of terga I-V; tergum V with a pair in the middle; tergum VI with 6 (1+2+2+1) and VII with 4-6 setae; sometimes there are 3 relatively smaller setae on each side of terga I-V and also additional setae on each side; ovipositor not exserted; third valvula always less than 0.5 of second valvifer. [Ovipositor normally a little shorter than middle tibia, and third valvulae shorter than middle basitarsus; Figs 186 and 187.]

**Male:** Length, 0.45-0.50mm Similar to female in colour and other details except gaster completely dark brown. Antennae as in Fig.192; pedicel shorter than F1 which is subequal to or rarely distinctly shorter than F2.

**Host:** Indet. aleyrodids.

**Distribution:** India: Andhra Pradesh, Uttar Pradesh.

**Material examined:** INDIA: UTTAR PRADESH: Hardoi, 54F, 11M (132E, 133E, 165E, 178E, 278E), x-xi.1969, ex aleyrodids; Aligarh, 1F (82E), 15.vi.1977; 1F, 1M (127E, 129E), 9.xii.1980.

**Comments:** I have examined a paratype female (length about 0.6mm). It is on a slide with the left fore wing detached. The original description is apparently erroneous in several respects, and these are corrected in the above redescription.

The species is very close to *E. azimi*, and differs in characters which may be confusing if specimens preserved in alcohol for long periods are to be identified. However, *gunturensis* differs from *azimi* mainly by having a relatively darker thorax; F1 at most 1.5x as long as wide; relatively broader fore wings; more or less dark brown coxae; and hind femora suffused with brown. [In *azimi*, body lighter in colour; F1 longer, 2x as long as wide in paratype and a few larger specimens; relatively narrower fore wings; and nearly pallid legs with at most hind coxae in about basal thirds and all femora and tibiae suffused with pale brown.] The species also appears close to *partenopea* as redescribed by Ferriere (1965), but that redescription differs from that given by Nikol'skaya & Jasnoch (1966). [See under *inaron* for further comments on these species.]

### 38. *Encarsia azimi* Hayat (Figs 193-198)

*Trichaporus indicus* Azim & Shafee, 1980: 335. Female. India, Ootacamund (Shafee's coll., ZDAMU) [paratype examined] Preoccupied by *P. indica* Shafee, 1973.

*Encarsia azimi* Hayat, 1986: 160. Replacement name for  
*T. indicus* Azim & Shafee.

Female: Length, 0.42-0.67mm Paler in colour compared to *gunturensis*; frontovertex and occiput above foramen pale yellow; occiput below and thorax largely yellow brown; pronotum and axillae a little dark in some specimens; gaster and ovipositor white except tergum I narrowly across base, and petiole dark brown. Antennae pallid with pedicel and clava pale brown. Wings hyaline or subhyaline with infuscation below submarginal vein. Legs pallid to white; hind coxae rarely brown at base. Some specimens, especially fresh material, have frontovertex, occiput above, face and mesothorax largely orange or reddish brown; rarely the thorax as dark as in *gunturensis*. Setae on head and thorax pale, not clearly visible in balsam.

Antennae (Fig.193) with the flagellar segments longer; F1 usually at least 1.5x as long as wide and usually distinctly shorter than pedicel (7-9:10-12; 11:14), rarely only slightly shorter than pedicel (10-11:12); F2 subequal in length to or slightly shorter than F3 (Fig.198a,b).

Thorax with the arrangement of setae as in *gunturensis*, but mid lobe usually with 8 setae. Fore wings as in Fig.196; basal cell with 3-6 setae; marginal vein with 5-7 setae; marginal fringe 0.33 to slightly less than 0.5 (4:9) of wing width.

Gaster with terga I-VII usually with 2+2, 2+2, 2+2, 2+2, 1+2+1, 2+2, and 6 setae; ovipositor not exserted; third valvulae less than 0.5 of second valvifers (12-17:27-41). [Ovipositor at least as long as middle tibia (9-13.75:8-12.25); Figs 194 and 195.]

Male: Unknown.

Host: Indet. aleyrodids.

Distribution: India: Tamil Nadu, Uttar Pradesh.

Material examined: INDIA: UTTAR PRADESH: Aligarh, 30F (75E, 134E, 162E, 279E), vii.1967, ex aleyrodids; 1F (83E), 15.vi.1977; 2F (80E), 13.xii.1979; 1F (170E), xii.1979; 1F (79E), 15.i.1980; 1F (78E), 17.i.1980; 1F (172E), iv-v.1980; 1F (139E), iv-vii.1980; 1F (109E), i-iv.1981; 1F (286E), 17.x.1987.

Comments: I have examined a paratype (dissected and mounted on two slides). The holotype was not available to me. The original description is erroneous in stating that the maxillary palps are 2-segmented, axillae bare, and the dimensions of the fore wing.

Among the specimens referred to this species here, two specimens (slides, 109E and 80E) agree with the paratype in having longer antennae (pedicel plus flagellum length, 0.37mm) and four specimens (78E, 79E, 80E, 286E) have F1 only slightly shorter than pedicel (10-11:12). But the specimens bred from aleyrodids (75E, etc.) have the antennae shorter (pedicel plus flagellum length, 0.23-0.30mm); otherwise, these are indistinguishable from the paratype of *azimi*.

*E. azimi* is very close to *gunturensis*, but as noted under

comments given for that species, there are some differences which refrain me from synonymizing the two. This species also appears close to *margaritiventris* (Mercet), but that species has a pale brown band on face, gaster whitish yellow and fore wings broader with very short marginal fringe.

*E. azimi* is placed in inaron-group.

### 39. *Encarsia inaron* (Walker) (Figs 5,231-237)

*Aphelinus Inaron* Walker, 1839: 10. Female. England (Haliday coll., Dublin). Lectotype selected and designated by Graham, 1976: 142.

*Encarsia inaron* (Walker): Graham, 1976: 142. Hayat, 1981a: 465; 1986: 161.

[*Trichaporus partenopeus* (Masi): Azim & Shafee, 1980: 337, misidentification!]

**Female:** Length, 0.61 to over 0.67mm (Thorax plus gaster measure 0.52-0.67mm in seven specimens). Head and thorax dark brown to black; head with the usual pale lines; mid lobe and scutellum with pale lines as in *gunturensis*, seen clearly in two specimens (17E,173E); mouth margin and malar space darker than face; side lobes brown; petiole, and tergum I of gaster narrowly across base, dark brown; sides of gaster up to cercal plates with varying amounts of brown to dark brown, and terga V and VI and sometimes also IV, except in middle third, brown to dark brown; ovipositor pallid. Antennae pale yellow brown; scape largely, pedicel and clava infuscate brown. Wings hyaline; fore wing infuscate below submarginal vein, the infuscation getting pale below marginal vein, or most of the disc except basal cell, hyaline. Legs yellow with femora and tibiae lightly suffused with brown; base of hind coxae brown. Setae on head and thorax dark brown, those on eyes brown.

Head dimensions as in Fig.232. Antennal segments (Figs 5,231a-d) with dimensions variable; segments relatively longer compared to those of *azimi* (pedicel plus flagellum 0.37-0.48mm, against a maximum of 0.37mm, but usually less, of the latter species); pedicel at least a little shorter than F1 (13-15:15-17), in one specimen (Fig.231d) the ratio is 15:21; F1 slightly more than 2x to 3x as long as wide, subequal in length to or slightly shorter than F2; F2 may be a little shorter or longer than F3.

Thorax as in Fig.235; mid lobe with 8-10 setae. Fore wings (Fig.236) 2.33-2.5x as long as wide; basal cell with 5-8 setae; marginal vein with 7-9 setae; marginal fringe not more than 0.20 of wing width. Hind wings 7-8x as long as wide; marginal fringe as long as to a little longer than (one-sixth to one-fifth) wing width. Middle tibial spur at most 0.5 of basitarsus; hind tibia subequal in length to middle tibia.

Petiole plus gaster slightly longer than thorax (18-20:17-19); terga I-IV with 2-3 setae on each side; terga V-VII with 3+2+3,2+2+2, and 4 setae; ovipositor shorter, third valvula usually less than 0.5 of second valvifer. [Relative lengths of ovipositor and middle tibia as in

Figs 233, 234 and 237.]

Male: Unknown from India.

Host: Unknown for the Indian specimens.

Distribution: India: Maharashtra, Uttar Pradesh.  
[Palaearctic.]

Material examined: (Material recorded by Hayat, 1981a, is on slides 17E-21E). INDIA: UTTAR PRADESH: Aligarh, 2F (22E, 23E), 5.iv.1980; 1F (144E), 5.x.1984; 1F (173E), xi. 1979. Dehra Dun, 1F (184E), 18.iv.1978 (M.Verma).

Comments: The identity, and hence the validity, of the species considered here as related to *inaron* is a difficult problem to solve without study of relevant types and larger series of authentically determined specimens. These species are: *lopezi*, *aleyrodis*, *longicornis*, *partenopea*, *siphonini*, *persequens*, *margaritiventris*, *azimi* and *gunturensis*. All these species appear to be similar morphologically and, where hosts are known, are aleyrodid parasites. But differences are noticed in the relative lengths of antennal segments, dimensions of fore wings, lengths of marginal fringe, and slight differences in the colour of the gaster and of legs.

The Indian specimens largely agree with the brief redescription of the British specimens (including types) given by Graham (1976) except for longer flagellar segments (2x to 3x as long as wide and F1 from about as long as to 1.6x as long as pedicel). The specimens with the extreme measurements of antennal segments have also the basitarsi of middle legs robust and longer (0.4 of middle tibia). Such variations noticed in just a few Indian specimens indicate the possibility of *partenopea*, *longicornis*, *siphonini* and *aleyrodis* being synonyms of *inaron*; or that these specimens may actually represent more than one species (!), but this is unlikely.

The specimens determined as *partenopea* by Nikol'skaya and Jasnoch (1966) (I have 2F, 2M, sent by Dr Jasnoch) undoubtedly belong to *inaron*. Their treatment of *aleyrodis* as a synonym of *partenopea* further supports Graham's suspicion of *aleyrodis* being the same as *inaron*. It is, therefore very likely that the Indian specimens identified by Azim & Shafee (1980) as *partenopea* are misidentification for *inaron*. These specimens are not available to me and it is not possible to further comment on that material.

I have renamed *partenopea*-group (Viggiani & Mazzone, 1979) as *inaron*-group, and included two other species (see above) from India in this group.

#### 40. *Encarsia brevivena*, sp. nov. (Figs 199-203)

Female: Length, 0.67mm Head and thorax reddish brown to dark brown; head with the usual pale lines and distinct postocellar bars; side lobes and mid lobe posteriorly yellow brown; petiole, tergum I of gaster narrowly across base and sides of gaster narrowly from base to cercal plates, dark brown; terga V and VI pale brown, otherwise gaster white.

Antennae pallid with clava infuscate brown. Wings hyaline. Legs pallid; hind coxae except apices, dark brown.

Frontovertex wider than half of head width (11:17.75); POL nearly equal to OOL; eyes with fine, pale setae, each seta about as long as diameter of an ommatidium. Antennae as in Fig. 199.

Thoracic dorsum as in Fig. 202. Fore wings as in Fig. 203; venation about half the length of wing; setae of marginal fringe distad of venation only slightly shorter than those on (outer margin of) marginal vein; marginal fringe about half of wing width.

Petiole plus gaster 1.5x as long as thorax (22:15); terga with normal number of setae except VI with 1+2+2+1 setae; ovipositor (somewhat tilted upwards) not exserted; third valvula about 0.33 of second valvifer. [Ovipositor slightly longer than middle tibia, Figs 200 and 201.]

Male: Unknown.

Host: *Bemisia tabaci*.

Distribution: India: Maharashtra.

Holotype: Female (84E, clava of left antenna missing): INDIA: MAHARASHTRA: Elephanta (caves off Bombay), x.1967, ex *Bemisia tabaci*.

Comments: The new species is very close to *japonica* Viggiani, 1981a [I have in my collection Japanese specimens of this species sent by Dr Kajita] and might be mistaken for that species. It, however, differs from the Japanese species in having 10 setae on mid lobe, less elongate flagellar segments, and F1 shorter than pedicel. In *japonica*, mid lobe with 4 (rarely 6) setae, flagellar segments very long (F2-6 each at least 3x as long as wide), and F1 at least as long as pedicel, usually longer. The body colour is dark brown to black and terga V-VII or V and VI black.

These two species are here placed in a separate group, *japonica-group*. This group is related to *inaron-group*, but is distinguished by the longer wings, relatively shorter venation, longer marginal fringe, and the arrangement of placoid sensilla and setae on the scutellum; the two placoid sensilla close to each other, and the distance between the anterior pair of setae less than or at most equal to that between the posterior pair; it is the other way in most species of *inaron-group*.

Etymology: Latin: brevis=short; vena=vein; and refers to the relatively short venation of the fore wing.

#### 41. *Encarsia tristis* (Zehntner) (Figs 14, 204-211)

*Prospalta tristis* Zehntner, 1896: 11. Female. Indonesia, Java (?).

*Aspidiotiphagus aleyrodis* Ashmead, 1904b: 139. Female. Male. Philippines, Manila (USNM) [examined]. Synonymy by Gahan, 1932: 742.

*Encarsia neomaskelliae* Prasad, 1955: 49. Female. Male. India, Pusa (?IARI). Synonymy by Hayat, 1981a: 468.

*Prospaltella breviclavata* Shafee, 1973: 252. Female.

**Male.** India, Aligarh (Shafee's coll., ZDAMU) [paratype examined]. Synonymy by Hayat, 1981a: 468.

**Encarsia tristis** (Zehntner): Hayat, 1981a: 468; 1986:164.

**Female:** Length, 0.50-0.80mm Frontovertex and face yellow with orange tinge; ocellar area yellow brown; malar space washed with brown; occiput yellow above, brown to yellow below, with a dark cross-band at level of foramen; thorax brown to dark brown with distal two-third or so of mid lobe, side lobes and scutellum white to pale yellow with some indistinct pale brown; petiole and gaster dark brown, slightly shiny. Antennal scape yellow in about basal half or so, yellow brown distally; pedicel and flagellum yellow to orange brown. Wings uniformly pale infuscate throughout, with a darker infuscated band from junction of submarginal vein and parastigma, running obliquely inwards to posterior margin. Legs white to pale yellow; fore femora and tibiae and hind femora basally very lightly infuscate; fore coxae basally brown; hind coxae largely brown to dark brown except pale apex.

Head in front view as in Fig.208; POL greater than OOL (14-18:12-16); eyes appear bare; mouth fossa less than half of frontovertex width (18-20:53-62). Antennae as in Fig.204; F2 usually longer than F3, but in some specimens these may be subequal in length; F4 at least partially separated from F5 so that the clava may appear 2-segmented.

Thorax as in Fig.210; setae hyaline, not clearly visible in balsam especially in uncleared specimens; mid lobe with usually 10 (rarely 9) setae; compared to other species, the dorsum somewhat more convex and the scutellum larger with a strongly rounded posterior margin. Fore wings as in Fig.209; basal cell with 3-5 setae; marginal fringe usually about 0.33 of wing width, but may be longer, nearly 0.4. Hind wings about 8x as long as wide; marginal fringe 1.5x (or slightly longer) as long as wing width. Hind tibia appears a little longer than middle tibia (55:51).

Petiole plus gaster about a third longer than thorax; terga II-VII usually with 2+2, 2+2, 2+2, 3+2+2+3, 2+2, and 5 or 6 setae; sometimes terga II, IV and VI each with 3+3 setae; ovipositor short with broader outer plates (Figs.205, 206), and originating in distal third of gaster, and not exserted at apex; third valvula at most about 0.5 of second valvifer. [Ovipositor distinctly shorter than middle tibia, Figs 206 and 207.]

**Male:** Similar to female in colour and dimensions of body parts except mid lobe and scutellum more yellow brown. Antennae as in Fig.211. Genitalia (Fig.14), compared to those in a majority of the species, with a shorter and broader phallobase.

**Hosts:** *Aleyrodes* sp.; *Neomaskellia bergii*; *N. andropogonis*; indet. aleyrodids; [?] scales.

**Distribution:** India: Bihar, Karnataka, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh. Bangladesh. [Indonesia. Philippines. Australia.]

**Material examined:** (Material reported up on by Hayat, 1981a, is on slides 6E-9E, 135E, 136E, 164E, and in alcohol): INDIA: MAHARASHTRA: Chadogaon, 3F, 1M (201E), 26.x.1983, ex whitefly, No. 6, CIE.15767. BIHAR: Pusa, 23F, 12M (202E, 203E), 15.vi.1928, ex *N. bergii* on sugarcane, No. 4 (K.S. Lamba). INDIA: CIBC, A.6901, 1F, 1M (204E). KARNATAKA: Bangalore, 9F (205E), v.1936, ex *N. bergii* on sugarcane, (T.V.Subramaniam); 5F, 2M (207E), CIBC.8010. TAMIL NADU: Coimbatore, 7F, 9M (206E), 20.ii.1967, ex *N. bergii*, CIE. A.1457, No.16 (D.S.Hill). UTTAR PRADESH: Lucknow, 1F, (208E) LW 385, (all BMNH). Aligarh, 1F (182E), 6.x.1984; 2F on cards, 9.xii.1980. BANGLADESH: 3F, 1M (239E), 10.xii.1974, CIE.9374, ex scales (BMNH).

**Comments:** I have not seen the types of *tristis*, and their location is unknown. As noted earlier by me (1981a), the identification of this species was based on 15F and 5M specimens determined as *tristis* by Gahan, and my study of the types of *Asp. aleyrodis* Ashmead (re-examined in 1987), which Gahan (1932) synonymized with *tristis*. Types of *neomaskelliae* (see Hayat, 1981a) are not located in IARI, New Delhi, but the host record and figures leave no doubt that it is identical with *tristis*. I have examined a paratype female of *P. brevoclavata* and confirm the synonymy proposed earlier by me.

E. *tristis* is a very distinctive species, all the characters indicate that it represents a group of its own-*tristis*-group (see figures and the key).

#### 42. *Encarsia septentrionalis*, sp. nov. (Figs 212-219, 297)

**Female:** Length, 0.70-1.00mm Head dark brown to black, with the usual pale lines; malar space along suture and face around toruli yellow brown; prothorax and mid lobe dark brown to black (rarely mixed with yellow); rest of thorax yellow to testaceous, or pale orange yellow, with scutellum pale yellow to white; petiole and gaster pale yellow to pale orange yellow; occasionally petiole pale brown, tergum I narrowly across base, terga IV-VI especially on sides, or sides of gaster up to cercal plates, infuscate brown and may be a little shiny; ovipositor pallid to white. Antennae yellow to testaceous; scape pale yellow in distal 0.66 except ventral margin; pedicel in proximal 0.5 to 0.66, brownish; F6 infuscate brown. Wings hyaline. Legs pallid. Setae on frontovertex, pronotum and mid lobe, dark brown; remaining setae transparent and not clearly visible.

Frontovertex width at anterior ocellus (depending on whether the specimens are on cards or on slides) varies from less than 0.5 to 0.5 of head width (Figs 213, 297), and usually a little longer than wide; head in front view as in Figs 213 and 214; eyes distinctly setose, setae pale and fine. Antennae as in Fig. 212; F1 distinctly longer than pedicel and at least 3x as long as wide; the following segments gradually decreasing in length distad, but F4 not less than 2x as long as wide; clava (in Fig. 212, slightly compressed) at most only slightly wider than F4.

Thorax as in Figs 215 and 297; mid lobe with raised hexagonal cells, and usually with 10 setae. Fore wings (Fig. 218) about 2.5x as long as wide; the setae on submarginal vein long, the distal seta a little longer than the longest marginal fringe (in holotype the left wing with 3 setae on this vein); basal cell with 6-10 setae; marginal vein with 10-12 setae; marginal fringe about one-sixth of wing width. Hind wings 7-7.5x as long as wide; marginal fringe as long as or slightly longer than wing width. Hind tibia usually slightly shorter than middle tibia.

Petiole plus gaster from about as long as to three-fifth longer than thorax (20:20, 26.5:30, 25:36, 25:39); terga with the usual number of setae; third valvula less than half the length of second valvifer, usually only slightly longer than 0.33 of second valvifer. [Ovipositor at most as long as middle tibia and third valvula shorter than basitarsus; Figs 216 and 217.]

**Male:** Unknown.

**Hosts:** *Aleurolobus* sp.; *Dialeurodes* sp.; *Singhiella bicolor*; [?] *Cerococcus* sp.

**Distribution:** India: Bihar, Delhi, Uttar Pradesh. Pakistan.

**Holotype:** Female (100E): INDIA: UTTAR PRADESH: Aligarh, i-iv.1981. **Paratypes:** INDIA: UTTAR PRADESH: Aligarh, 11F (52E, 156E, and on a card), iii.1965, ex *Aleurolobus* sp. on *Eugenia jambolana*; 2F (53E, 54E), same data except date x.1965; 1F ((57E), iii.1966, [with] *Cerococcus* sp. on *Hibiscus rosasinensis*; 24F (55E, 56E, 99E, and on cards), collected on different dates in 1979 to 1983.

The following specimens are not designated as types: INDIA: DELHI, 1F (on card 189E), 1.v.1965, ex scale on jasmin (Abbasi & Singh) (USNM). BIHAR: Pusa, 9F (227E), 14.xii.1927, ex *Dialeurodes* sp. on E. jambolana, (K.S. Lamba), No.2. PAKISTAN: Rawalpindi, 13F (245E, card 261E, and 3F on unnumbered cards), 7.xii.1980, ex *Singhiella bicolor* on *Syzygium cumini*, CIE 12853, CIBC.4797; Faisalabad 4F (246E), 5F (on cards), 29.i.1980, ex S. bicolor, CIE.A. 12005 No.4650 (BMNH).

**Comments:** The species is distinct from all the known species of the genus by the body colour, relatively narrower frontovertex, long flagellar segments, and long setae on the submarginal vein. It superficially resembles *duorunga* in colour, but the two species are quite different.

Since the species can not be placed with certainty in any of the known groups, a new group, *septentrionalis*-group, is proposed to include it.

**Etymology:** Latin: *septentrionalis*=northern; and in this case refers to the distribution of the species in the northern parts of India and Pakistan.

#### 43. *Encarsia norani*, sp. nov. (Figs 220-224)

**Female:** Length, 0.70mm. Frontovertex lemon yellow; ocellar area light brown; face pallid; malar space and mouth margin

brownish; occiput white suffused with brown on sides of foramen; thoracic dorsum yellow with dark brown pronotum; mid lobe pale brown in anterior half, sides and posterior half yellow; axilla, epimera above, propodeum except mesally brownish; venter and mesopleura except upper part of epimera pallid; propleura and prosternum suffused with brown; petiole, terga I and V and very narrowly the sides of gaster, brownish; tergum VI brown and VII yellow brown with white apex; terga II-IV with pale brown bands; venter pallid with distal two sternites brown. Antennae yellow brown; radicle white; pedicel somewhat brown, darker than flagellum. Wings hyaline; fore wing lightly infuscate below submarginal vein. Legs yellow to yellow brown; middle coxae pale brown; hind coxae dark brown; middle femora except apices and hind femora, brown; middle and hind tibiae in proximal third to half pale brown.

Frontovertex, at narrowest, slightly less than 0.5 of head width (7.5:17); mouth fossa wider than half the width of frontovertex (4.5:7.5); eyes densely setose, the setae brown and each seta clearly longer than diameter of an ommatidium. Antennae as in Fig.220; flagellar segments with long setae.

Thorax as in Fig.223; the setae brown and clearly visible in balsam. Fore wings 2.66x as long as wide (46:17); costal cell with two prominent setae at distal end; setae on veins and disc as in Fig.224; marginal fringe about 0.25 of wing width. Hind wings nearly 10x as long as wide; marginal fringe 1.5x as long as wing width. Hind tibia nearly as long as middle tibia (65:68).

Petiole plus gaster (somewhat shrunken) slightly longer than thorax (20.5:18.5); exserted part of ovipositor about one-tenth of gaster, but this may be due to the shrunken condition of the gaster; tergum VI with 1+1+2+1+1 setae, other terga with the usual number of setae. [Relative lengths of ovipositor and middle tibia as in Figs 221 and 222; as the ovipositor is slightly tilted upwards posteriorly, it should be a little longer than shown in the figure.]

Male: Unknown.

Host: Unknown.

Distribution: India: Uttar Pradesh.

Holotype: Female (85E): INDIA: UTTAR PRADESH: Aligarh, 1978, (M.Hayat & M.Verma).

Comments: The species appears distinct from all the known species of the genus, but the habitus suggests that it is close to *tricolor* (I have in my collection a female of this species sent by Dr Jasnoch, Tbilisi, U.S.S.R.), and is here placed in *tricolor*-group. It differs from *tricolor* in having a different colour, longer flagellar segments with conspicuously long setae, and longer marginal fringe of fore wing.

Etymology: The specific name is an anagram of *inaron*.

**Female:** Length, 0.52-0.73mm Body golden yellow, cleared specimens translucent white; postocellar bars, mouth margin, a cross-band on occiput at level of foramen, and collar of pronotum brown; rarely anterior margin of mid lobe and tergum I of gaster appear very pale brown. Antennae yellow; scape pale yellow; pedicel basally and F6 pale brown. Wings hyaline. Legs pallid.

Frontovertex broader than half of head width (9.5-12: 16.5-20); POL a little longer than or subequal to OOL; mouth fossa a little less than 0.33 of frontovertex width; eyes with short colourless setae. Antennae as in Fig.243; F1 distinctly shorter than F2 and usually slightly shorter than pedicel, but apparently subequal in length to pedicel.

Thorax as in Fig.247. Fore wings as in Fig.246; basal cell with 5-10 setae; marginal vein with 5-9 setae; marginal fringe slightly less than 0.25 of wing width, but in two specimens respectively 0.33 and 0.40 of wing width. Middle tibia subequal in length to hind tibia.

Petiole plus gaster longer than thorax (17-23:13-18); terga II-VII with the usual number of setae. [Ovipositor usually subequal in length to middle tibia (Figs 244 and 245); relative lengths of second valvifer, third valvula, and middle tibia: 31-43:10-14:43-56.]

**Male:** Unknown.

**Host:** *Aleurolobus* sp. near *niloticus*.

**Distribution:** India: Uttar Pradesh.

**Holotype:** Female (147E): INDIA: UTTAR PRADESH: Aligarh, 23.vi.1984 (M.Hayat & S.S.Islam). **Paratypes:** 2F, with the same data as holotype; 1F (90E), 29.v.1983; 2F (166E, 167E), vi-vii.1984; 1F (105E), i-iv.1981; Aligarh, Sasni, 1F (65E), vii.1968, ex *Aleurolobus* sp. near *niloticus* on *Dalbergia sissoo*.

**Comments:** The species was initially confused for *transvena* as it resembles that species in habitus and several structural details, and the specimens have often been collected along with specimens of that species. However, *confusa* differs from *transvena* by having F1 distinctly shorter than F2; distance between anterior pair of scutellar setae greater than that between the posterior pair; placoid sensilla near the origin of anterior pair of setae; and ovipositor not longer than middle tibia. The species is placed in *lahorensis*-group.

**Etymology:** Latin: *confusus*=confused, troubled; and refers to the fact that this species can be easily confused for *transvena*.

#### 45. *Encarsia transvena* (Timberlake) (Figs 248-257)

*Prospaltella transvena* Timberlake, 1926: 312. Female.

Male. U.S.A., Hawaii, Honolulu (BPBM; paratypes USNM).

*Prospaltella sublutea* Silvestri, 1931b: 20. Female.

Somalia (IEUN). Synonymy by Viggiani, 1985a: 90.

*Prospaltella flava* Shafee, 1973: 254. Female. India, Aligarh (Shafee's coll., ZDAMU) [examined]. Preoccupied

by *E. flava* (Compere, 1936). SYN. NOV.

*Encarsia shafeei* Hayat, 1986: 163. Replacement name for  
*P. flava* Shafee. SYN. NOV.

*Encarsia transvena* (Timberlake): Viggiani, 1985a: 90.

**Female:** Length, 0.45-0.70mm Body pale yellow to golden or lemon yellow (cleared specimens translucent white); face pallid, paler than frontovertex; rarely the pronotal collar, anterior margin of mid lobe, axillae, sides of propodeum mesad of spiracles, petiole and tergum I of gaster narrowly across base, brown; ovipositor pallid. Antennal scape white; pedicel and flagellum pale yellow, the latter especially the clava infuscate brown. Wings hyaline with a light infuscation below submarginal vein of fore wing. Legs pallid. Setae, including those on eyes, pale and difficult to see in balsam.

Frontovertex broader than 0.5 of head width (9-10:15-17.5); ocelli in about a right-angled triangle or the anterior ocellus forming a slight obtuse angle with the lateral ocelli; POL less than OOL. Antennae (Fig. 250a-c) apparently variable; pedicel and F1 usually subequal in length, but rarely F1 slightly shorter; F1 usually more than 2x as long as wide (rarely less than 2x, Fig. 250b), usually a little shorter than or subequal in length to F2, rarely slightly longer than F2; clava at least as long as funicle; relative lengths: scape, 5-6.5; pedicel plus flagellum, 17-24; clava, 8-9.5.

Thorax as in Figs 248 and 249; mid lobe with 8 setae, rarely 9 or 10; arrangement of the setae and sensilla as in the figures. Fore wings (Figs 255, 256) usually slightly less than 3x as long as wide; sometimes broader; basal cell with 4-11 setae; marginal vein with 6-9 setae; marginal frings from about 0.33 to slightly less than 0.5 of wing width. Hind wings 8-10x as long as wide; marginal fringe 1.5x to 2x of wing width. Middle tibial spur slightly longer than 0.5 to about 0.66 the length of basitarsus (10:15-17, 12:17, 11:19); hind tibia subequal in length to middle tibia.

Petiole plus gaster about 1.5x as long as thorax, but measurements vary depending on the condition of the gaster (16.5-24.5:11-15.75); terga II-VII with the usual number of setae; third valvula 0.25 to 0.33 of second valvifer (13-17:43-57; 14:51; 16:57; 15:50). [Ovipositor longer than middle tibia (Figs 251 and 252); relative lengths of second valvifer, third valvula, middle tibia and basitarsus, 43-57:13-17:45-60:15-19.5.]

**Male:** Length, 0.43-0.60mm Similar to female except body darker yellow in colour; pronotal collar, anterior margin of mid lobe and axillae brown; gaster dorsum only or whole, brown to dark brown. Antennae as in Fig. 257.

**Hosts:** *Acaudaleyrodes rhachipora*; *Aleurolobus* sp. near *niloticus*; *Bemisia tabaci*; indet. aleyrodids; [?] coccids.

**Distribution:** India: Delhi, Karnataka, Kerala, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. Pakistan. [Africa. Hawaii. Japan.]

**Material examined:** INDIA: KARNATAKA: Bangalore, 5F (229E) 30.i.1983, ex whitefly on gooseberry, (Peter), CIE.A. 15395. KARNATAKA: 5F (230E), 8117. TAMIL NADU: Coimbatore, 2F (238E), 14774, No.11. DELHI: IARI area, 5F (263E-267E), on different dates in Oct., 1979 (Z.Boucek). PAKISTAN: Rawalpindi, 3F (251E), ex aleyrodids on *Gardenia*, No.4631, CIE.A.11531 (all BMNH). INDIA: RAJASTHAN: Rajkot, 4F (197E), 9.ii.1958, ex aleyrodid on castor bean (G.W.Angelet) (USNM). UTTAR PRADESH: Aligarh, 9F, 5M (71E,76E,77E,137E,158E), vii. 1967, ex aleyrodids; Aligarh, Sasni, 1M (65E), vii.1968, ex *Aleurolobus* sp. near *niloticus* on *Dalbergia sissoo*; Aligarh, 8M (159E), viii.1967, ex aleyrodids on *D. sissoo*; Aligarh, 22F (73E,120E,121E,141E,142E,145E,147E,155E,166E, 270E), on different dates in 1979-1986. MAHARASHTRA: Elephanta (caves off Bombay), 1F (72E), x.1967, ex *Bemisia tabaci* RAJASTHAN: Jodhpur, 10F, 2M (281E), 1976, ex *Acaudaleyrodes rhachipora* on *Prosopis juliflora*; 5F, 1M (74E), 10.xi.1976. KERALA: Trivandrum, 3F (91E), ex *B. tabaci*. WEST BENGAL: Chandaneswer, 1F (111E), 1.x.1983 (S.S.Islam). Also I have recently identified several female specimens (ex *B. tabaci*) received from Dr K.Natarajan of the C.I.C.R., Coimbatore.

**Comments:** *P. flava*: I have seen the holotype and the paratype, mounted on separate slides. The body has pale brown markings as noted in the description above, not completely yellow. Viggiani (1985a) has not seen the types of this species, and therefore considered it as a doubtful synonym of *transvena*. My enquiries with Pr. G.Viggiani and Dr M.E.Schauff revealed that the arrangement of setae and sensilla on scutellum in *transvena* are about the same as in Shafee's species, and hence the synonymy proposed here.

The species is placed in *lahorensis*-group and differs from *lahorensis* and *confusa* in several characters as noted in the key. The species of this group are very close to those of *strenua*-group, and the two may eventually have to be united.

#### 46. *Encarsia lahorensis* (Howard) (Figs 258-262)

*Prospaltella lahorensis* Howard, 1911: 132. Female. Male. Pakistan, Lahore (Lectotype, USNM). Lectotype designated by Hayat, 1981a. Woglum, 1913: 58pp. Ayyar, 1925: 251. Mani, 1938: 123. Pruthi & Mani, 1940: 27. Viggiani & Mazzone, 1978: 99-166.

*Encarsia lahorensis* (Howard): Viggiani & Mazzone, 1979: 46. Hayat, 1981a: 466; 1986: 161.

**Female:** Length, 0.58mm (lectotype). Two specimens from Pakistan measure about 0.68mm and 0.71mm. Body pale yellow without any markings; in two specimens head orange yellow. Antennae whitish, very lightly infuscate with prominent pale brown setae. Wings hyaline. Legs pallid.

Head dorsum strongly transverse (apparently shrunken), about 3x as wide as long (Fig.261). Antennae as in Fig.258; F1 as long as F6; F4 (in lectotype also) is the shortest segment of the flagellum; F1 varies from 2.66 to 3x as long as wide.

Thorax as in Fig. 261; each side lobe apparently with two setae; anterior pair of scutellar setae minute. Fore wings as in Fig. 262. Hind wings about 6.5x as long as wide; marginal fringe about 1.25x as long as wing width. Middle tibial spur slightly longer than half of basitarsus length.

[Relative lengths of second valvifer, third valvula, middle tibia and basitarsus as in Figs 259 and 260.]

**Male:** Known, but I have seen only paralectotypes in which the heads were missing. A redescription and figures were provided by Viggiani & Mazzone (1978).

**Hosts:** *Dialeurodes citri*; [?] *Aleurodes ricini*.

**Distribution:** Pakistan. India: 'North India', [?] Bihar. [Introduced: U.S.A. Italy.]

**Material examined:** PAKISTAN: 2F (248E), CIE, No. 4658, (BMNH).

**Comments:** The species was redescribed in details by Viggiani & Mazzone (1978), and brief notes were provided by Hayat (1981a). It can be recognized from these two accounts and from the illustrations and the redescription given here.

Viggiani & Mazzone (1979) proposed *lahorensis-group*, for this and other (unnamed) Oriental species. I have referred a few species to this group in this paper. The species of this group are related to those of *strenua-group*, differing in having broader tergum VII of gaster and relatively short ovipositor.

The record of this species as a parasite of *A. ricini* in Bihar (Misra, 1924, Rept. Proc. Vth Ent mtgs Pusa, Feb. 1923, 5: 129-135) needs confirmation.

#### 47. *Encarsia longivalvula* Viggiani

*Encarsia longivalvula* Viggiani, 1985a: 85. Female. Male. Pakistan, Peshawar (IEUN).

**Host:** *Dialeuropora decempunctata*.

**Distribution:** Pakistan.

**Comments:** The original description is in considerable details and is sufficient to recognize the species. *E. longivalvula* appears rather close to *bemisiae* (Ishii) [Specimens from Japan, tentatively determined by me] of *lahorensis group* in having relatively shorter venation and in the conformation of the antennal segments, but differs from the Japanese specimens in having longer ovipositor, longer third valvulae, fewer setae in basal cell of fore wing, and an apparently 2-segmented clava.

The habitus and characters of the species suggest that it is probably best placed in *strenua-group*.

#### 48. *Encarsia muliyali* Mani (Figs 264-269)

*Encarsia muliyali* Mani, 1941: 35. Female. India, Cuttack (IARI) [examined]. Mahmood, 1955: 28. Hayat, 1986: 162.

*Encarsia ochai* Viggiani, 1981a: 63. Female. Thailand, Kanchanaburi (IEUN). SYN. NOV.

**Female:** Body yellow with only the pronotal collar on sides brownish. Antennae and legs pale. Wings hyaline.

Mandibles with two teeth and a truncation. Antennae as in Fig. 264. Thoracic dorsum as in Fig. 267; mid lobe with 10 setae; placoid sensilla on scutellum placed close to each other and the distance between anterior pair of scutellar setae less than that between the posterior pair. Fore wings (Fig. 269) long with marginal fringe about 0.33 of wing width; basal cell with 10-12 setae. Gaster (shrunken) (Fig. 268) about as long as thorax; tergum VII conical, about 1.33x as wide as long; ovipositor originating from base of gaster and distinctly exserted at apex (This character may be misleading because in a normally preserved or distended gaster the ovipositor may appear to originate in proximal fourth and may be unexserted, as shown for *ochai*.) [Relative lengths of second valvifer, third valvula and middle tibia as in Figs 265 and 266.]

**Male:** Unknown.

**Host:** *Aleurolobus barodensis*.

**Distribution:** India: Orissa, Uttar Pradesh. [Thailand.]

**Comments:** *E. muliyali*: The holotype female is on a slide. The head is detached from the rest of the body and right side wings and clava of one antenna are missing. The data on the slide [PCS No. 23C. Bred from nymph of *Aleurolobus barodensis*, Cuttack, Anwar 2-XII-38] agree with the original data except that collector's name was Manzur Ahmad, not Anwar as written on the slide.

*E. ochai*: I have not seen the types, but the original description, figures (Viggiani, 1981a: Fig. II 1-4) and the host record leave no doubt as to its being conspecific with *muliyali*.

The species is placed here in **strenua-group**. It appears close to **longivalvula** of that group, but differs in several characters as noted in the key to the species.

#### 49. *Encarsia dialeurodis*, sp. nov. (Figs 275-280, 303)

**Female:** Length, 0.77-0.87mm Body pale lemon yellow; facial area pale orange yellow; petiole and tergum I of gaster each with a brownish cross-band; a brownish patch in center covering part of terga IV and V. Antennae pale yellow, the flagellum very light brown. Wings hyaline. Legs pallid, paler than body.

Head in front view as in Fig. 276; POL at least a little less than OOL; mouth fossa about 0.5 of frontovertex width. Antennae as in Fig. 275; F1 longer than pedicel; F2 longer than F1 and subequal in length to F3.

Thorax as in Figs 277 and 303; each side lobe with 3 setae; metanotum with a slight median extension overlapping propodeum in the middle. Fore wings as in Fig. 280; basal cell with 6-9 setae; marginal vein with 7-10 setae; marginal fringe 0.25 or slightly longer, than wing width. Hind wings 8.5-9x as long as wide; marginal fringe about 1.2x as long as wing width.

Petiole plus gaster (Fig. 303) longer than thorax; tergum VI with 6 (1+1+2+1+1) setae, other terga with the usual number of setae; tergum VII 1.3-1.7x as wide as long. [Relative lengths of second valvifer, third valvula, middle tibia and basitarsus as in Figs 278 and 279.]

Male: Unknown.

Host: *Dialeurodes* sp.

Distribution: Pakistan.

Holotype : Female (272E), 5F (249E, 271E, one on card), paratypes: PAKISTAN: Multan, 2.ii.1981, ex *Dialeurodes* sp. on *Ficus religiosa*, CIBC. 4796 (BMNH).

Comments: The species appears close to *strenua*, *muliayali* and *protransvena*, but differs from all these species in body colour and relatively shorter third valvulae which are subequal in length to middle basitarsus, and in having F1 distinctly shorter than F2.

The new species superficially resembles species of *lahorensis*-group, but is placed here in *strenua*-group on balance of characters.

Etymology: The specific name is derived from the generic name of the aleyrodid host.

#### 50. *Encarsia aonidiae* Howard

*Encarsia aonidiae* Howard, in Howard & Ashmead, 1896: 636.

Female=Male. Sri Lanka, Pundaluoya (Lectotype, USNM). Lectotype designated by Hayat, 1981a: 464. Ayyar, 1925: 251. Mani, 1938: 121. Hayat, 1986: 160.

Host: *Greeniella corniger*.

Distribution: Sri Lanka.

Comments: This species was described from males which Howard erroneously considered females. It was redescribed by Hayat (1981a) and nothing more need be added to that redescription.

#### 51. *Encarsia planchoniae* Howard

*Encarsia planchoniae* Howard, in Howard & Ashmead, 1896:

635. Female=Male. Sri Lanka, Pundaluoya (Lectotype, USNM). Lectotype designated by Hayat, 1981a: 467. Ayyar, 1925: 251. Mani, 1938: 121. Hayat, 1986: 163.

Host: *Bambusaspis delicatum*.

Distribution: Sri Lanka.

Comments: This species was based on males. Hayat (1981a) provided a redescription. Since based on males, it is not possible to comment on its relationship. But it appears close to the Taiwanese *E. singularis* (Silvestri) which was also described from a male specimen.

#### NOTES ON SOME INDETERMINED SPECIES

##### *Encarsia* sp. 1 (Fig. 63)

INDIA: DELHI, IARI area, 1F (255E), 5.x.1979 (Z. Boucek) (BMNH).

This specimen appears close to *E. longicauda*, sp. nov., but differs in having the fore wings lightly infuscate below marginal vein; the cross-band on face above toruli is distinct and dark brown; third valvula nearly 0.8 the length of second valvifer (19:25); and F1 only a little longer than wide. Since only a single specimen is available, it is not possible to decide with certainty whether it represents a separate species or is an extreme variant of *longicauda*.

#### *Encarsia* sp. 2 (Fig.60)

INDIA: DELHI, IARI area, 1F (256E), 27.x.1979 (Z.Boucek) (BMNH).

This specimen also appears close to *E. longicauda*, but has a relatively broader tergum VII (width:length, 48:28), hyaline fore wings, and only tergum II of gaster light brown with yellow sides. It may also be regarded as close to *smithi*, but differs from that species in having light brown tergum II of gaster, completely yellow tergum VII, hyaline fore wings and pallid legs.

#### *Encarsia* sp. 3

INDIA: TAMIL NADU: Shenbaganur, 1F (253E), x.1979 (J.S. Noyes) BM 1979-518 (BMNH).

Before mounting the specimen on a slide (and losing the antennae during that process!), I placed it near *terebrator* because of similar body colour, longer ovipositor, and F1 being shorter than both pedicel and F2. It differs from Shafee's species in having the face above toruli dark brown, subhyaline fore wings, relatively longer marginal fringe (0.20 of wing width) of fore wing, and ovipositor shorter than middle tibia and tarsus combined (105:111). It differs from *longicauda* in having brownish tergum VII.

#### *Encarsia* sp. 4 (Figs 52,53)

INDIA: UTTAR PRADESH: Aligarh, 1F (183E), 14.iv.1980.

This specimen appears close to *E. ishii* and it may prove to be conspecific with that species, but it differs from *ishii* in having the fore wings infuscate below marginal vein, basal cell with 2-3 setae, and legs pallid with only hind coxae brown. It differs from *opulenta*, *brasiliensis* and *terebrator* in having completely dark brown gaster.

#### *Encarsia* sp. 5 (Figs 61,62)

INDIA: UTTAR PRADESH: Aligarh, 1F (34E), 1978.

This specimen is very close to and might prove to be conspecific with *longicauda*, but differs in having the cross-band on face distinct and dark brown and basal cell of fore wing with 4-5 setae.

#### *Encarsia* sp. 6

PAKISTAN: Lahore, 4F, 5M (194E), 1911, ex *Aleuroplatus pectiniferus*, (R.S.Woglum) (USNM).

Two of the four females are very near *brasiliensis* as illustrated by Grissell (1979), but the marginal fringe of fore wing is longer, 0.20 to 0.25 of wing width. In one specimen the axillae are yellowish, fore wings hyaline and tergum I of gaster brown. In the other two specimens basal three terga of gaster are yellow and the remaining terga including tergum VII, are dark brown, axillae yellow, third valvulae dark brown, fore wings lightly infuscate below marginal vein, and fringe 0.20 to 0.25 of wing width. Thus two specimens are close to *terebrator* and two to *longicauda*.

As I have noted in this paper, it seems that there exist a number of species very close to *opulenta* (such as *terebrator*, *brasiliensis*, *longicauda*, and the indet. spp.), but a final decision about their actual status is not possible to take now, and not until further specimens are collected and relevant types are studied.

#### *Encarsia* sp. 7 (Figs 105-109)

INDIA: UTTAR PRADESH: Aligarh, 1F (103E), i-iv.1981.

This specimen is apparently *closeto indica* (Shafee) and *davidi* Viggiani & Mazzone (see comments given under *indica* and *lutea*), and though there are some differences in the relative lengths of flagellar segments, it might ultimately prove to be conspecific with *indica*. But a definite opinion on the identity of this specimen is not possible as the details of the ovipositor are unknown for Shafee's species.

#### *Encarsia* sp. 8

INDIA: UTTAR PRADESH: Aligarh, 1F (150E), 18.x.1985.

This specimen appears intermediate between *divergens* and *bifasciafacies*. It differs from the latter in having hyaline fore wings, brown hind femora and base of hind coxae, and 6 setae on tergum VII of gaster. It agrees with *divergens* in a majority of characters, but the differences (4 setae on tergum VII, stigmal vein with a long, narrow neck, and 2 setae in basal cell of fore wing, in *divergens*) appear to be sufficient not to regard them as conspecific.

#### *Encarsia* sp. 9

INDIA: UTTAR PRADESH: Aligarh, 1F (169E), 9.iii.1980 (M.Verma).

This specimen appears close to *E. affectata*, but differs by having F1 a little longer than wide, clava not clearly differentiated from funicle, fore wing with indication of a postmarginal vein, ovipositor slightly shorter than middle tibia, and tergum VII with 4 setae.

## HOST-PARASITE LIST

## Homoptera: Aleyrodidae

ACAU DALEYRODES RHACHIPORA

Encarsia acaudaleyrodis,  
transvena

ALEUROCANTHUS INCERATUS

clypealis, opulenta

A. SPINIFERUS

smithi

A. WOGLUMI

bennetti, clypealis, divergens  
merceti, opulenta, smithi

ALEURODES HUSSINI

narayananii, smithi

A. RICINI

[?] lahorensis

ALEURODES SPP.= ALEYRODES SPP.

clypealis, tristis,

ALEUROLOBUS BARODENSIS

udaipuriensis  
isaaci, macroptera, muliyali,  
udaipuriensis

A. NILOTICUS

bifasciafacies

A. SP. NEAR NILOTICUS

bifasciafacies, confusa,  
transvena

ALEUROLOBUS SPP.

albiscutellum longipalpa,  
septentrionalis, trivittata  
brevivena, lutea, mohyuddini,  
[?] smithi, transvena

BEMISIA TABACI

lahorensis

DIALEURODES CITRI

dialeurodis, septentrionalis  
dialeuroporae, longivalvula

DIALEURODES SPP.

tristis

DIALEUROPORA DECEMPUNCTATA

isaaci, tristis

NEOMASKELLIA ANDROPOGONIS

septentrionalis

N. BERGII

bifasciafacies

SINGHIELLA BICOLOR

azimi, bifasciafacies, clypea-  
lis, gunturensis, indica,

SIPHONINUS SP.

isaaci, longifasciata,  
leptosoma, longicauda,

Indetermined aleyrodids

lutea, merceti, perflava,  
terebrator, transvena, tristis

## Homoptera: Diaspididae

AONIDISELLA ORIENTALIS

aurantii, [?] bifasciafacies  
citrina, obtusiclava

AULACASPIS TUBERCULARIS

planchoniae

BAMBUSASPIS DELICATUM

citrina, [?] clypealis

CORNUASPIS BECKII

citrina

DUPLACHIONASPIS GRAMINIS

elongata, sankarani

FIORINIA THEAE

aonidiae

GREENIELLA CORNIGER

aurantii

HEMIBERLESIA LATANIAE

aurantii

LINDINGASPIS FUSCA

berlesei, aurantii

PINNASPIS STRACHANI

citrina, perniciosi

QUADRASPIDIOTUS PERNICIOSUS

citrina, obtusiclava,

Indetermined diaspids

perniciosi, [?] tristis

The following host records are considered as erroneous:

## Homoptera: Cerococcidae

CEROCOCCUS SP.

septentrionalis

Homoptera: Coccoidea

CHLOROPULVINARIA SP.

bifasciafacies

Homoptera: Kerriidae

KERRIA LACCA

udaipuriensis

Homoptera: Pseudococcidae

NIPAECCUS SPP.

albiscutellum longipalpa

PLANOCOCCUS CITRI

udaipuriensis

RASTROCOCCUS ICERYOIDES

narayanani, pseudococci, pura

Indet. coccids

transvena

Lepidoptera: Pyralidae

POLYCHA DEPRESSELLA

udaipuriensis

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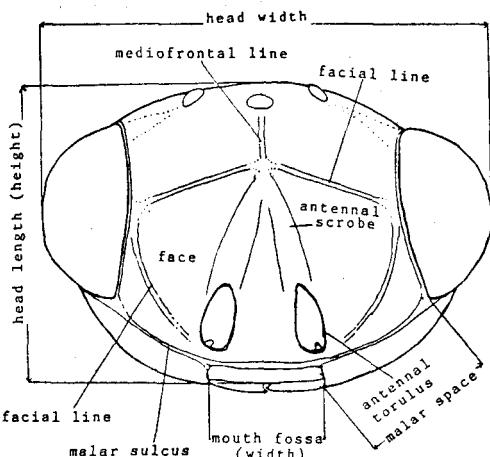
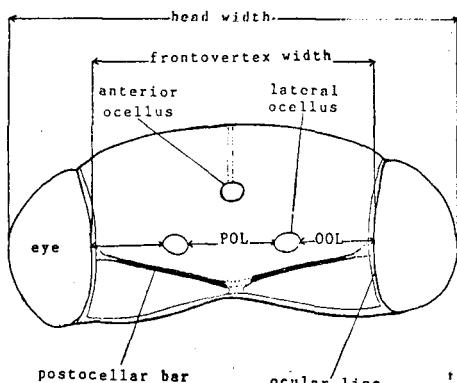
## I N D E X

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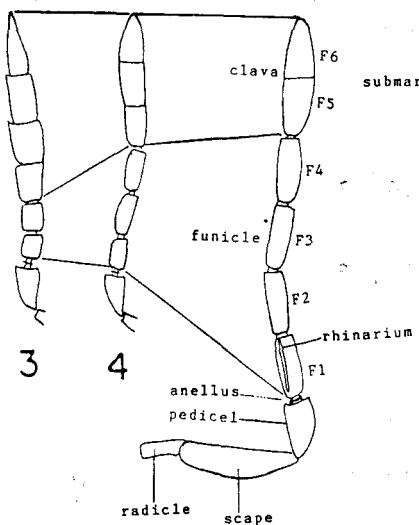
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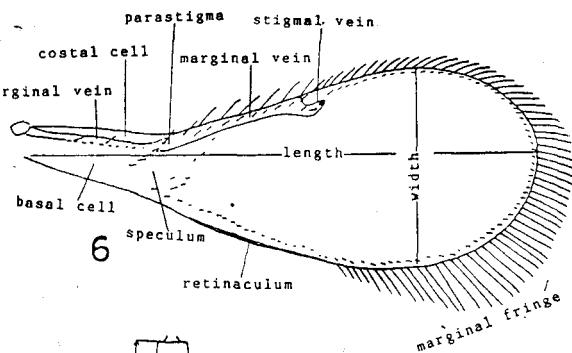
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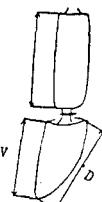


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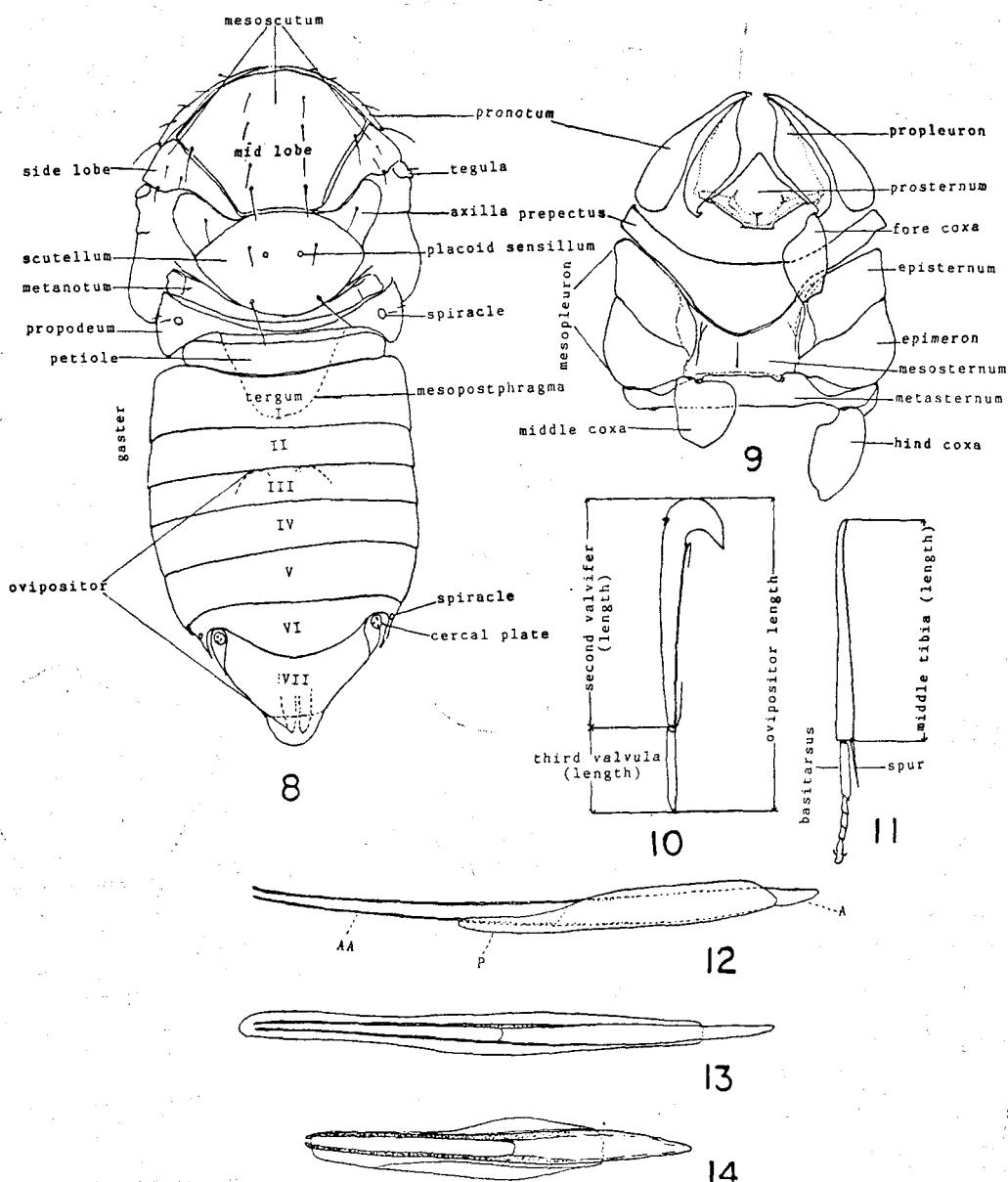
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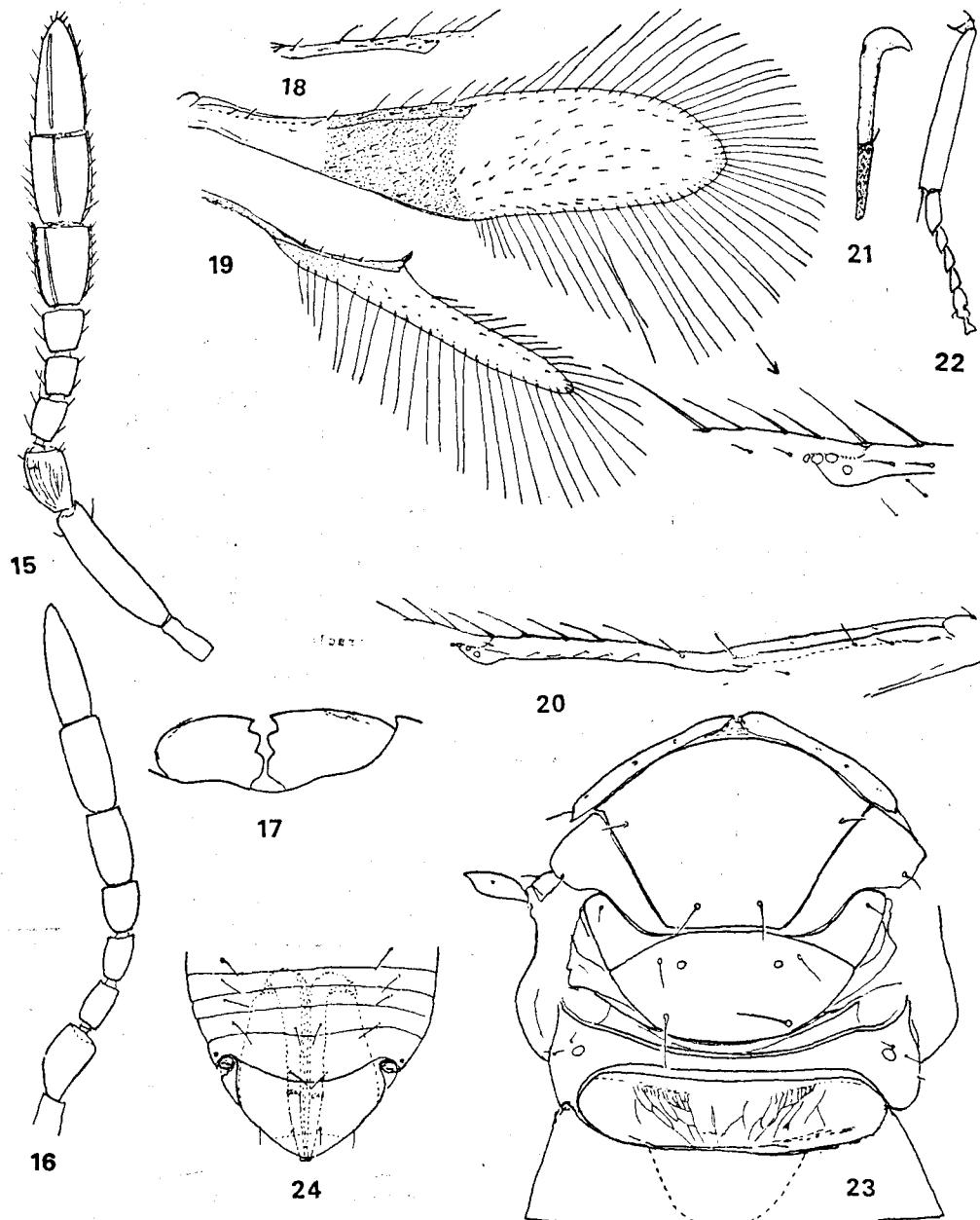


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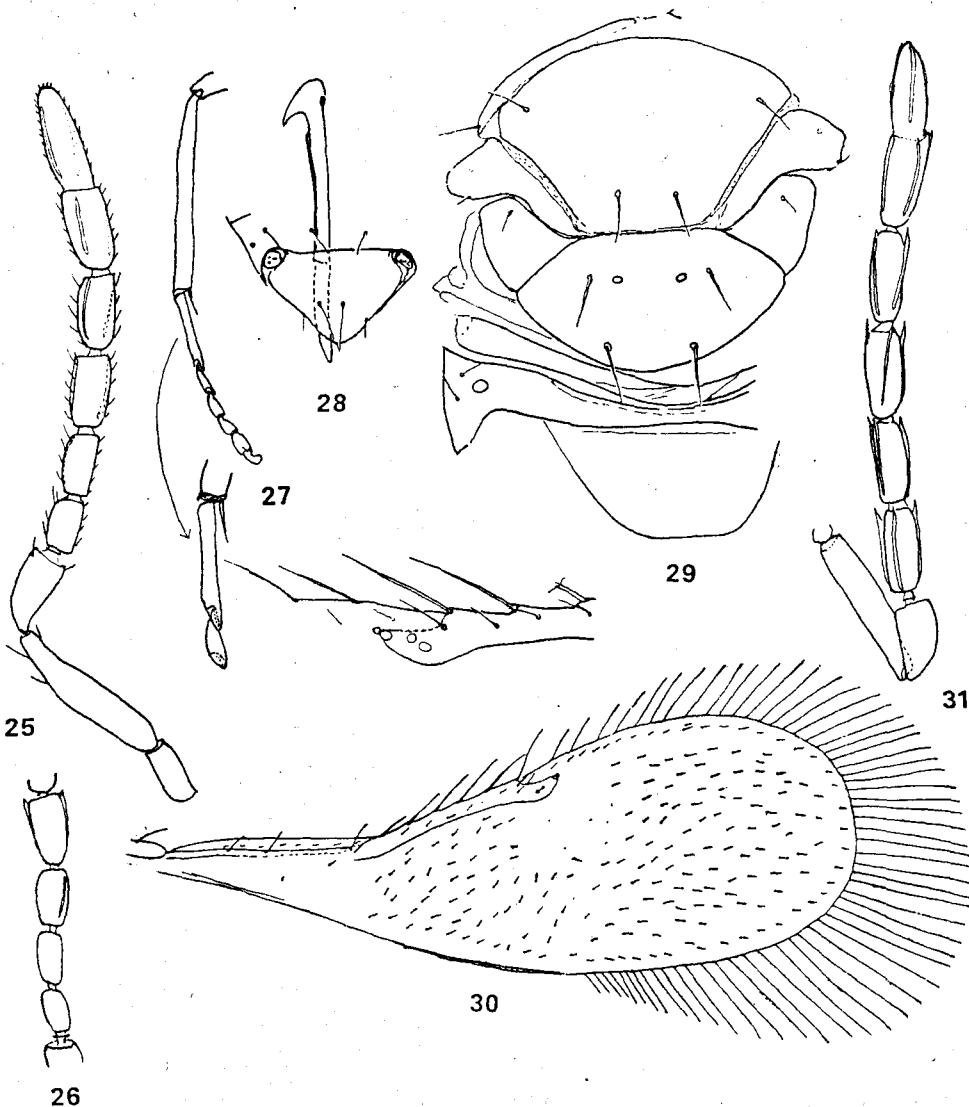
Figs. 1-7. Explanation of terms and measurements: All from females: 1, head dorsum, *Encarsia perniciosi* (Tower); 2, head in front view, *Encarsia* sp.; 3, pedicel and flagellum, *E. inquirenda* (Silvestri) Chinese specimen; 4, pedicel and flagellum, *E. bemisiae* (Ishii) Japanese specimen; 5, antenna, *E. inaron* (Walker), slide 184E; 6, fore wing, diagrammatic; 7, pedicel and F1, note the difference in dorsal (D) and ventral (V) lengths of pedicel.



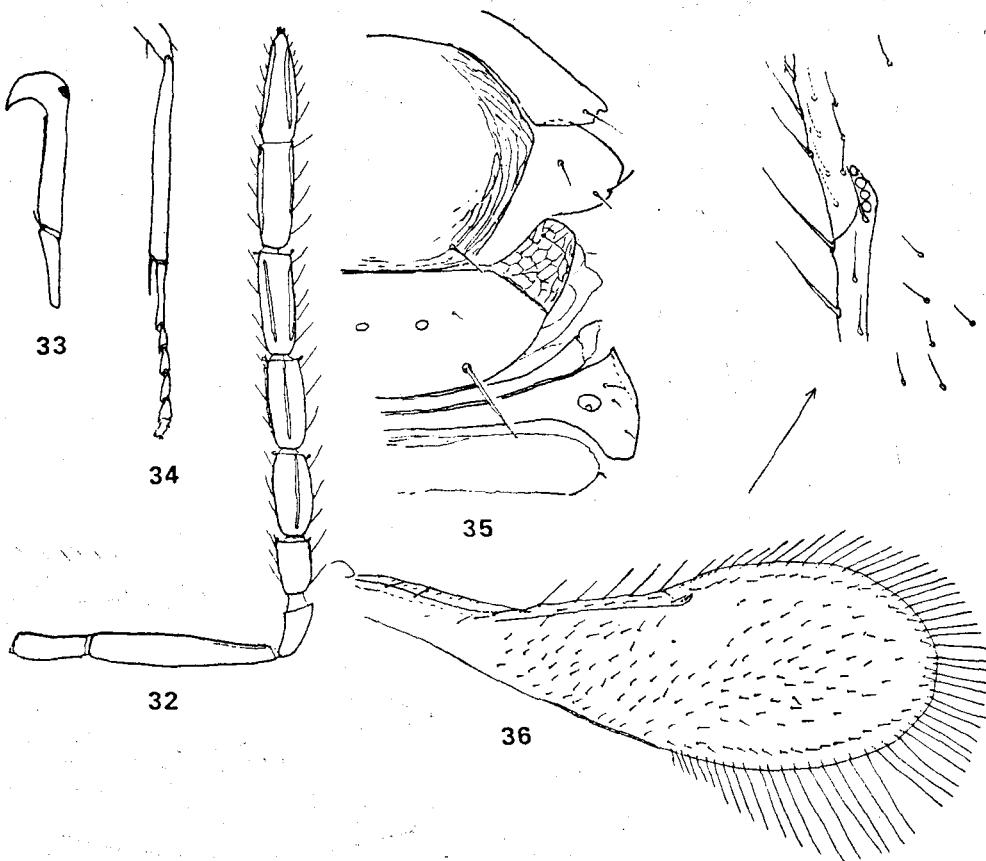
Figs. 8-14. Explanation of terms and measurements, continued; 8-11 from females: 8, thorax and gaster, dorsal, *E. bifasciafacies*, sp. nov. (5E); 9, thorax, ventral, *E. longicauda*, sp. nov. (33E); 10, second valvifer and third valvula, diagrammatic; 11, middle tibia and tarsus, diagrammatic 12-14, male genitalia: 12, *Encarsia* sp.; 13, *E. obtusiclava*, sp. nov.; 14, *E. tristis* (Zehntner). A = aedeagus; AA = aedeagal apodeme; P = phallobase.



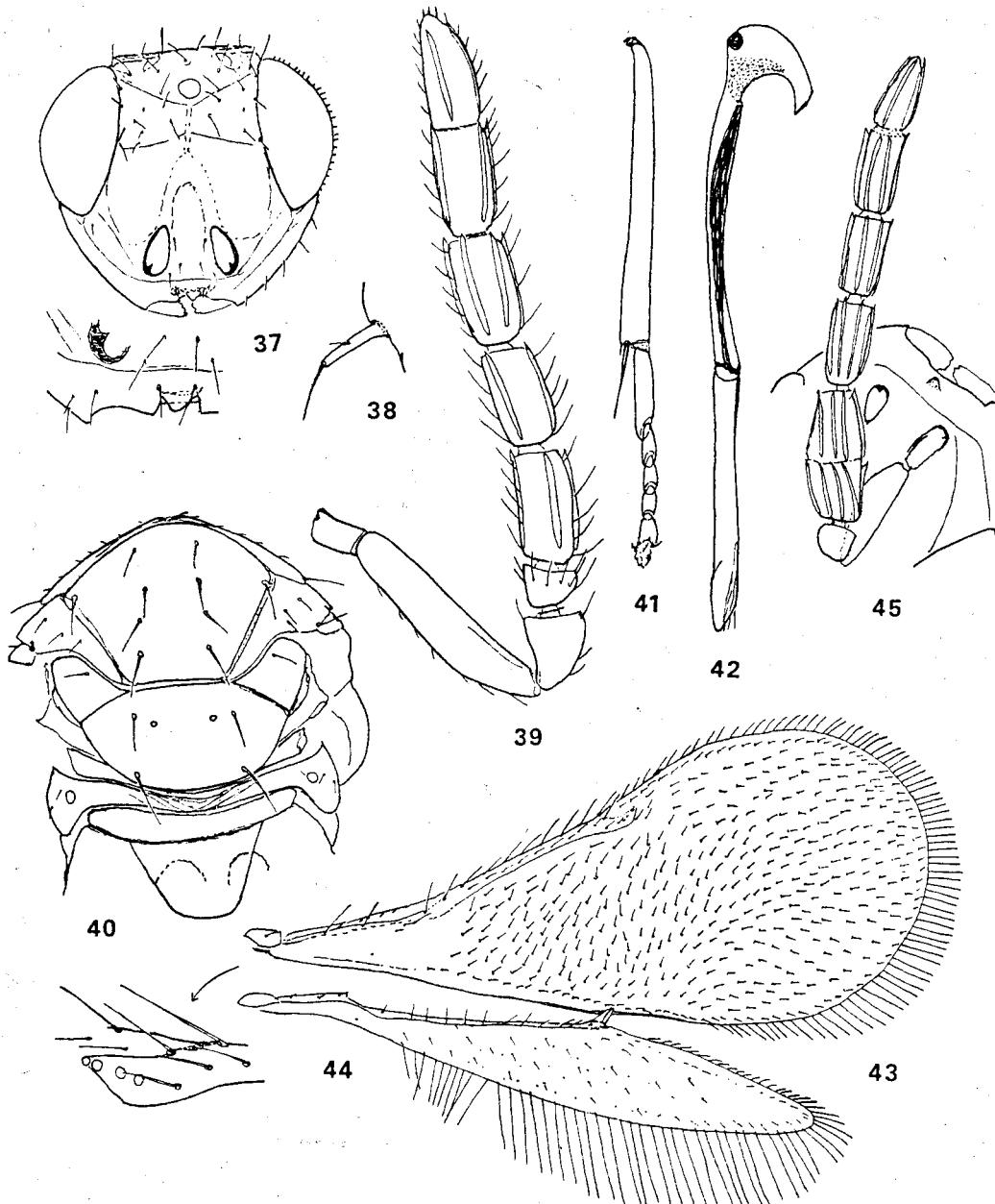
Figs. 15-24. *Encarsia citrina* (Craw), female: 15, 16, antennae; 17, mandible; 18, right fore wing, and marginal vein of left fore wing from ventral side; with distal veins enlarged and shown separately; 19, hind wing; 20, venation of fore wing; 21, second valvifer and third valvula; 22, middle tibia and tarsus; 23, thoracic dorsum; 24, distal part of gaster. Figs. 15, 18, 19, 21, 22 (slide 185E); 16, 17, 20, 23, 24 (200E).



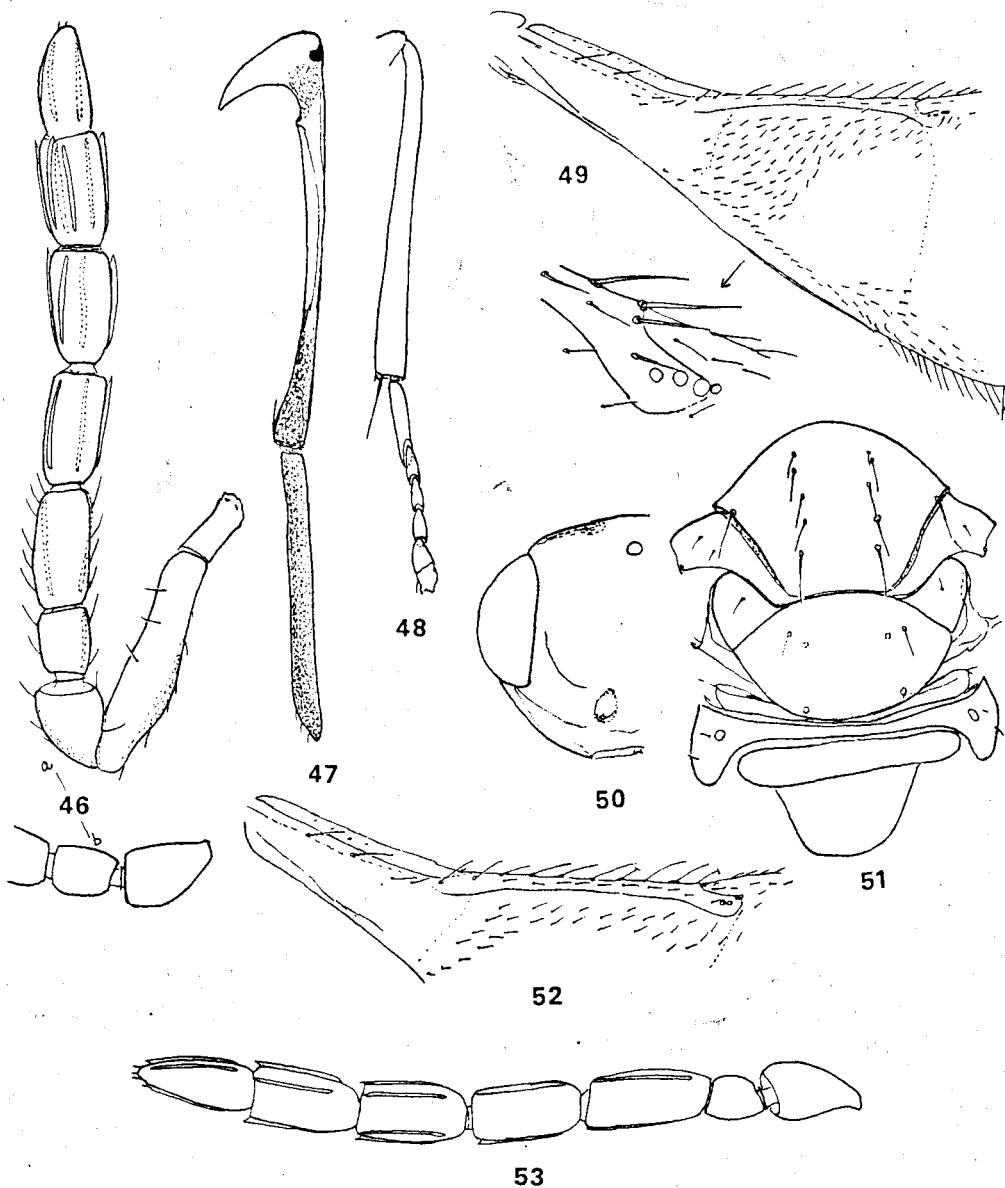
Figs. 25-31. *Encarsia acaudaleyrodis* Hayat, female except Fig. 31: 25, antenna, 26, funicle; 27, middle tibia and tarsus; 28, second valvifer and third valvula and tergum VII of gaster; 29, thoracic dorsum; 30, fore wing, with distal veins from a second specimen, enlarged and shown separately; 31, male antenna. All from specimens from Rajasthan.



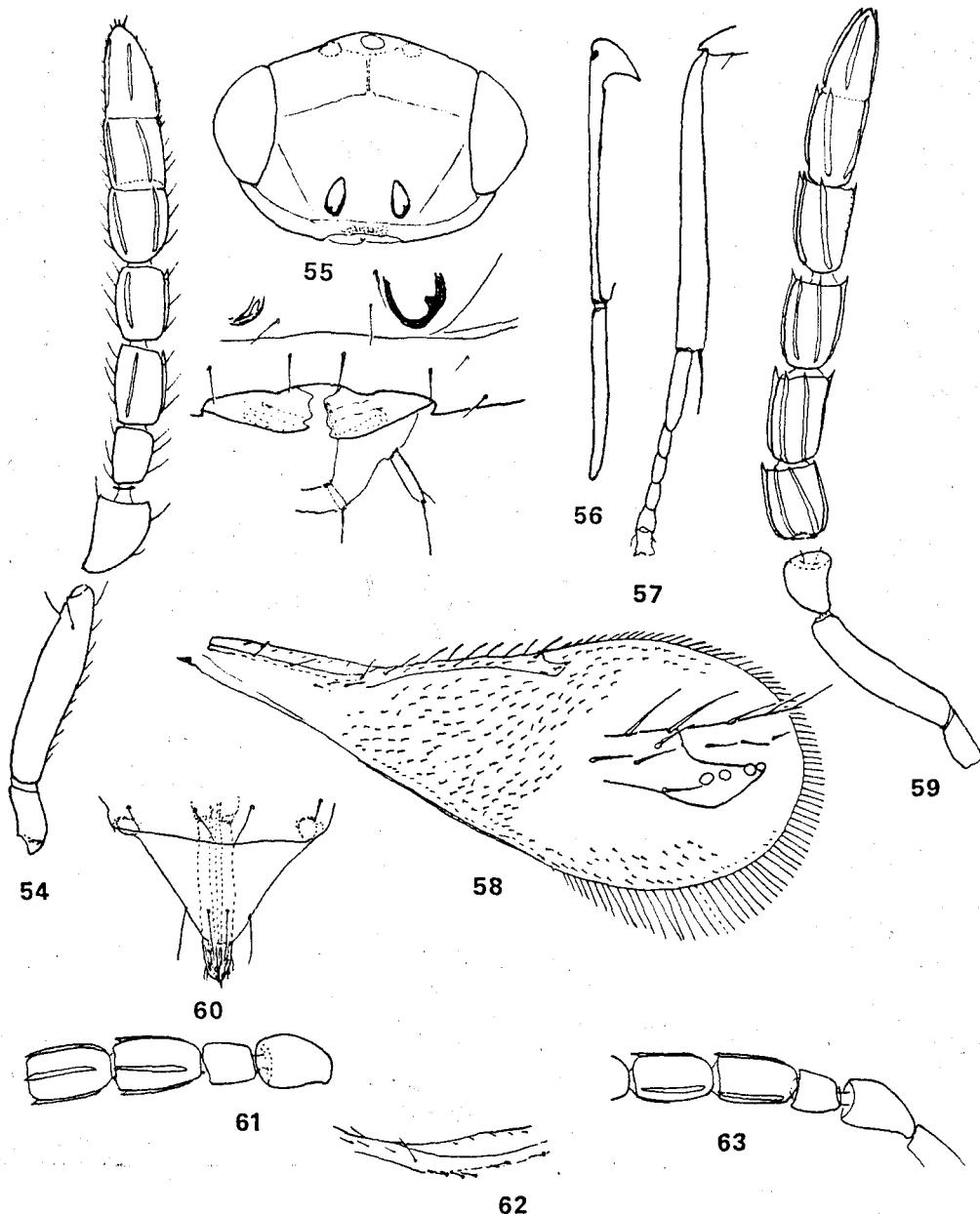
Figs. 32-36. *Encarsia longifasciata* Subba Rao, holotype female: 32, antenna; 33, second valvifer and third valvula; 34, middle tibia and tarsus; 35, part of thoracic dorsum; 36, fore wing with distal veins enlarged.



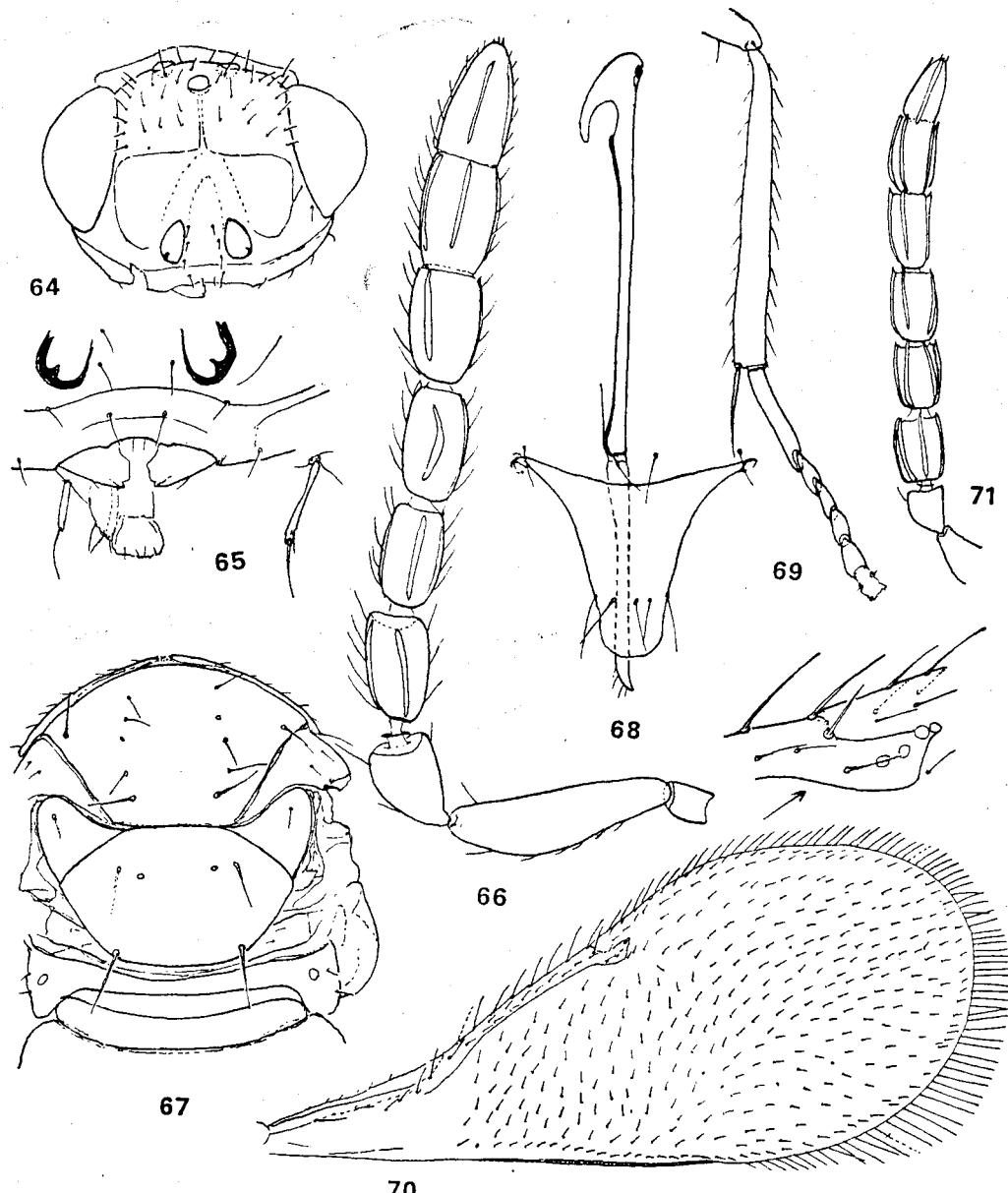
Figs. 37-45. *Encarsia clypealis* (Silvestri), female except Fig. 45: 37, head in front view, with part of mouth margin enlarged to show the tooth; 38, maxillary palp; 39, antenna; 40, thoracic dorsum; 41, middle tibia and tarsus; 42, second valvifer and third valvula; 43, fore wing, enlarged stigmal vein from another wing; 44, hind wing; 45, part of head and antenna, male. Fig. 37 (36E); 38, 39, 41-44 (37E); 40 (38E); 45 (188E).



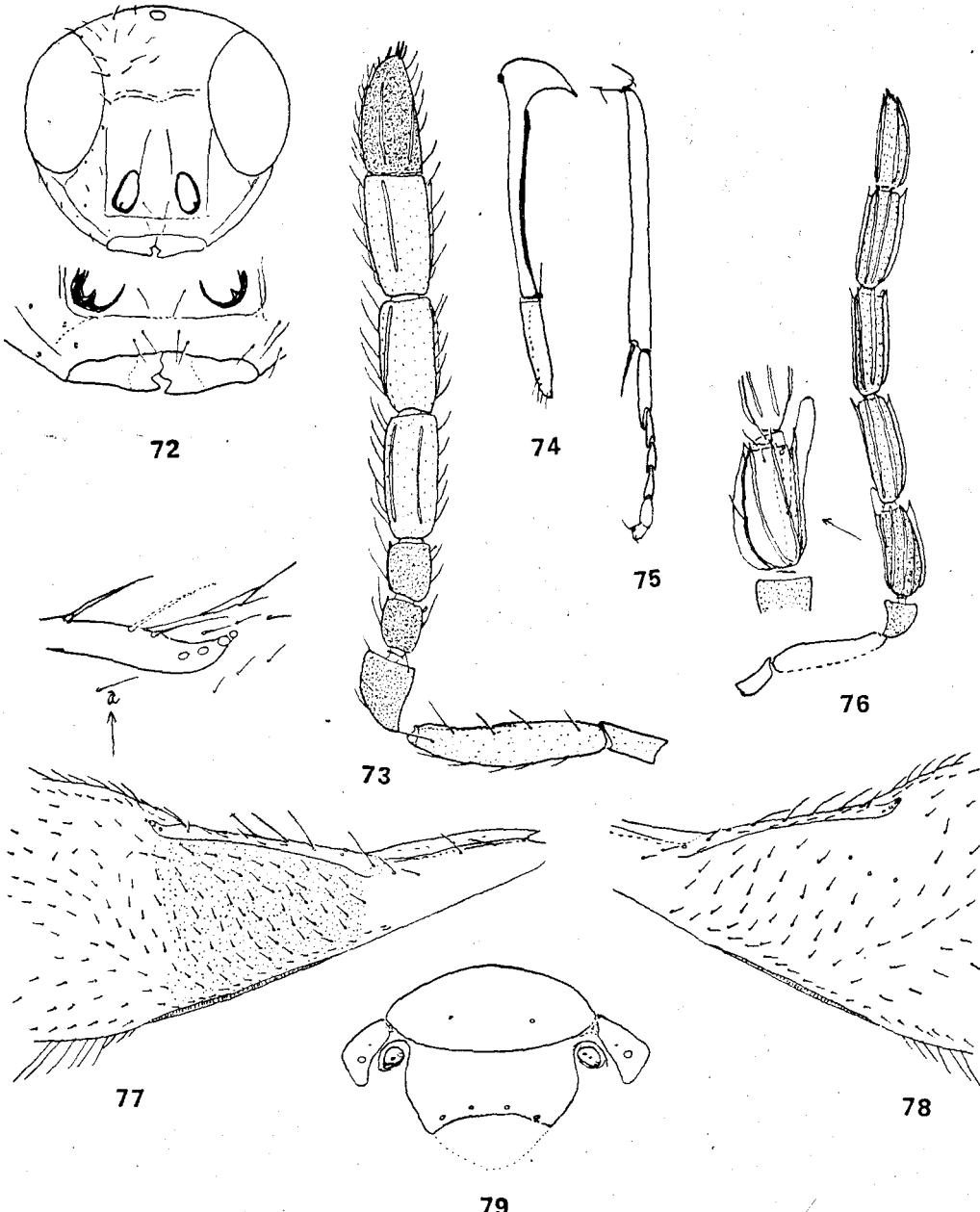
Figs. 46-53. (46-51) *Encarsia terebrator* (Shafee), female paratype: 46, antenna and pedicel and F1; 47, second valvifer and third valvula; 48, middle tibia and tarsus; 49, part of fore wing with enlarged stigmal vein shown separately; 50, left half of head in front view; 51, thoracic dorsum, excluding pronotum. (52, 53) *Encarsia* sp. (183E) part of fore wing and antenna excluding scape.



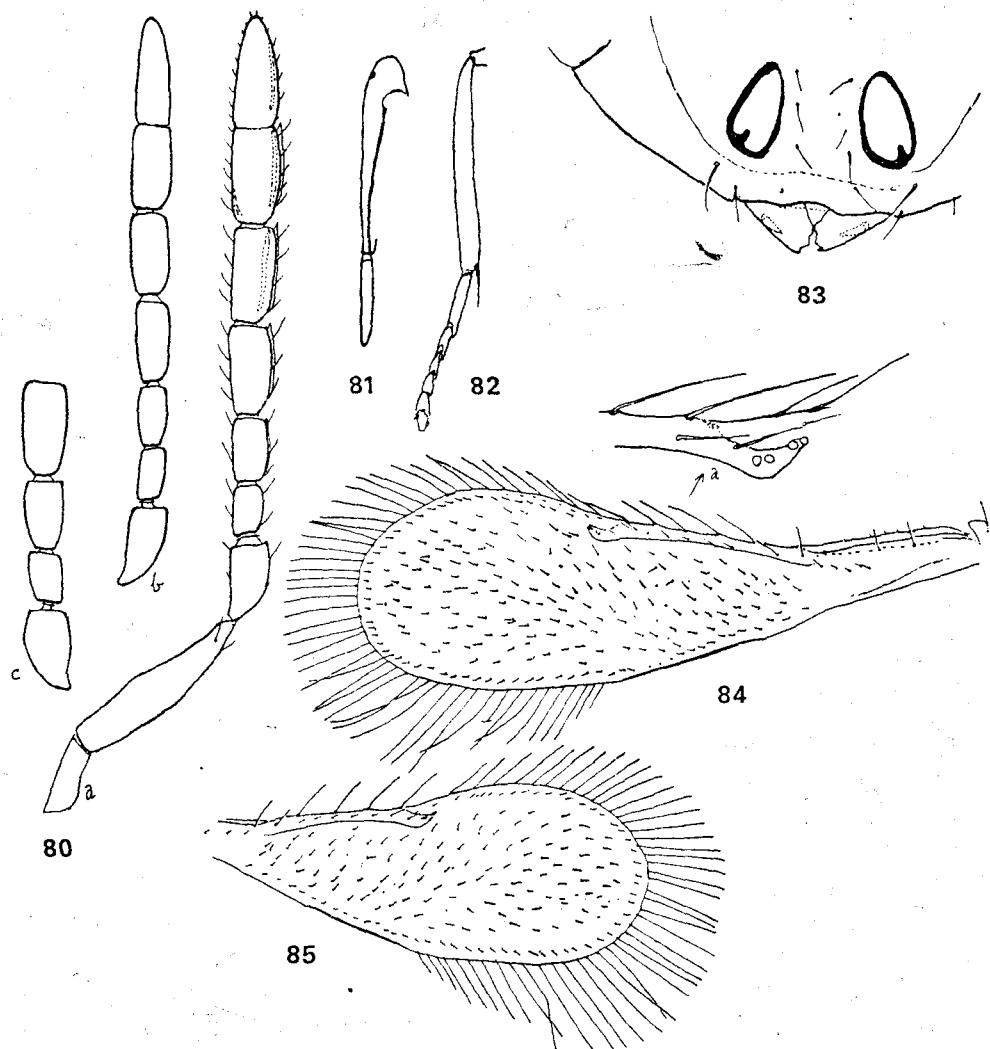
Figs. 54-63. (54-59) *Encarsia longicauda*, sp. nov., female except Fig. 59, paratypes: 54, antenna; 55, head in front view, enlarged facial region from another specimen; 56, second valvifer and third valvula; 57, middle tibia and tarsus; 58, fore wing; 59, antenna, male. Figs. 54, 58 and enlarged part of face (115E); 55, 59 (33E); 56, 57 (269E). (60-63) *Encarsia* sp., females: 60, apex of gaster, 256E; 61, 62, pedicel and F1-3, and part of sub-marginal vein and parastigma of fore wing, 34E; 63, pedicel and F1-3, 255E.



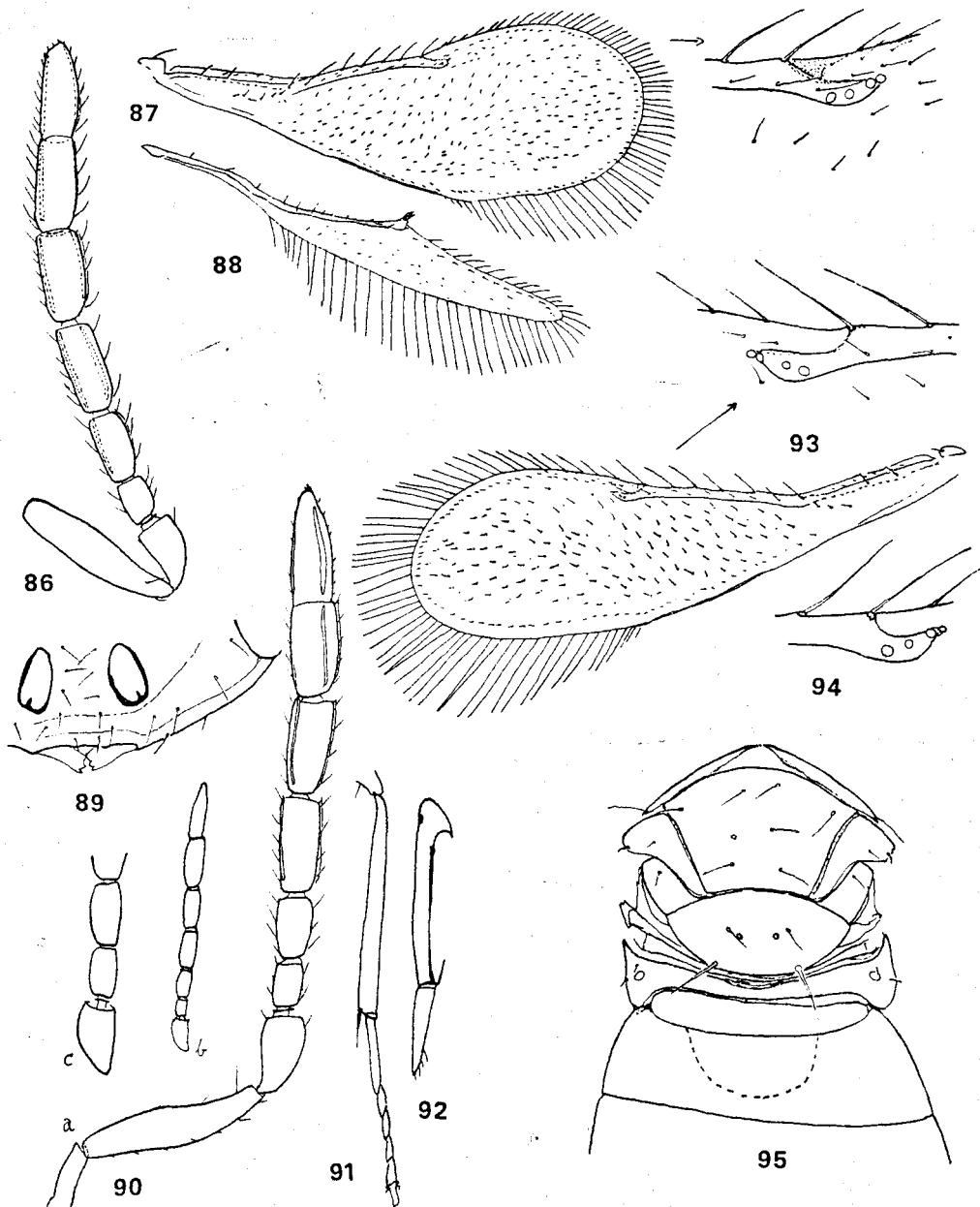
Figs. 64-71. *Encarsia albiscutellum longipalpa*, ssp. nov., female except Figs. 65 and 71, paratypes: 64, head in front view, enlarged facial region from another specimen; 65, maxillary palp, male; 66, antenna; 67, thoracic dorsum; 68, second valvifer and third valvula; and tergum VII; 69, middle tibia and tarsus; 70, fore wing; 71, antenna, male. Fig. 64 (45E); 65 (43E); 66-69 and enlarged facial region (101E); 70 (49E); 71 (44E).



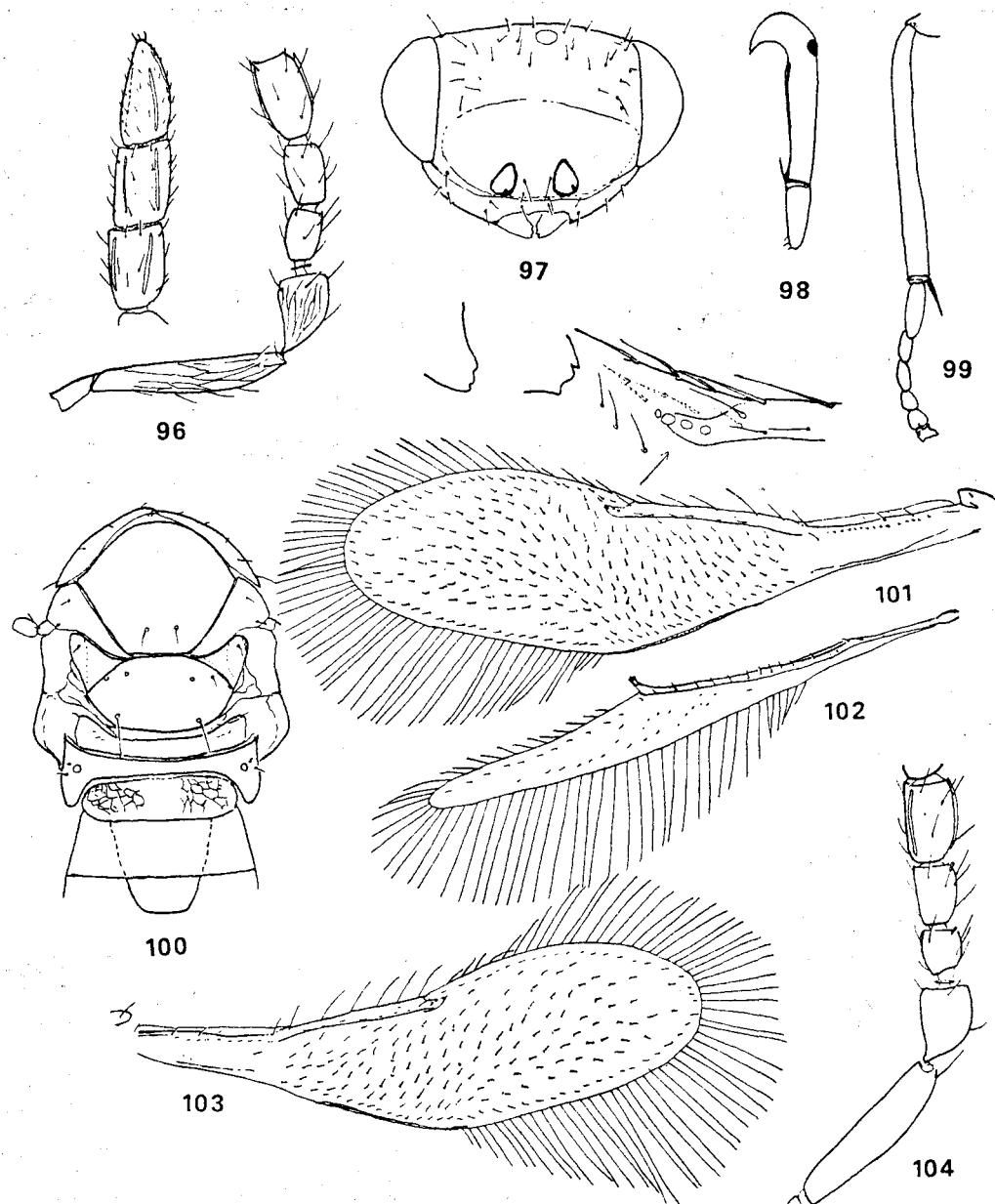
Figs. 72-79. *Encarsia merceti* Silvestri, female except Figs. 76 and 78: 72, head in front view; 73, antenna; 74, second valvifer and third valvula; 75, middle tibia and tarsus; 76, antenna, male; Fig. enlarged to show the club-shaped projection; 77, part of left fore wing, with enlarged stigmal vein from right wing; 78, part of fore wing, male; 79, apical two terga of gaster, note the subtriangular spiracular plates. Female slide 274E, male from 275E.



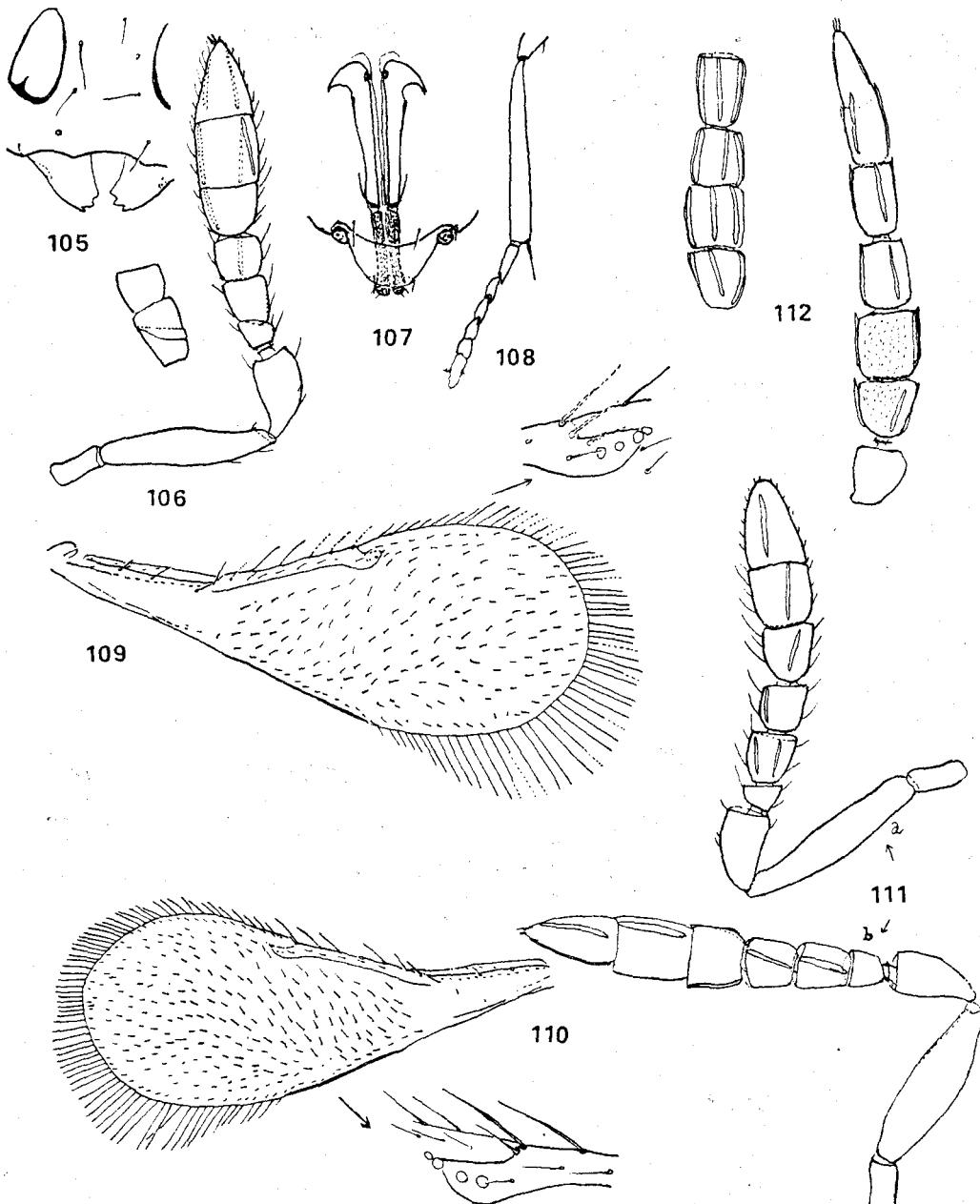
Figs. 80-85. *Encarsia duorunga*, sp. nov., female: 80, antennae or part of antennae; 81, second valvifer and third valvula; 82, middle tibia and tarsus; 83, facial region; 84, fore wing, enlarged venation from another wing; 85, fore wing. Figs 80a, 81, 82, 84 (126E); 80b (130E); 80c (87E); 83 (128E); 85 (86E).



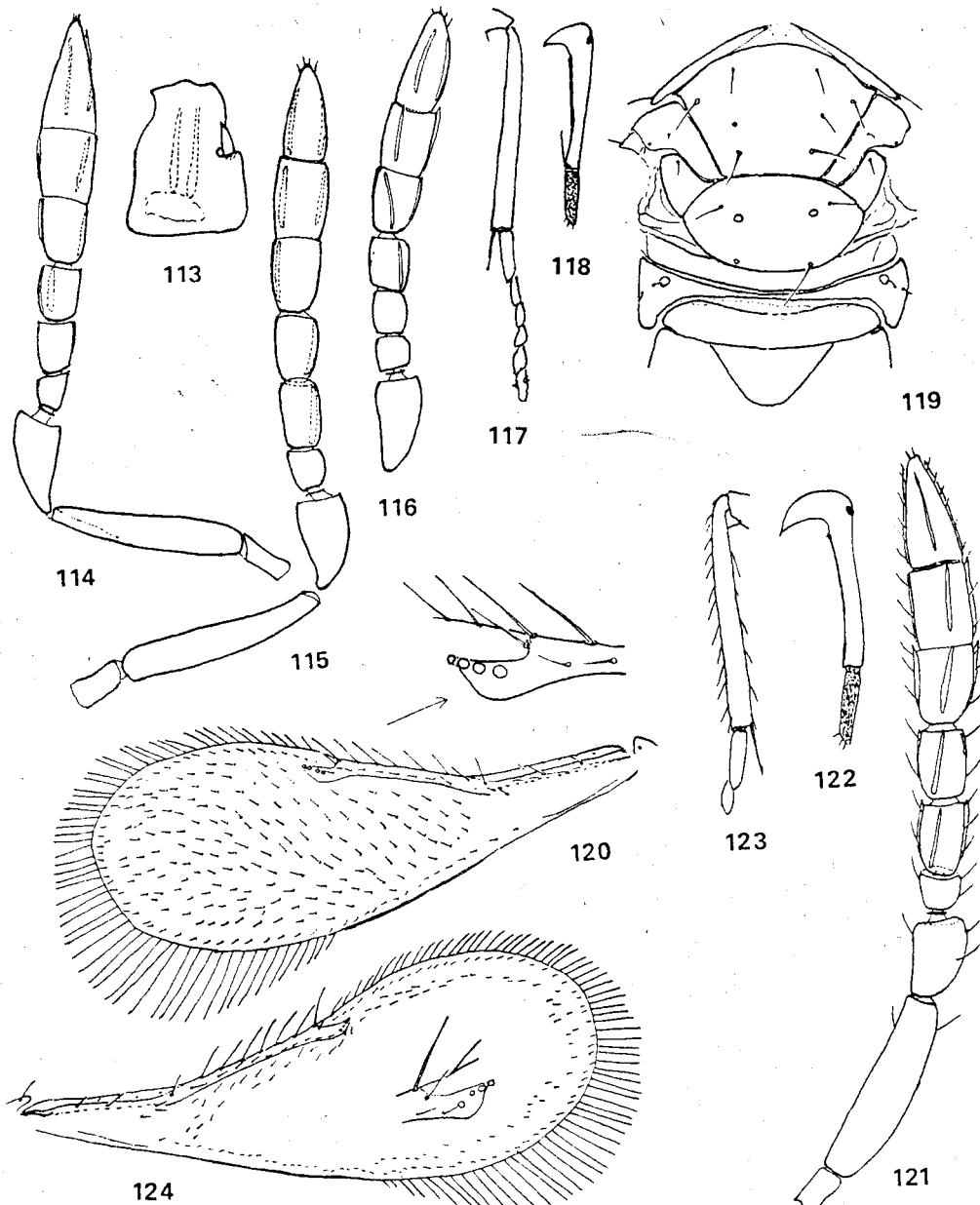
Figs. 86-95. (86-88) *Encarsia pseudococci* (Agarwal), holotype female: 86, antenna; 87, fore wing; 88, hind wing. (89-95) *Encarsia perflava*, sp. nov., female: 89, part of facial region; 90, antennae or part of antennae; 91, middle tibia and tarsus; 92, second valvifer and third valvula; 93, fore wing; 94, distal veins of right fore wing; 95, thorax and base of gaster, dorsal. Figs 89, 90a, 91-95 (102E); 90b (110E); 90c (125E).



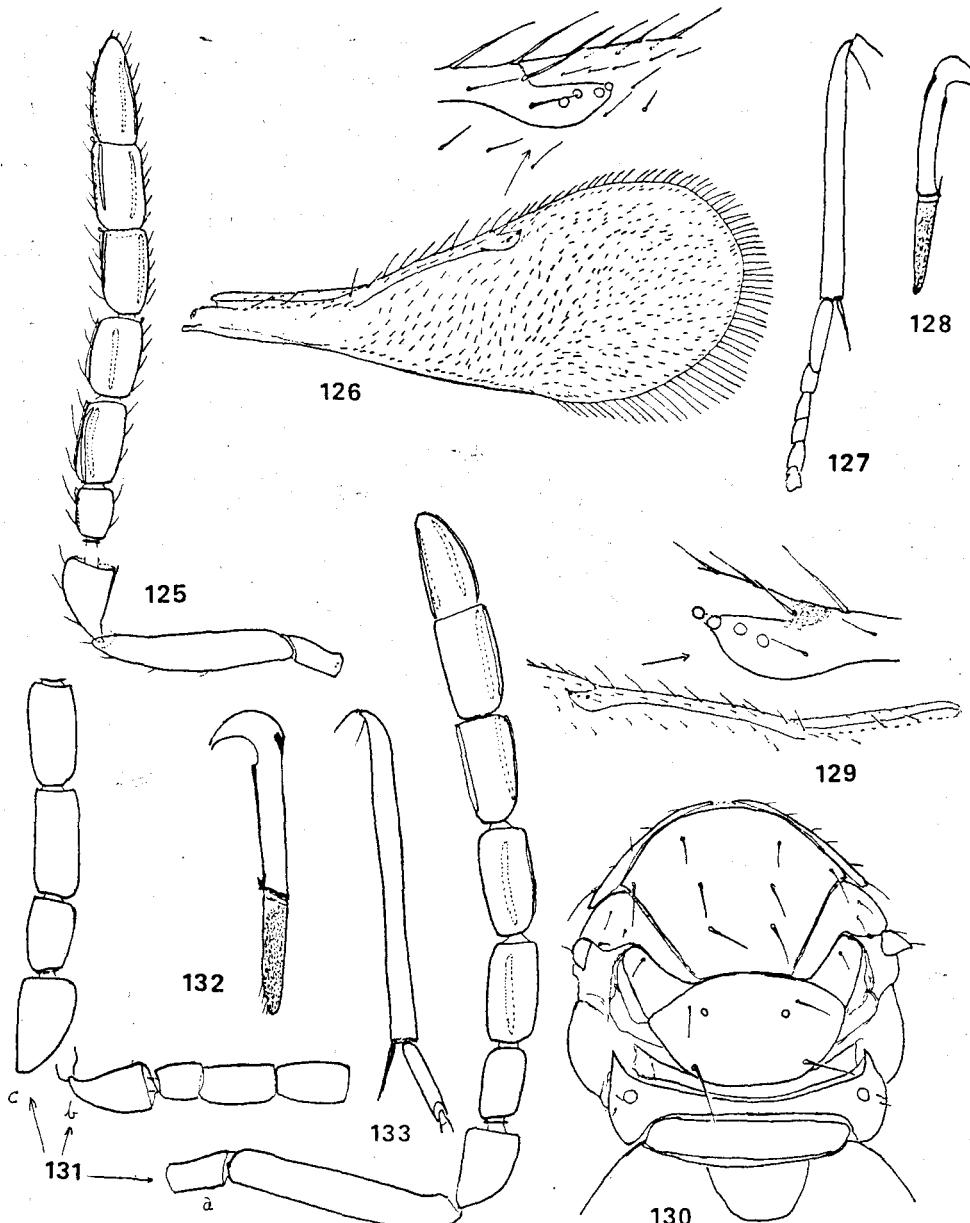
Figs. 96-104. *Encarsia sankarani*, sp. nov., female: 96, antenna; 97, head in front view, mandibles from other specimens; 98, second valvifer and third valvula; 99, middle tibia and tarsus; 100, thorax, petiole and tergum I of gaster, dorsal; 101, fore wing; 102, hind wing; 103, fore wing; 104, antenna excluding clava. Figs 98, 99 and 104 from holotype, rest from paratypes. Figs 96, 97, 100-102 (190E); 98, 99, 103, 104 (236E).



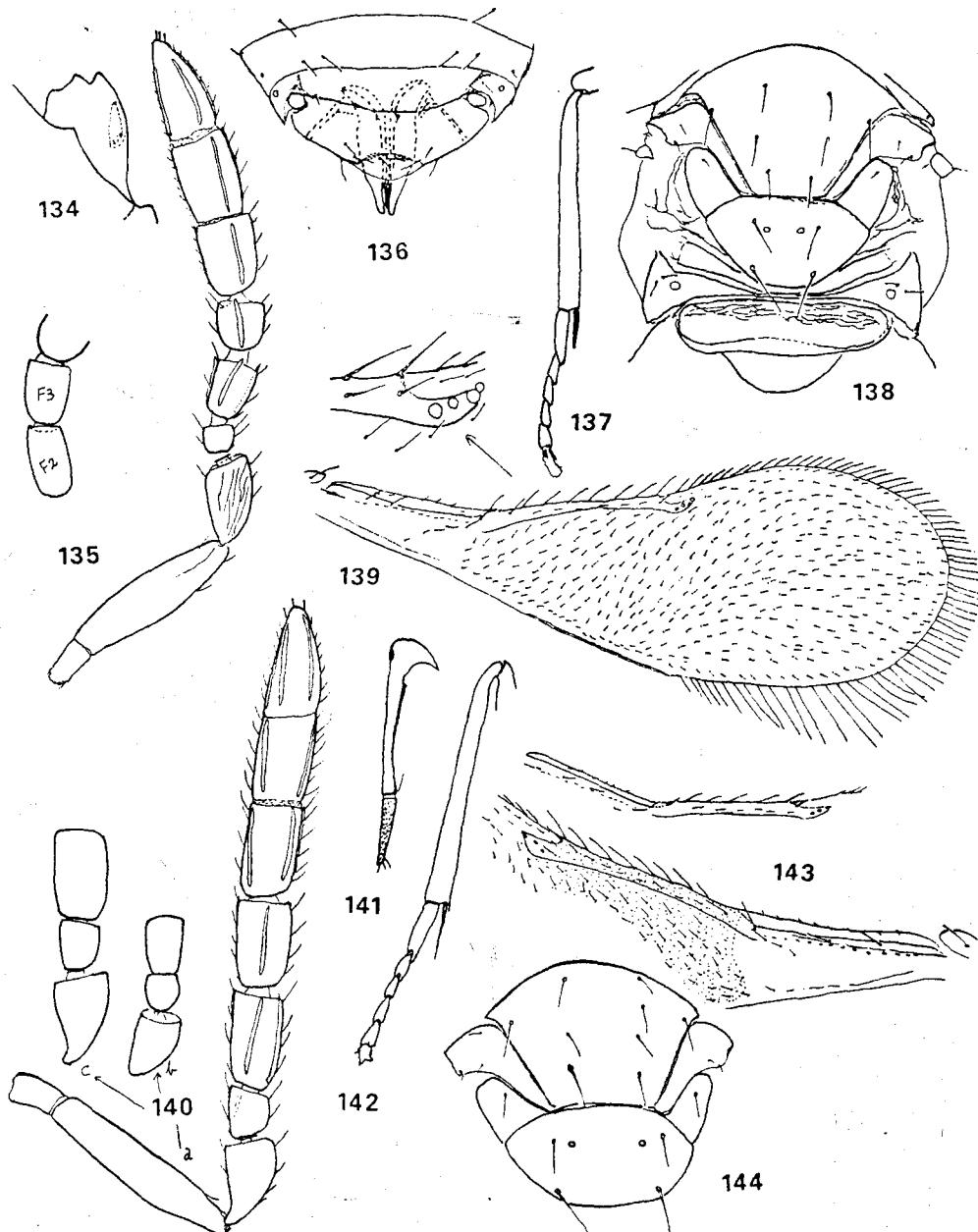
Figs. 105-112. (105-109) *Encarsia* sp., female: 105, part of facial region showing mandibles; 106, antenna, note the partly separated F2 and F3 in the left antenna; 107, second valvifer and third valvula; 108, middle tibia and tarsus; 109, forewing. (110, 111a) *Encarsia indica* (Shafee), holotype female: 110, fore wing; 111a, right antenna. (111b, 112) *Encarsia lutea* (Masi): 111b, antenna; 112, male antenna excluding scape, F1-4 from a second specimen. Fig. 111b (285E); 112 (12E); 105-109 (103E).



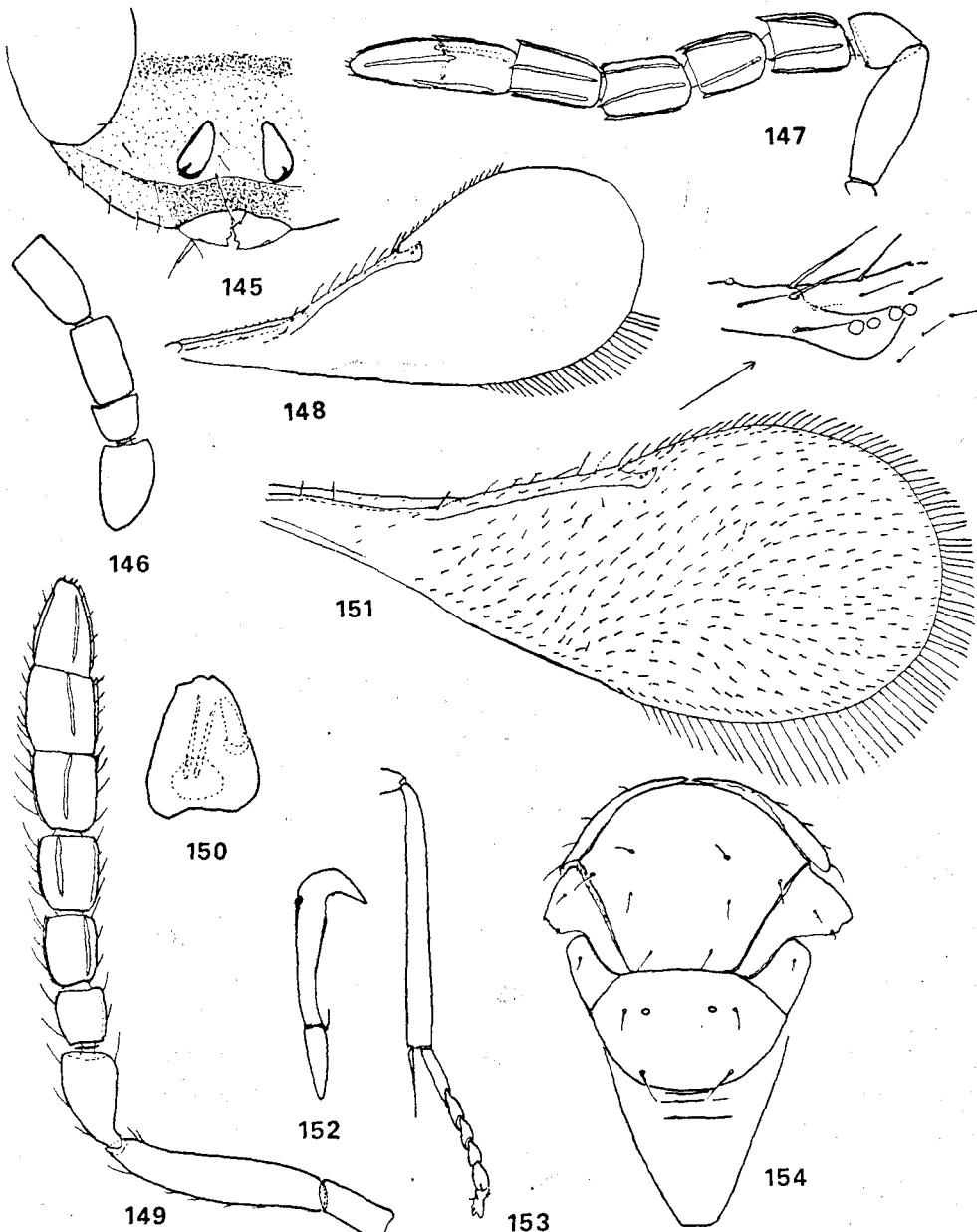
Figs. 113-124. (113-120) *Encarsia lutea* (Masi), female: 113, mandible; 114-116, antennae; 117, middle tibia and tarsus; 118, second valvifer and third valvula; 119, thoracic dorsum; 120, fore wing. (121-124) *Encarsia elongata* (Dozier), female: 121, antenna; 122, second valvifer and third valvula; 123, middle tibia and basal two tarsal segments; 124, fore wing. Figs. 113, 116-118, 120 (15E); 114 (106E); 115, 119 (122E); 121-124 (236E).



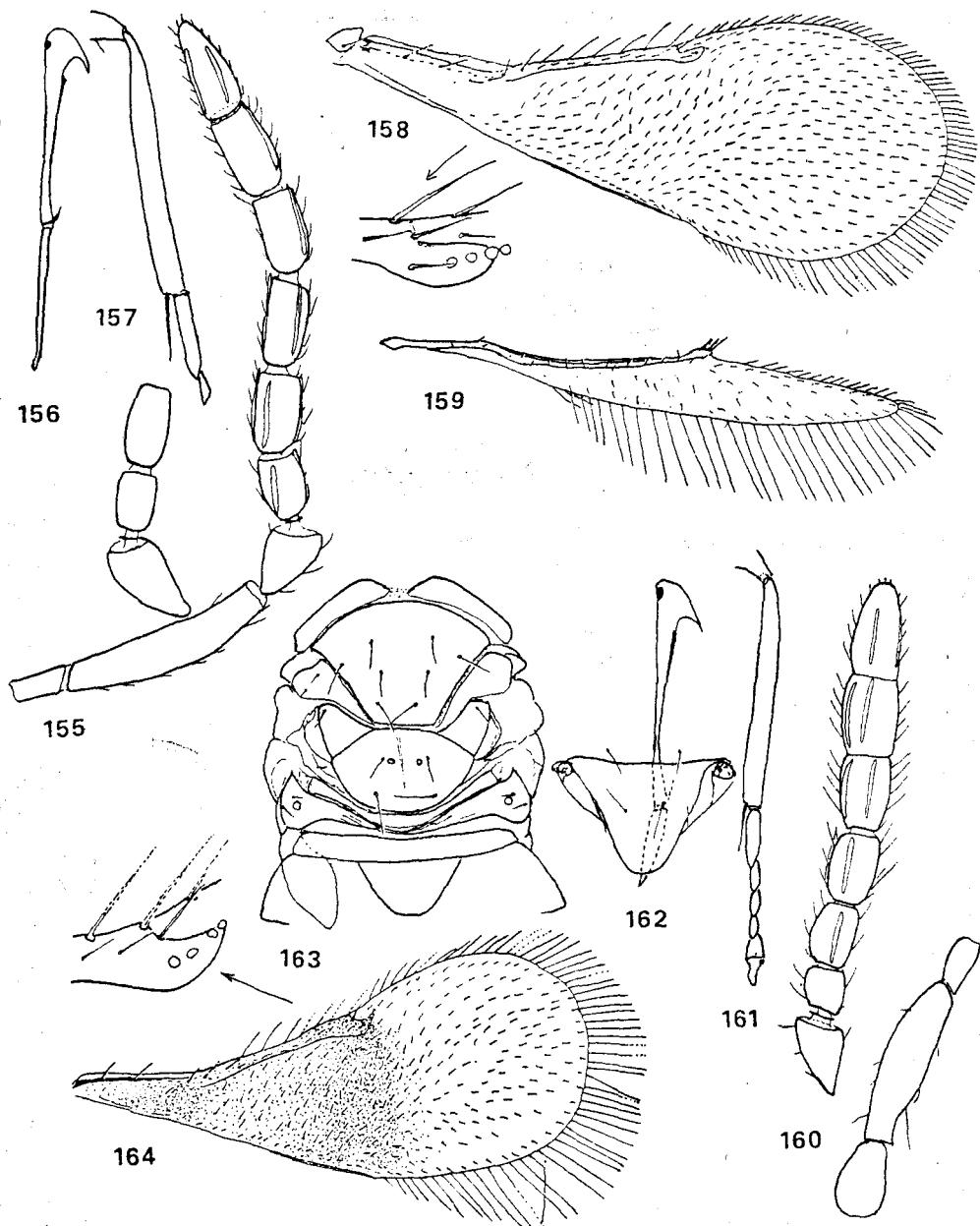
Figs. 125-133. *Encarsia udaipuriensis* (Shafee), female: 125, antenna; 126, fore wing; 127, middle tibia and tarsus; 128, second valvifer and third valvula; 129, fore wing veins, enlarged; 130, thoracic dorsum; 131, antennae or part of antennae; 132, second valvifer and third valvula; 133, middle tibia and basitarsus. Figs. 125-128 from holotype of *P. citri* Agarwal; 131a, 132, 133, from holotype of *P. udaipuriensis* Shafee; 129, 131c (28E); 130 (157E); 131b (140E).



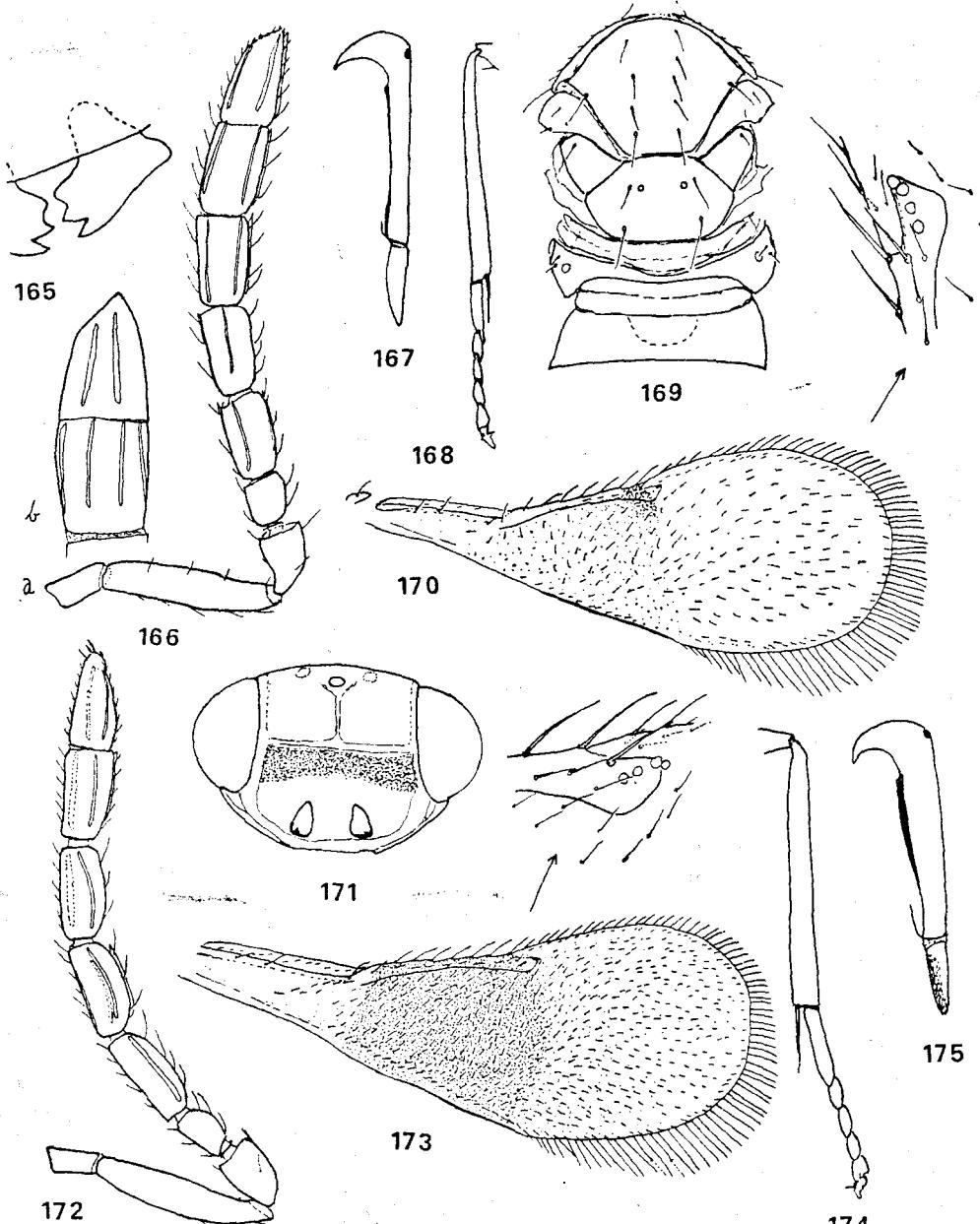
Figs. 134-144. (134-139) *Encarsia aurantii* (Howard), female: 134, mandible; 135, antenna, and longer F3 in one antenna; 136, distal part of gaster with ovipositor; 137, middle tibia and tarsus; 138, thoracic dorsum; 139, fore wing. (140-144) *Encarsia perniciosi* (Tower), female: 140, antennae or part of antennae; 141, second valvifer and third valvula; 142, middle tibia and tarsus; 143, part of fore wing from one specimen and venation from a second specimen; 144, mesothorax, dorsal. Figs. 134-136, 139 (92E); 135 from a specimen from CIBC Bangalore collection; 140, only venation in Fig. 143, 144 (161E); 141, 142, 143 (10E).



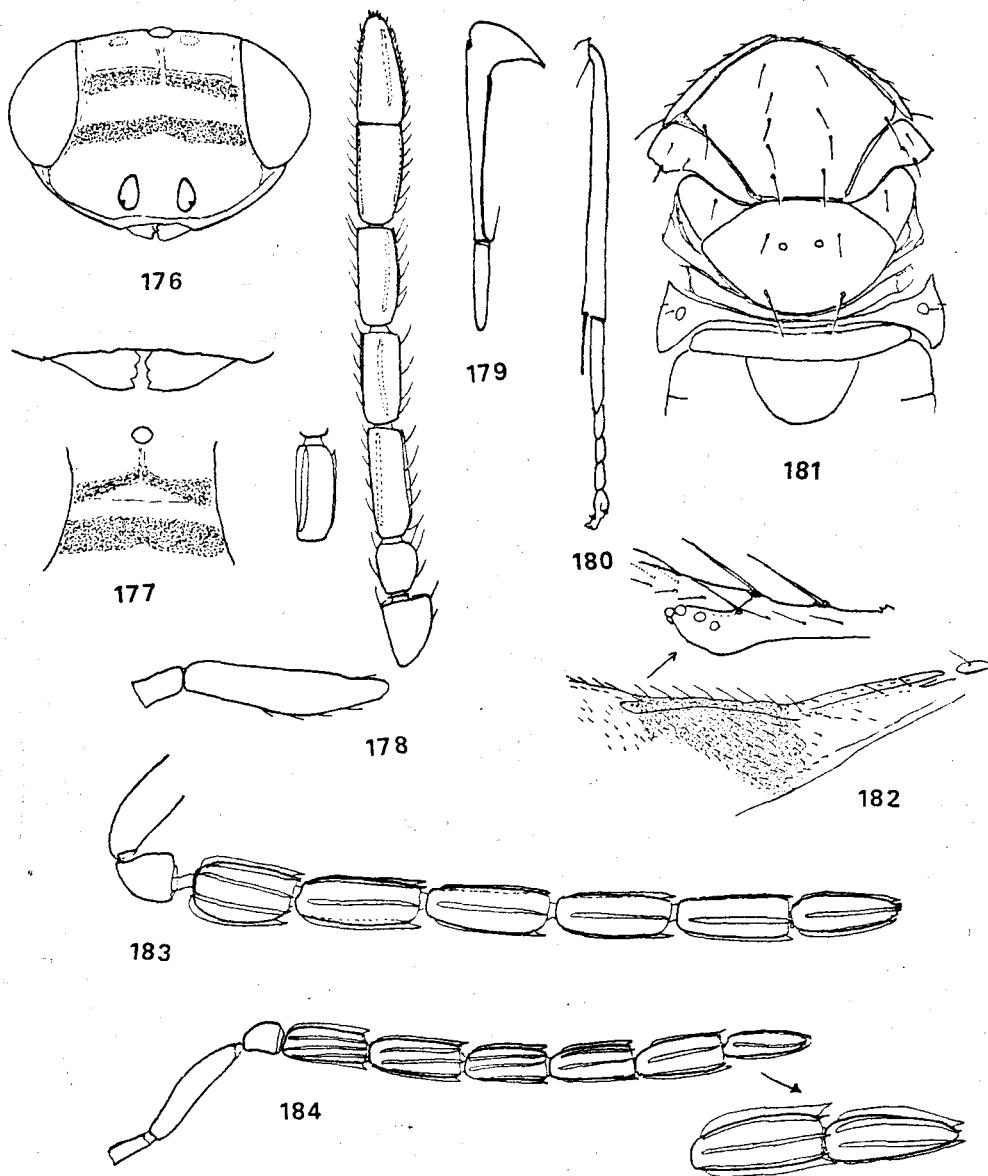
Figs. 145-154. (145-148) *Encarsia perniciosi* (Tower), female except Fig. 147: 145, part of head, note the brown band above toruli; 146, pedicel and F1-3; 147, antenna male; 148, fore wing with short marginal fringe. (149-154) *Encarsia pura*, sp. nov., female: 149, antenna; 150, mandible; 151, fore wing; 152, second valvifer and third valvula; 153, middle tibia and tarsus; 154, pro- and mesothorax, dorsal. Figs 145, 146 (213E); 147 (212E); 148 (217E); 149, 151, 154 (58E, holotype); 150, 152, 153 (59E, paratype).



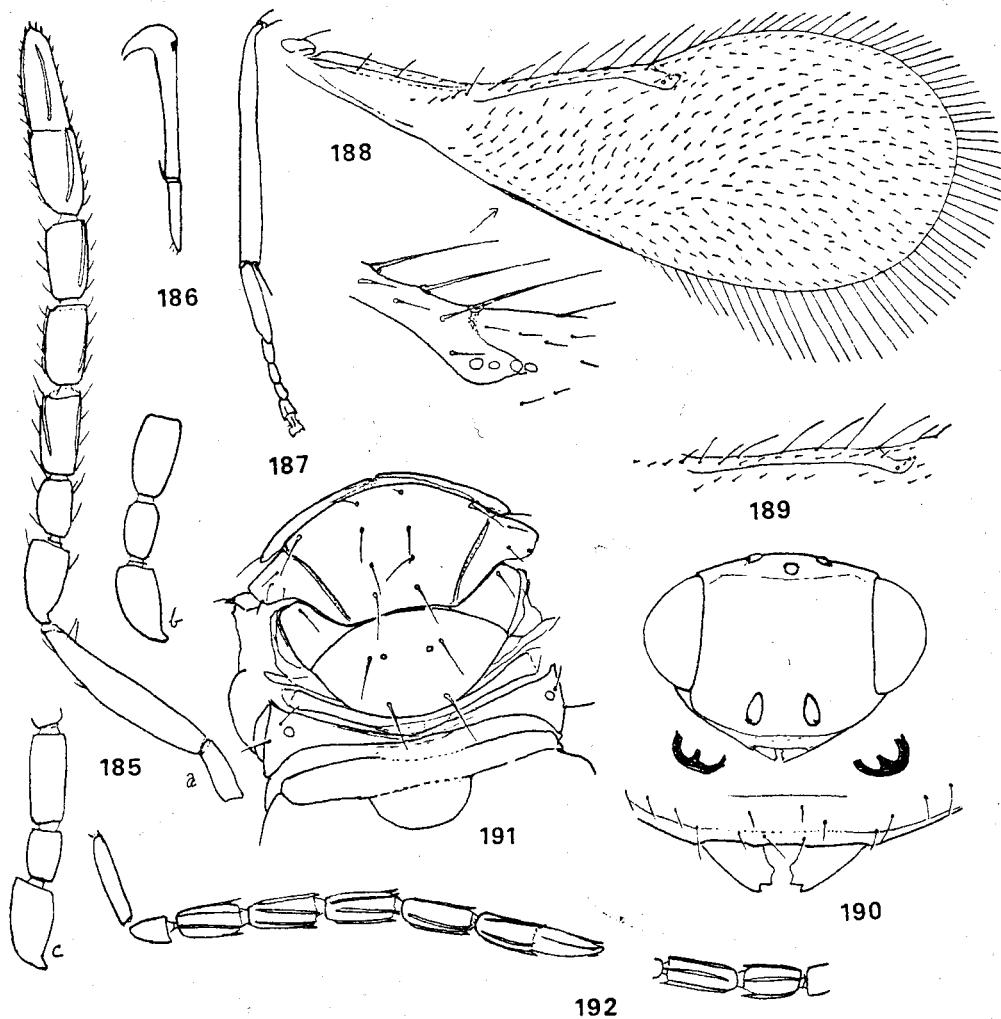
Figs. 155-164. (155-159) *Encarsia bangalorensis*, sp. nov., holotype female, 257E: 155, antennae; 156, second valvifer and third valvula; 157, middle tibia and basal two tarsal segments; 158, fore wing; 159, hind wing. (160-164) *Encarsia coimbatorensis*, sp. nov., holotype female, 254E: 160, antennae; 161, middle tibia and tarsus; 162, second valvifer, third valvula and tergum VII; 163, thorax and tergum I of gaster, dorsal; 164, fore wing.



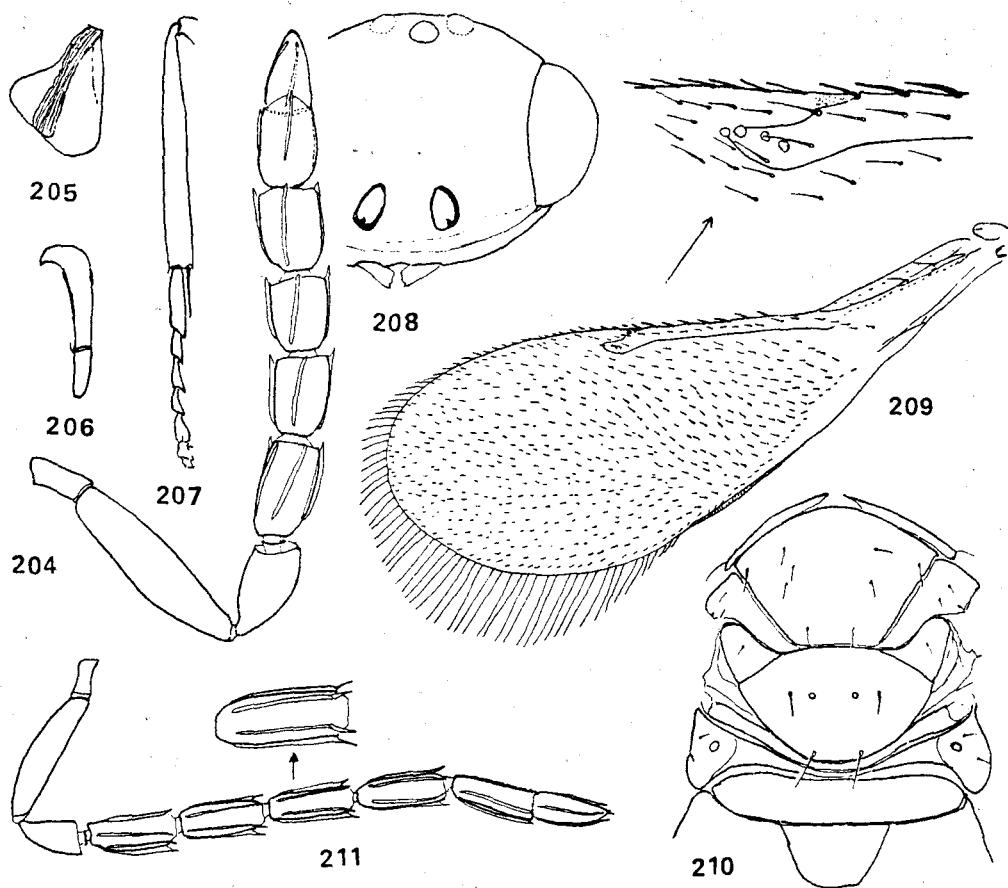
Figs. 165-175. (165-170) *Encarsia obtusiclava*, sp. nov., female: 165, mandible; 166, antenna, and collapsed F5 and F6; 167, second valvifer and third valvula; 168, middle tibia and tarsus; 169, thorax and base of gaster, dorsal; 170, fore wing. (171-175) *Encarsia narayananai* Agarwal, holotype female: 171, head in front view; 172, antenna; 173, fore wing; 174, middle tibia and tarsus; 175, second valvifer and third valvula. Fig. 166 (117E); 165, 167, 168, 170 (25E); 169 (179E); enlarged F5 and F6 (235E).



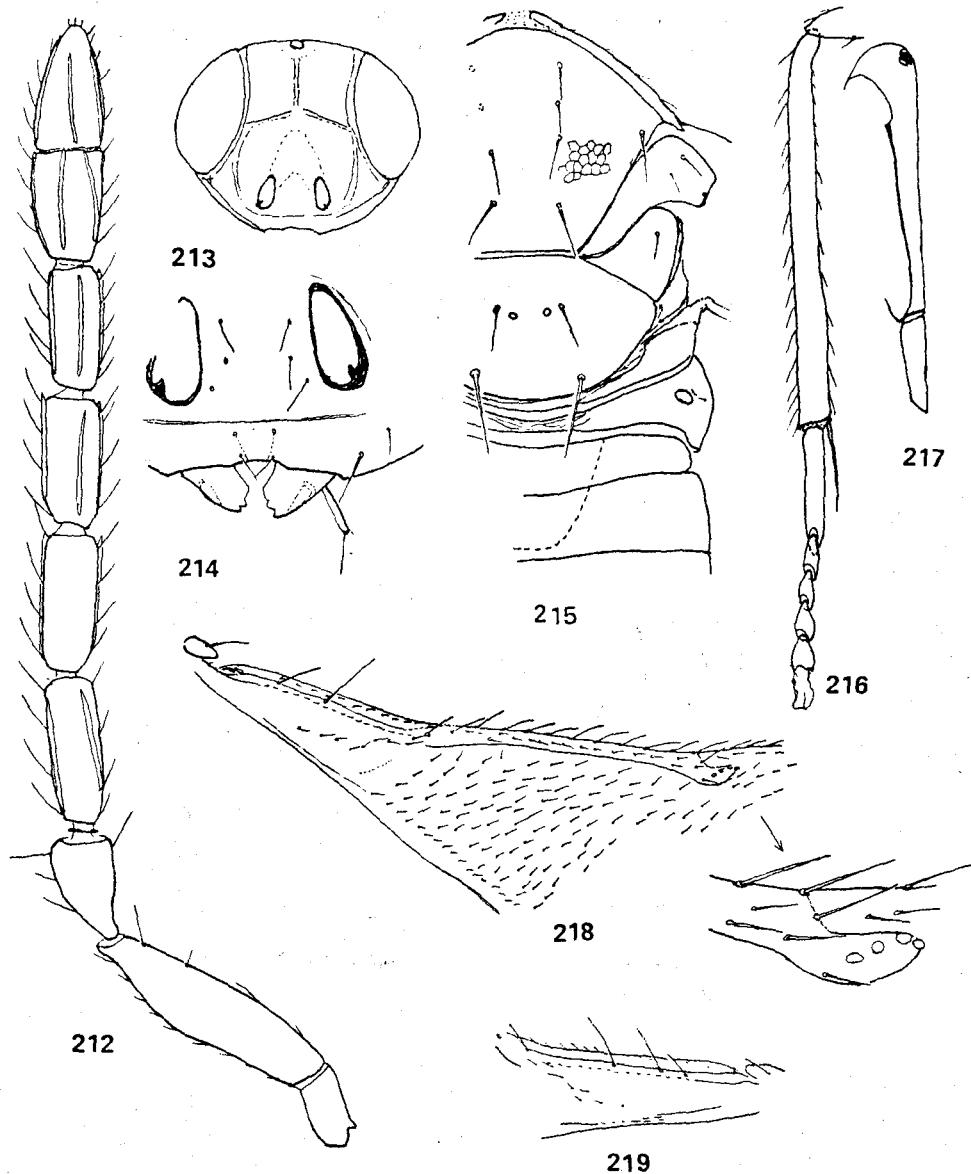
Figs. 176-184. (176-183) *Encarsia bifasciafacies*, sp. nov., female except Fig. 183: 176, head in front view; 177, facial region; 178, antenna, with F2 from another specimen; 179, second valvifer and third valvula; 180, middle tibia and tarsus; 181, thorax with base of gaster, dorsal; 182, part of fore wing; 183, antenna male. (184) *Encarsia obtusiclava*, sp. nov. antenna male (118E). Figs 176, 177, 181, (5E); 178-180, 182 (1E); 183 (4E), F2 shown separately (181E).



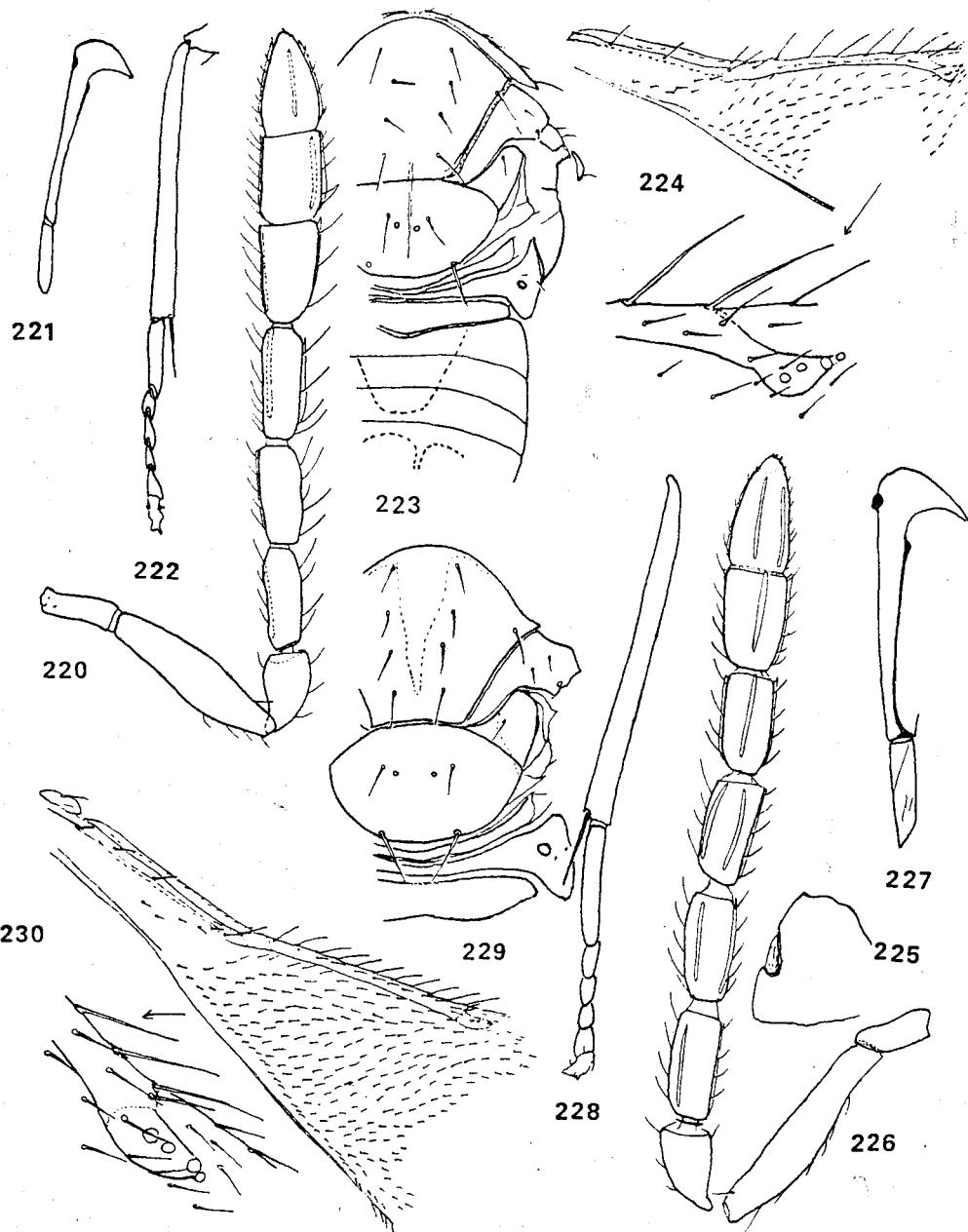
Figs. 185-192. *Encarsia gunturensis* (Azim & Shafee), female except Fig. 192: 185, antennae, or part of antennae; 186, second valvifer and third valvula; 187, middle tibia and tarsus; 188, 189, fore wing and distal venation; 190, head in front view, enlarged facial region from another specimen; 191, thoracic dorsum; 192, antennae. Figs. 185a, face (133E); 185b, c, 186, 187, 189, 191 (178E); 188, 190, 192 (165E).



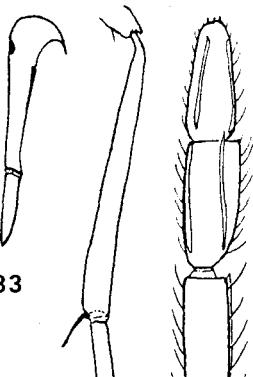
Figs. 204-211. *Encarsia tristis* (Zehntner), female except Fig. 211: 204, antenna; 205, outer plate of ovipositor; 206, second valvifer and third valvula; 207, middle tibia and tarsus; 208, part of head, front view; 209, fore wing; 210, thorax and base of gaster, dorsal; 211, male antenna. Figs. 204-207, 209 (8E); 208 (6E); 210 (182E); 211 (7E).



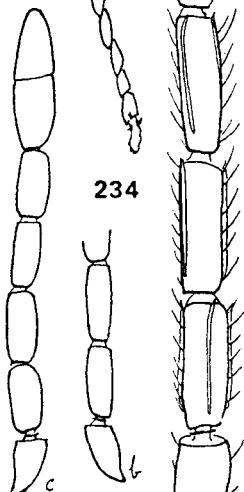
Figs. 212-219. *Encarsia septentrionalis*, sp. nov., female: Fig. 219 from holotype, rest from paratypes: 212, antenna; 213, head in front view; 214, facial region; 215, part of thorax and of gaster, dorsal; 216, middle tibia and tarsus; 217, second valvifer and third valvula; 218, part of fore wing; 219, basal third of fore wing. Figs. 212, 214, 216, 217 (99E); 213, 218 (56E); 215 (55E); 219 (100E).



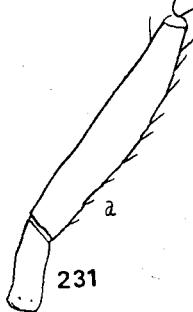
Figs. 220-230. (220-224) *Encarsia norani*, sp. nov., holotype female; 85E: 220, antenna; 221, second valvifer and third valvula; 222, middle tibia and tarsus; 223, part of thorax and of gaster, dorsal; 224, part of fore wing. (225-230) *Encarsia isaaci* Mani, female: 225, mandible; 226, antenna; 227, second valvifer and third valvula; 228, middle tibia and tarsus; 229, part of thoracic dorsum; 230, part of fore wing, infuscation not shown. Figs. 225, 229, 230 (50E); 226-228 (51E).



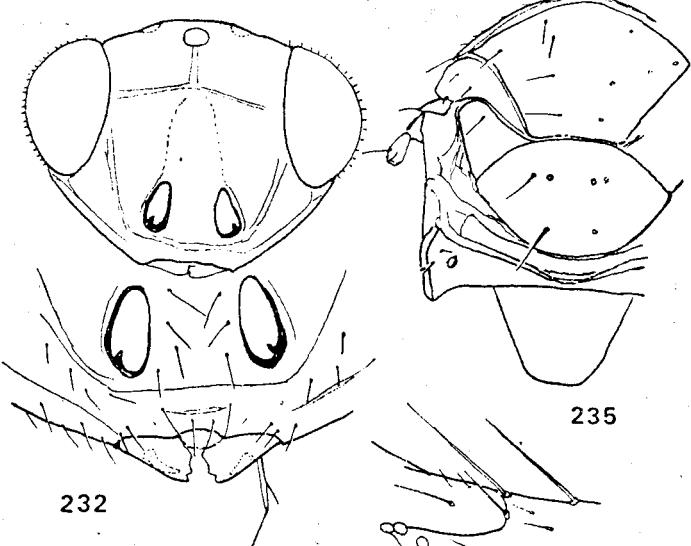
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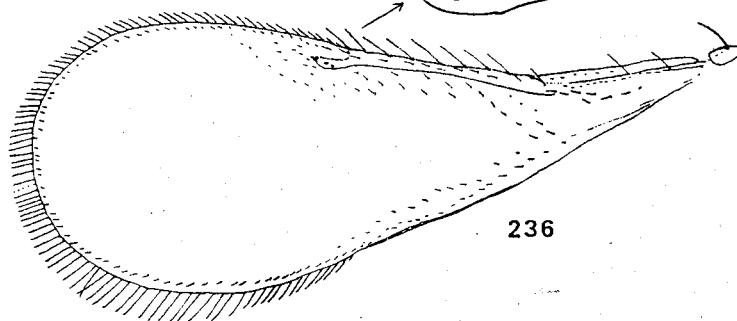
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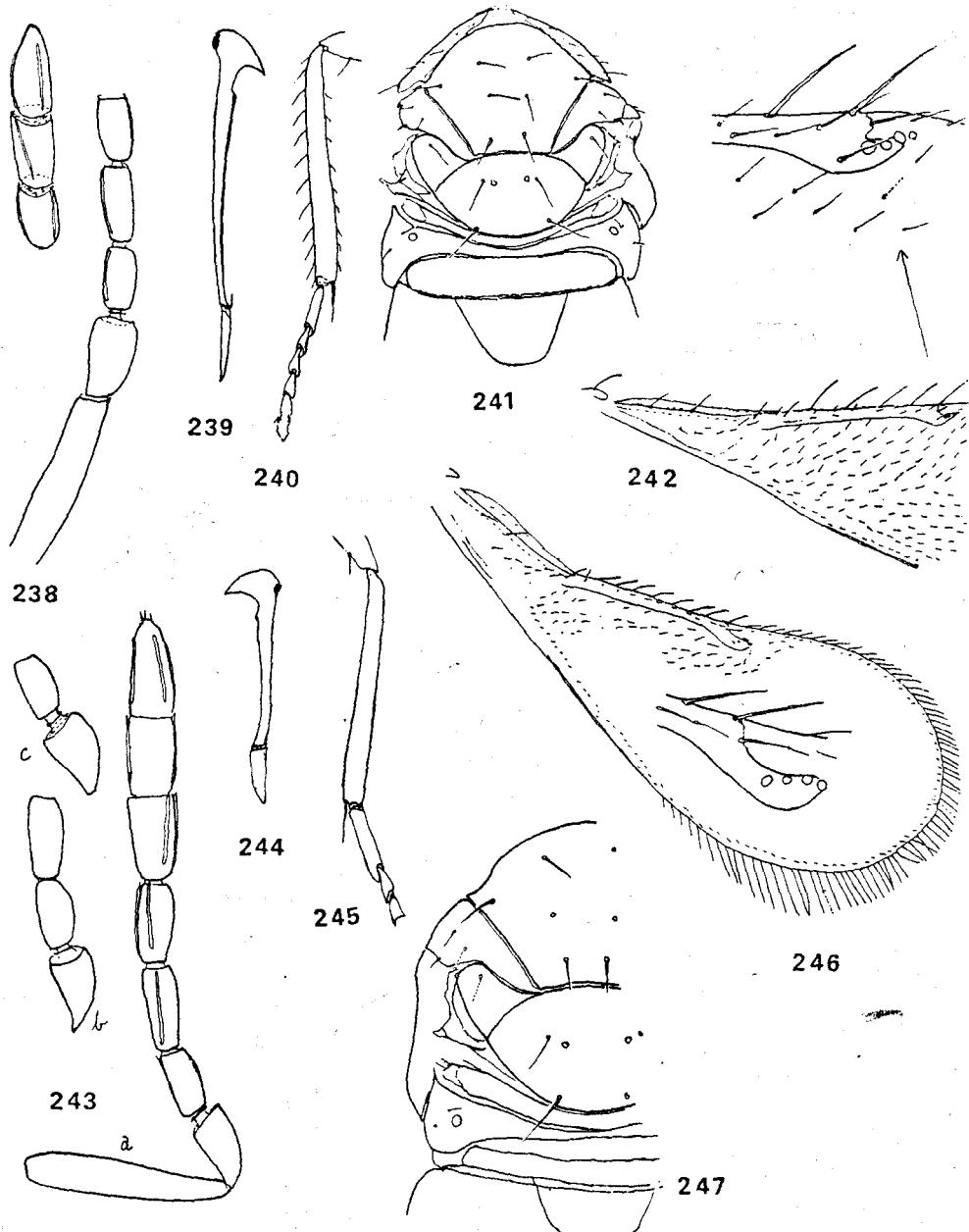
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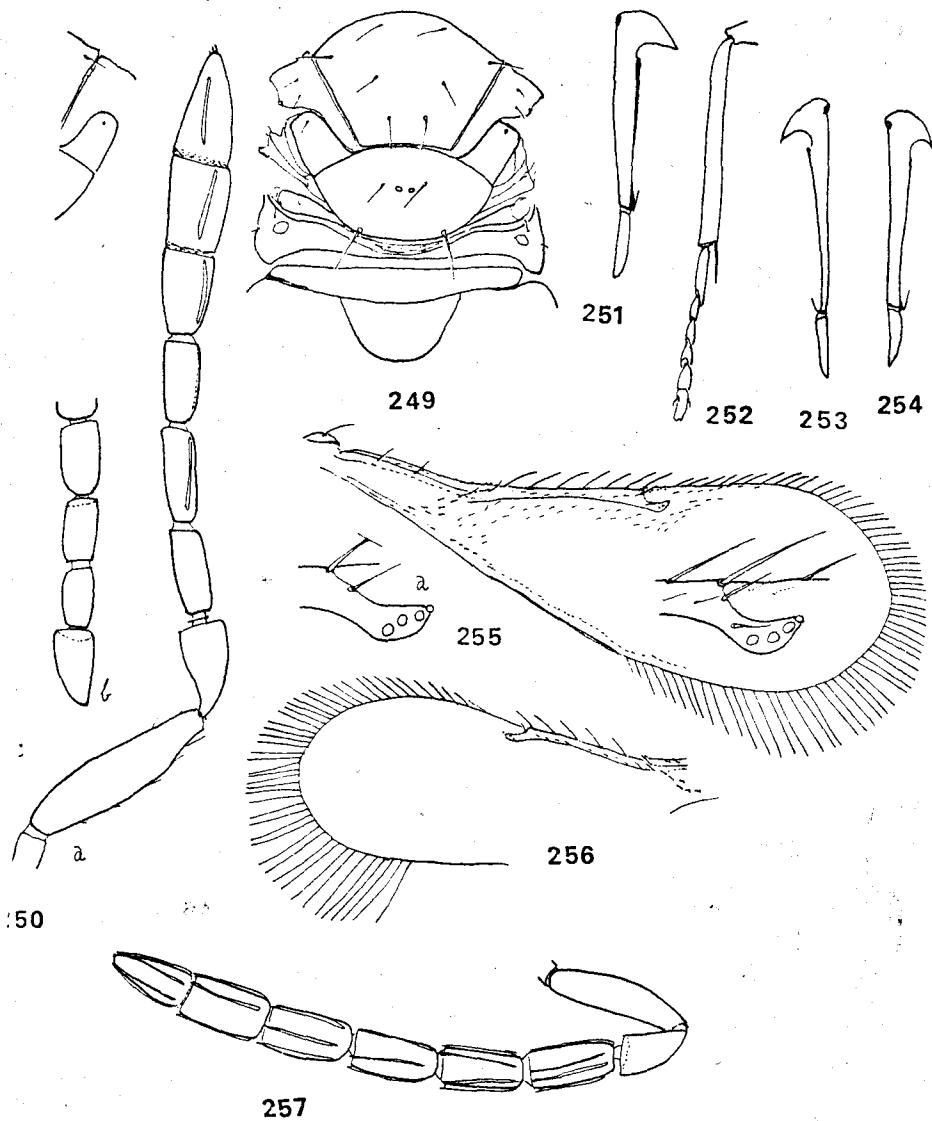
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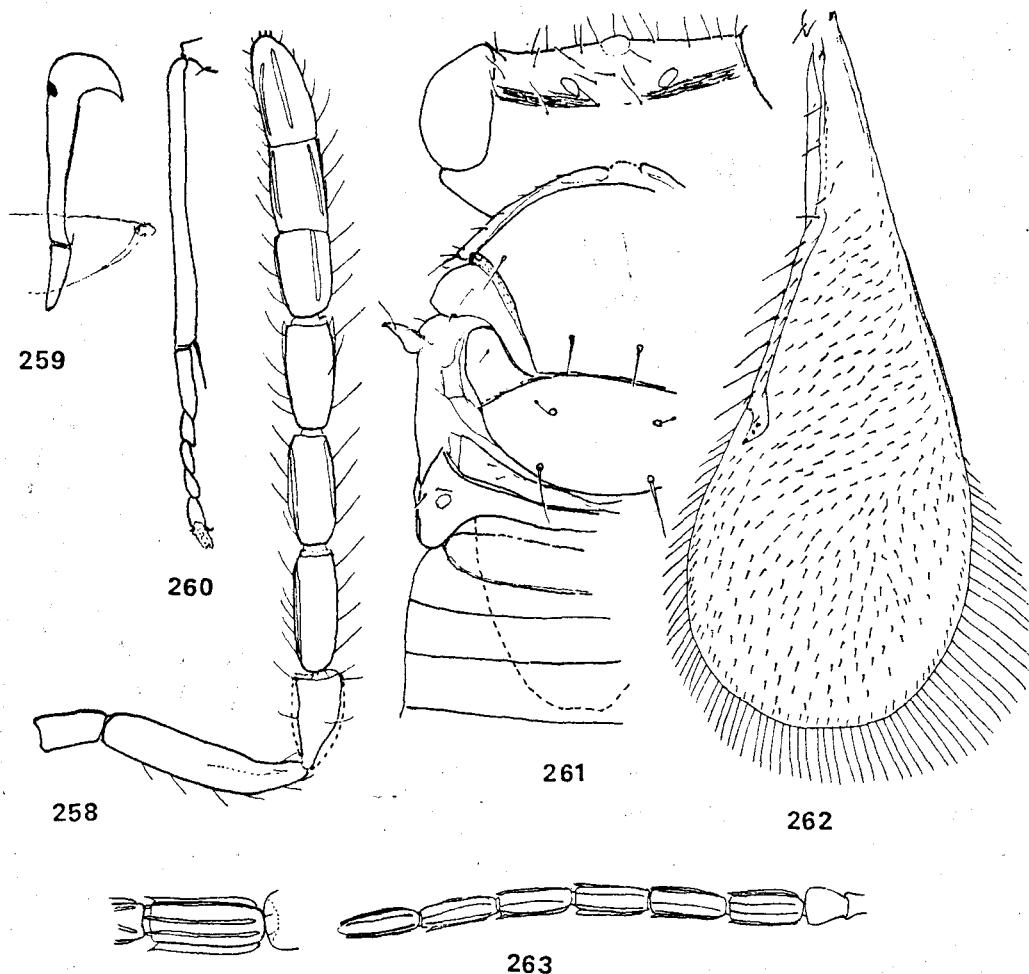
Figs. 231-237. *Encarsia inaron* (Walker), female: 231, antennae; 232, head in front view, enlarged facial region from another specimen; 233, second valvifer and third valvula; 234, middle tibia and tarsus; 235, part of thoracic dorsum; 236, fore wing; 237, middle tibia and tarsus. Figs. 231a, 232 head front view, 236 (17E); 231b (21E); 231c, 233, 234 (144E); 231d, 237 (22E); 235 (19E); 232 enlarged facial region (173E).



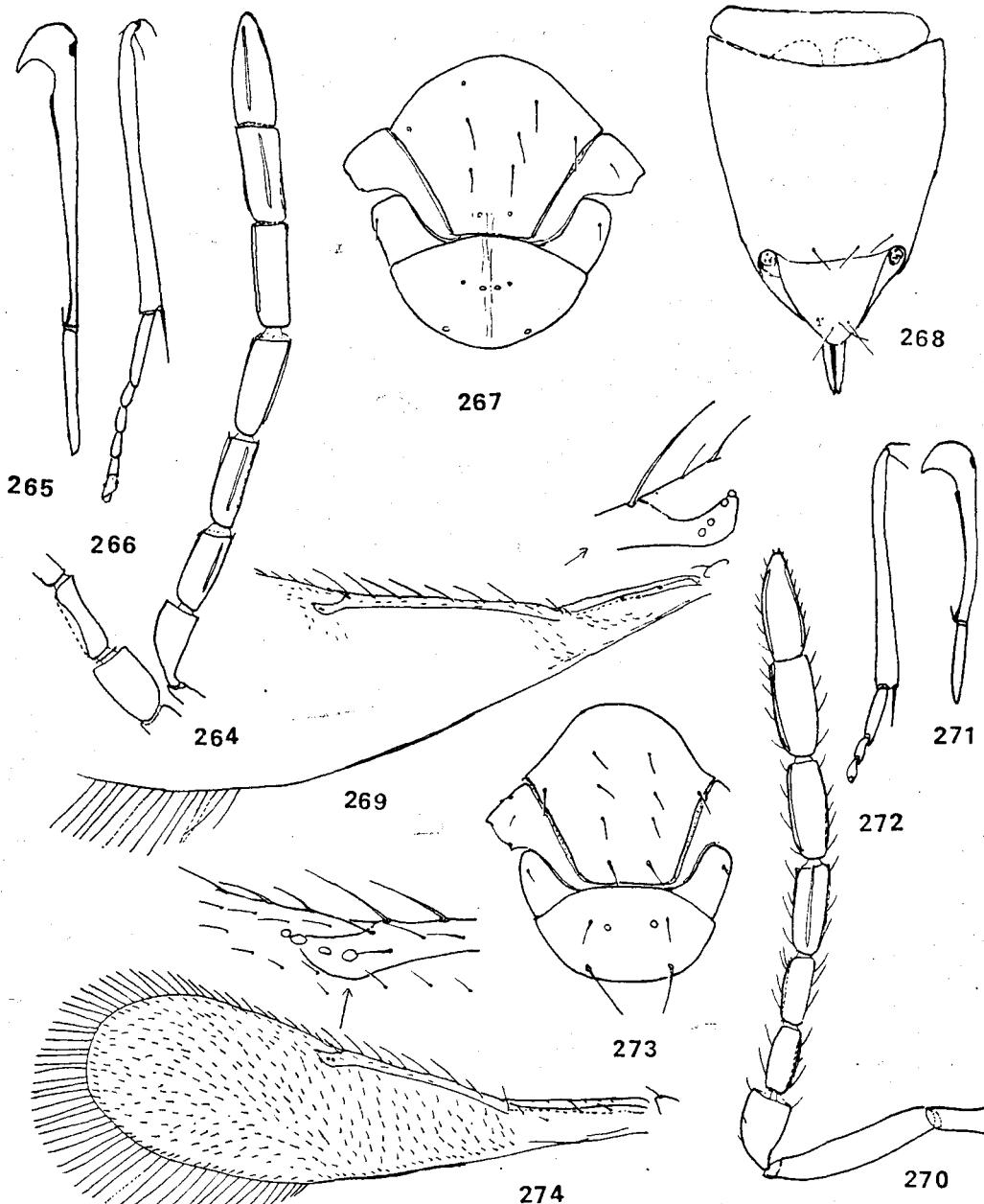
Figs. 238-247. (238-242) *Encarsia brevivalvula*, sp. nov., holotype female, 151E: 238, antenna; 239, second valvifer and third valvula; 240, middle tibia and tarsus; 241, thoracic dorsum; 242, part of fore wing. (243-247) *Encarsia confusa*, sp. nov., female: 243, antennae or part of antennae; 244, second valvifer and third valvula; 245, middle tibia and basal three tarsal segments; 246, fore wing; 247, part of thoracic dorsum. Fig. 243c (90E); rest from slide 147E. Figs. 243a, 244 and 245 from holotype, rest of Figs. from paratype.



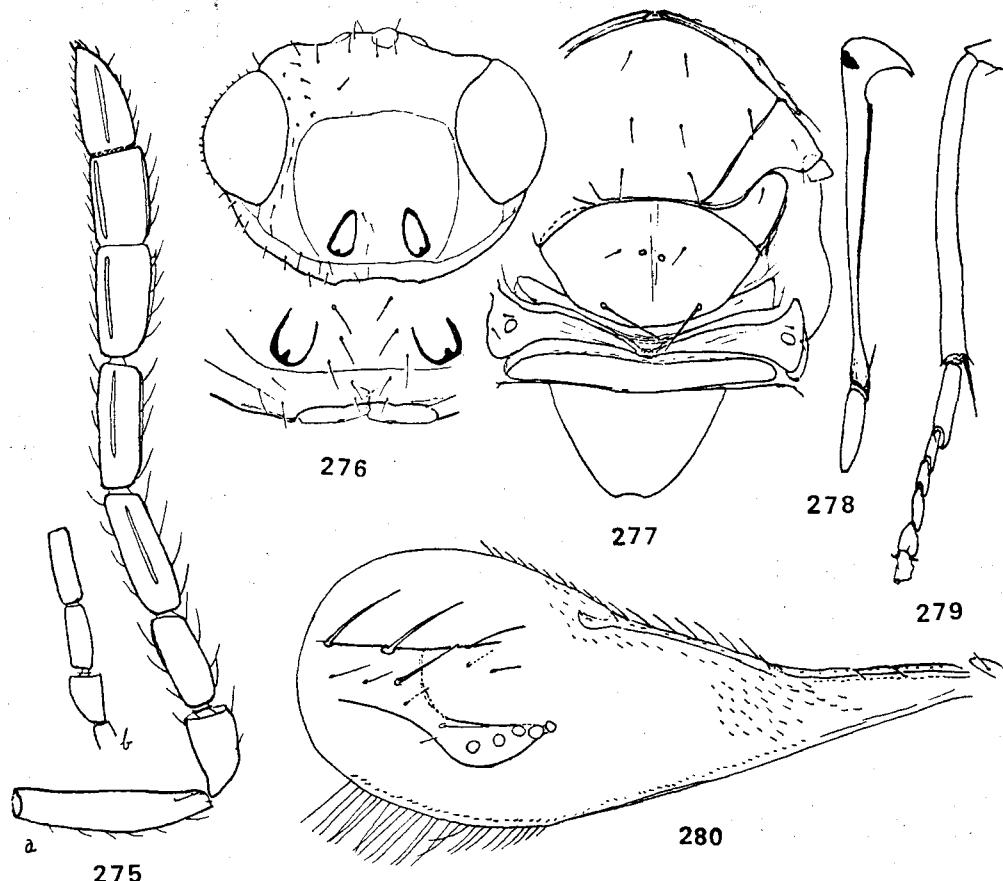
Figs. 248-257. *Encarsia transvena* (Timberlake), female  
 except Fig. 257: 248, 249, thoracic dorsum, part of left side omitted in Fig. 248; 250, antennae or part of antennae; 251, 253, 254, second valvifer and third valvula, in three specimens; 252, middle tibia and tarsus; 255, fore wing, right variation in stigmal vein shown in Fig. 255a; 256, right of fore wing showing longer marginal fringe; 257, male antenna. Figs. 248, 254 (155E); 249 (166E); 250a, 250b (121E); 250c (73E); 250c (120E); 251, 252, 256 (142E); 253 (147E); 255 (91E); 257 (76E).



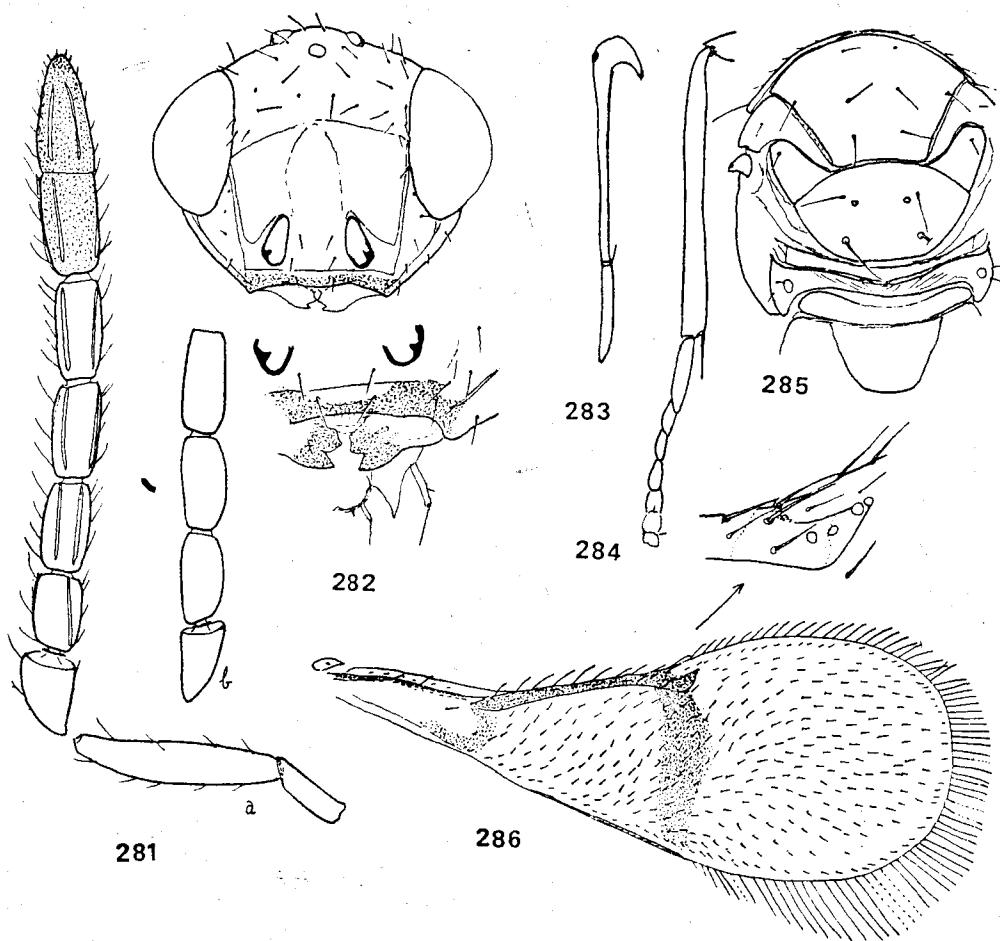
Figs. 258-263. (258-262) *Encarsia lahorensis* (Howard), female, 248E; 258, antenna; 259, second valvifer and third valvula; 260, middle tibia and tarsus; 261, part of head, thorax and gaster, dorsal; 262, fore wing. (263) *Encarsia leptosoma*, sp. nov., male antenna with F1 enlarged, 97E.



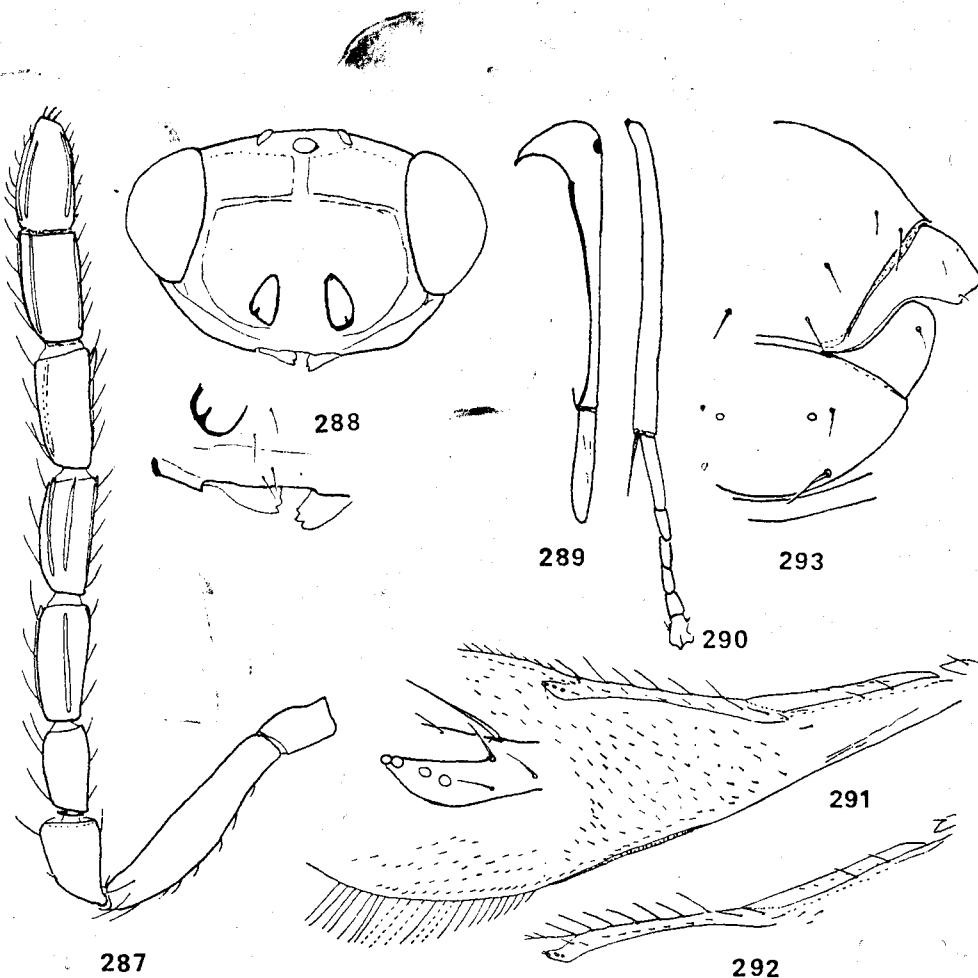
Figs. 264-274. (264-269) *Encarsia muliyali* Mani, holotype female: 264, antenna, with pedicel and F1 of left antenna; 265, second valvifer and third valvula; 266, middle tibia and tarsus; 267, mesothoracic dorsum; 268, petiole and gaster, dorsal; 269, part of left fore wing, enlarged stigmal vein from right fore wing. (270-274) *Encarsia leptosoma*, sp. nov., female: 270, antenna; 271, second valvifer and third valvula; 272, middle tibia and basal three tarsal segments; 273, mesothoracic dorsum; 274, fore wing. Figs 270-272, 274 (61E); 273 (63E).



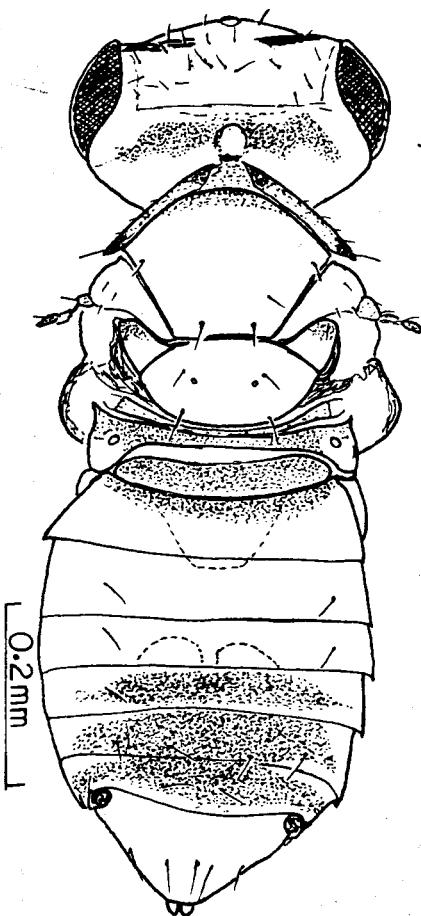
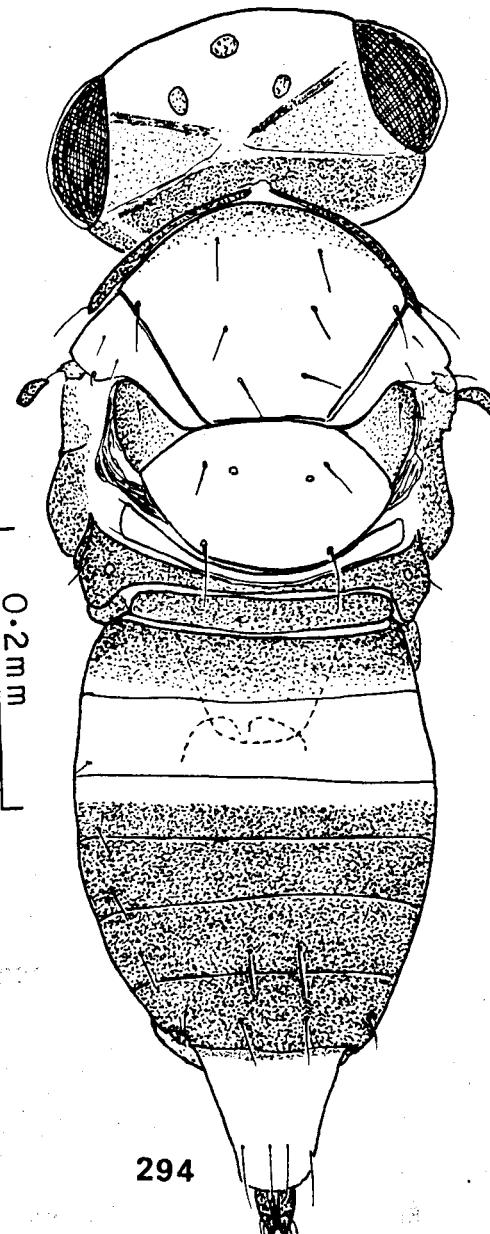
Figs. 275-280. *Encarsia dialeurodis*, sp. nov., female: 275, antennae; 276, head in front view; 277, thoracic dorsum; 278, second valvifer and third valvula; 279, middle tibia and tarsus; 280, fore wing, enlarged veins from another specimen. Figs 275b, 280 (from holotype, 272E); rest from paratypes; 275a, 277 (271E); 276, 278, 279 and enlarged venation (249E).



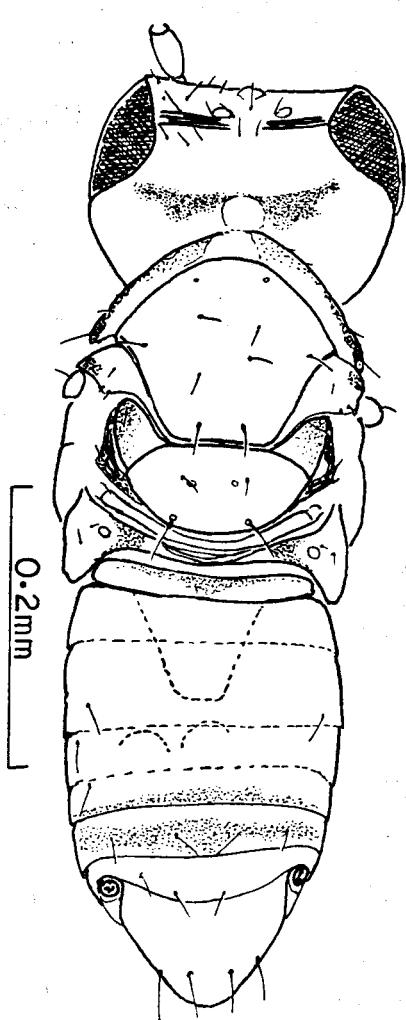
Figs. 281-286. *Encarsia bennetti* Hayat, paratype females, except Fig. 281b: 281, antennae; 282, head in front view, enlarged facial region from another specimen; 283, second valvifer and third valvula; 284, middle tibia and tarsus; 285, thoracic dorsum; 286, fore wing. Figs. 281a, 282 enlarged facial region, 286 (94E); 281b (96E); 282 (93E); 283-285 (95E).



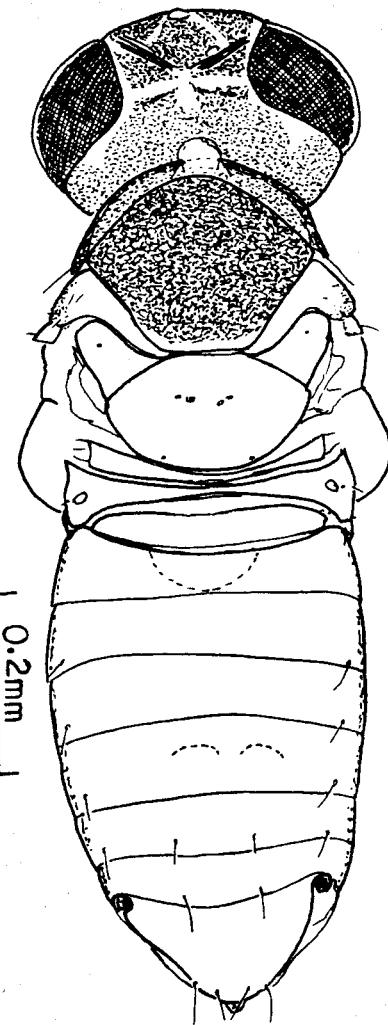
Figs. 287-293. *Encarsia trivittata*, sp. nov., female: 287, antenna; 288, head in front view; 289, second valvifer and third valvula; 290, middle tibia and tarsus; 291, fore wing; 292, venation of fore wing; 293, part of mesothorax, dorsal. Fig. 292 from holotype (148E), rest from paratypes; 287-291 (66E); 293 (67E).



Figs. 294, 295. (294) *Encarsia longicauda*, sp. nov., paratype female, 33E. (295) *Encarsia trivittata*, sp. nov., holotype female, 148E.



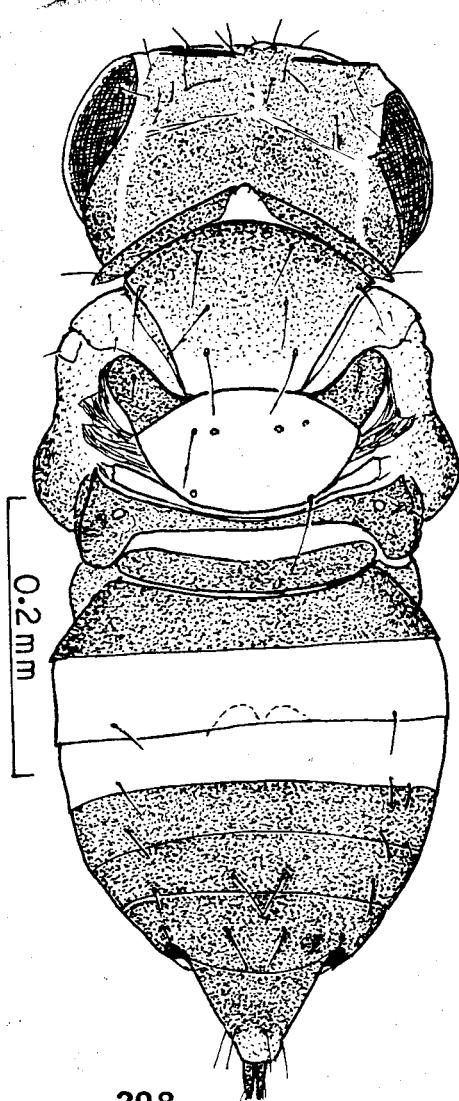
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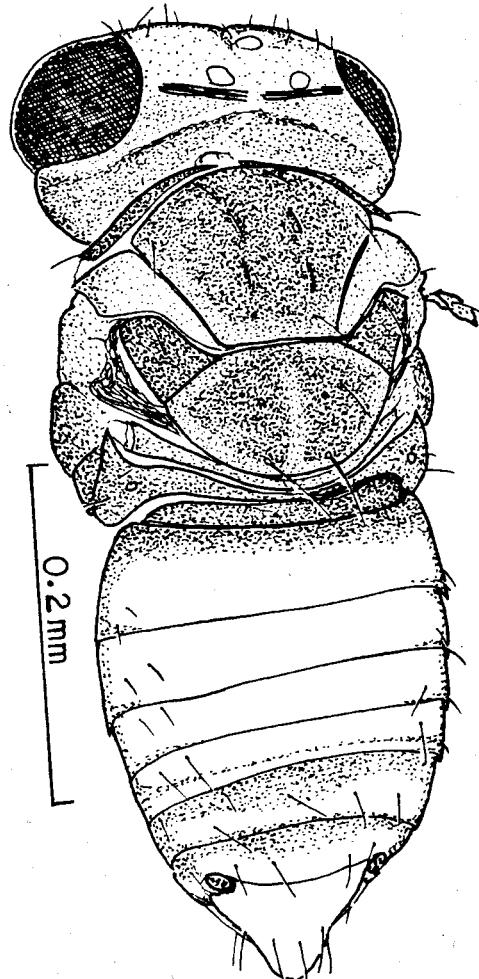
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Figs. 296, 297 (296) *Encarsia leptosoma*, sp. nov., female, 250E. (297) *Encarsia septentrionalis*, sp. nov., holotype female, 100E.



298

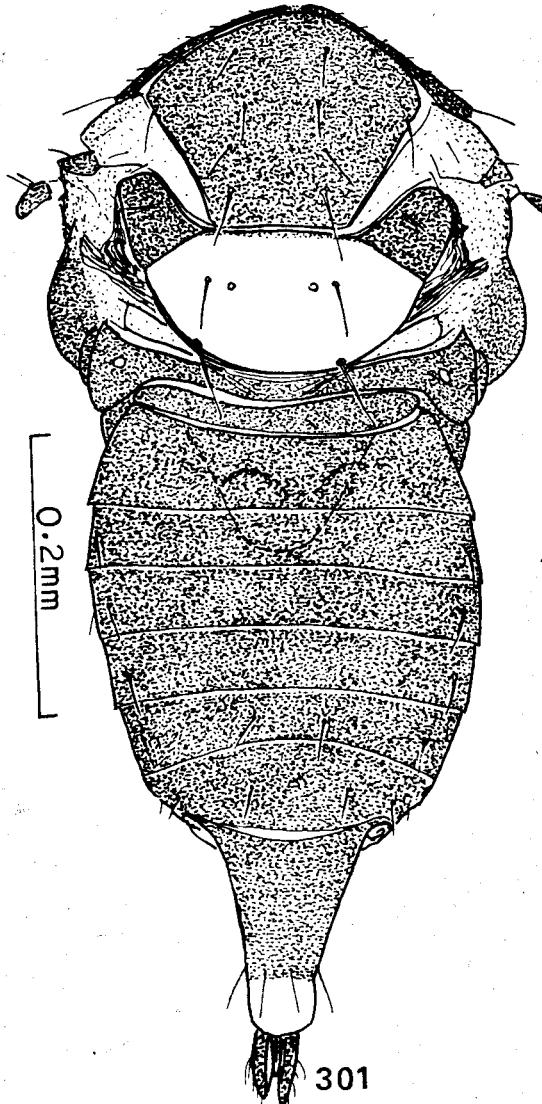


299

Figs. 298, 299. (298) *Encarsia bangalorensis*, sp. nov., holotype female, 257E. (299) *Encarsia gunturensis* (Azim & Shafee), female, 165E.

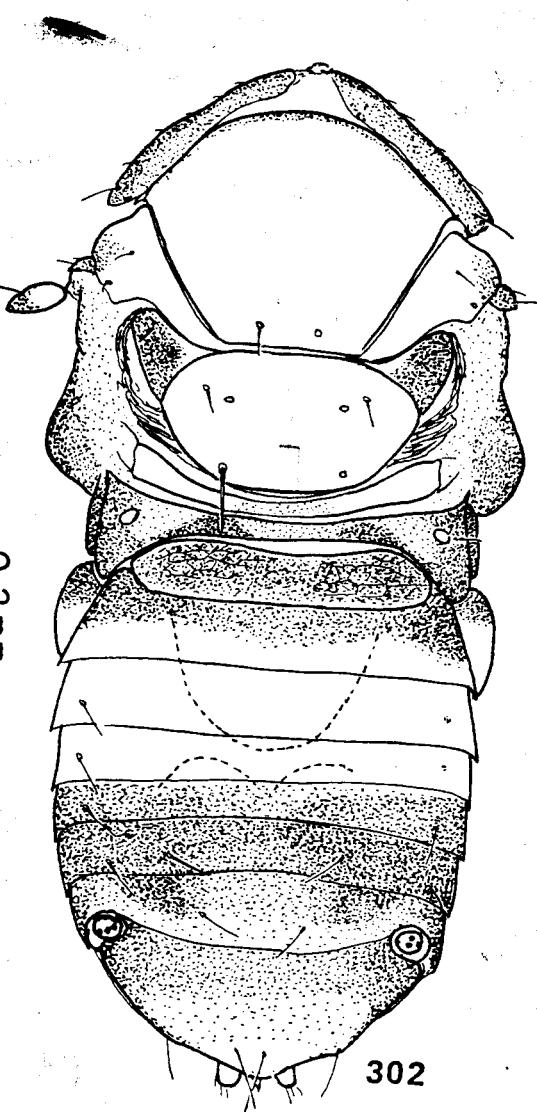


300

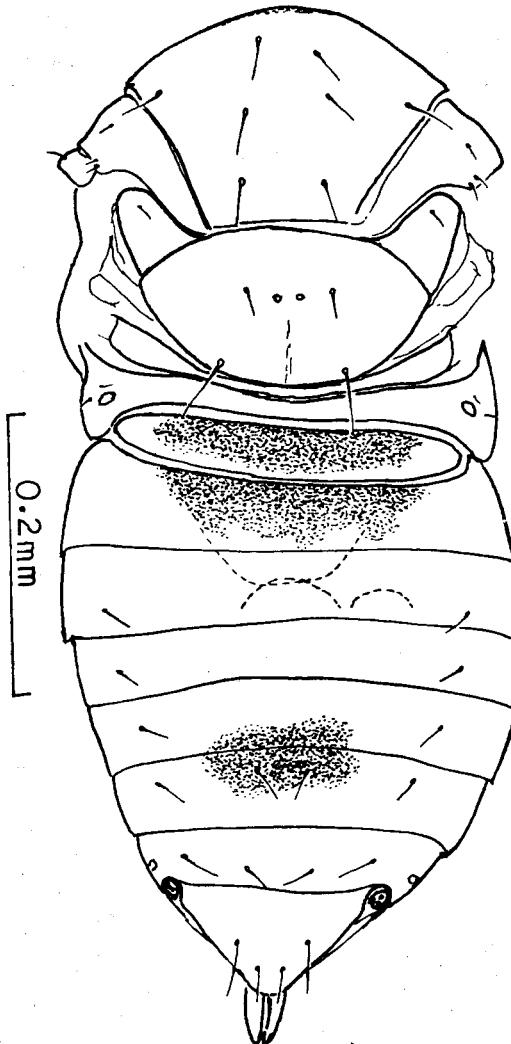


301

Figs. 300, 301. (300) *Encarsia duorunga*, sp. nov.  
Lotype female, 268E. (301) *Encarsia clypealis* (Silvestri)  
male, 38E.

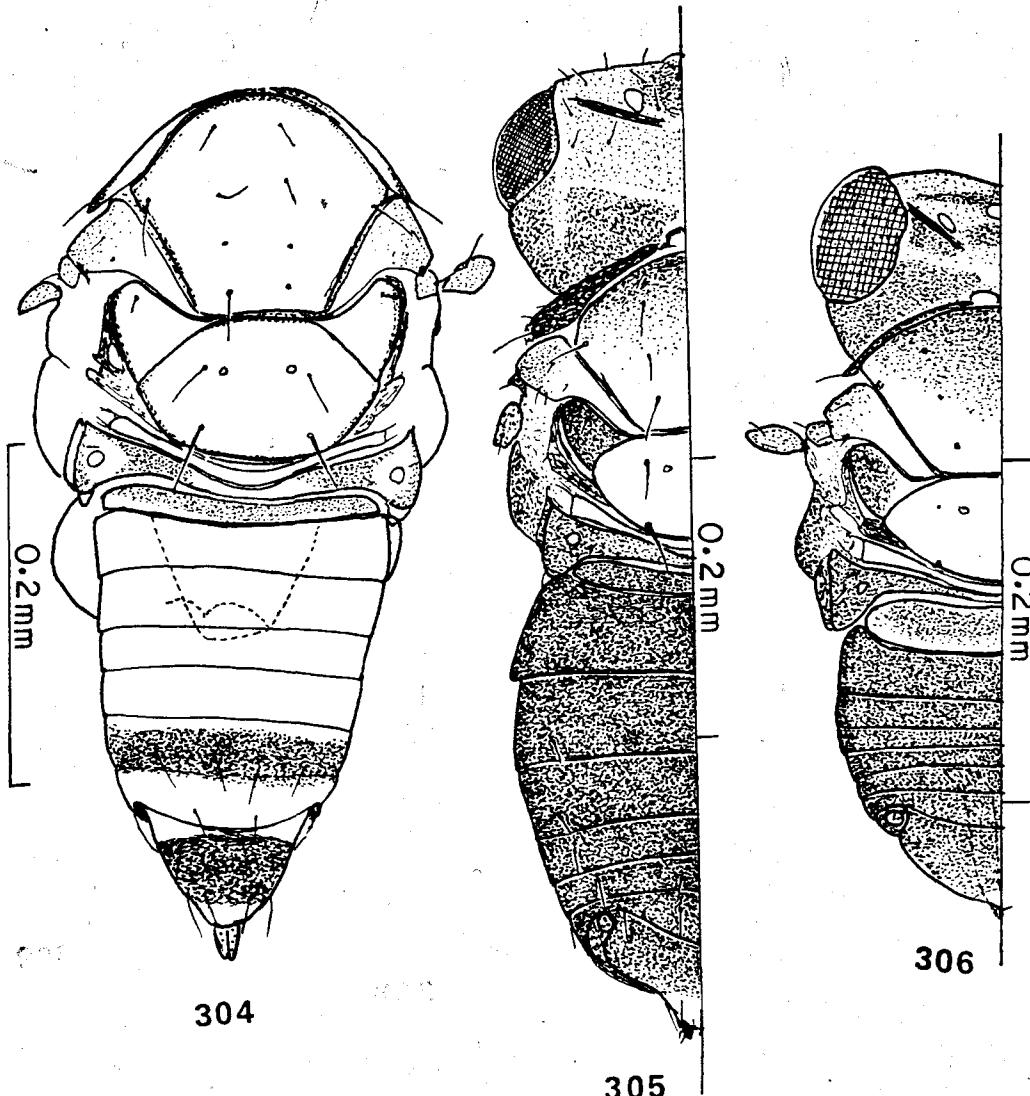


302

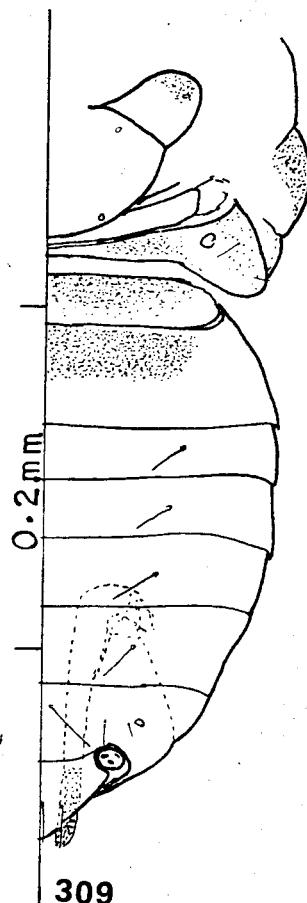
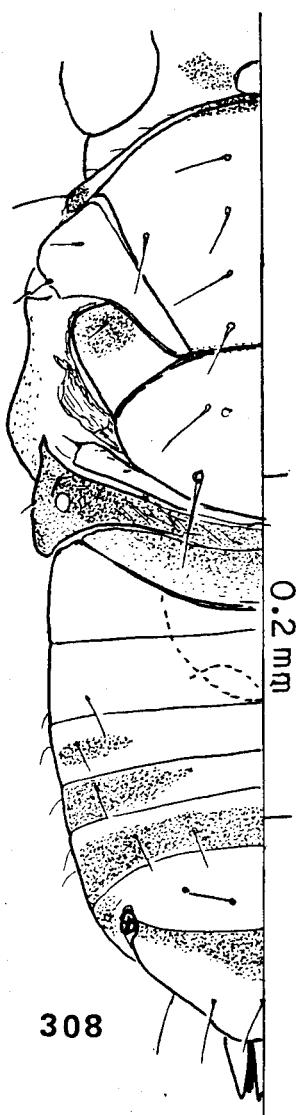
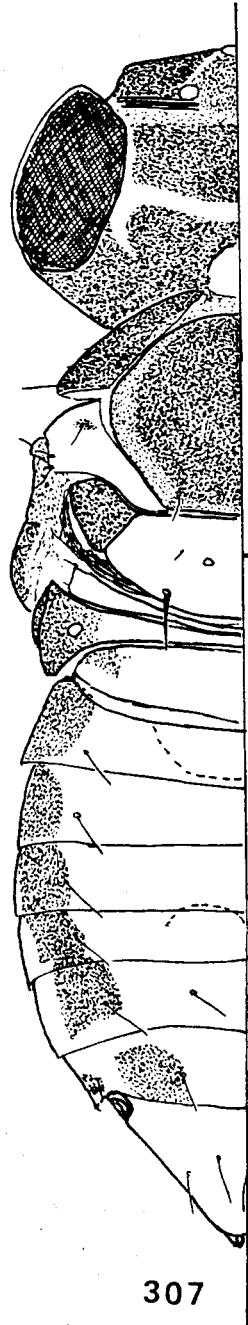


303

Figs. 302, 303. (302) *Encarsia sankarani*, sp. nov., holotype female, 236E. (303) *Encarsia dialeurodis*, sp. nov., paratype female, 249E.



Figs. 304-306. (304) *Encarsia obtusiclava* sp. nov., holotype female, 26E. (305) *Encarsia perniciosi* (Tower), female, 218E. (306) *Encarsia aurantii* (Howard), female, 221E.



Figs. 307-309. (307) *Encarsia longifasciata* Subba Rao, holotype female. (308) *Encarsia bennetti* Hayat, female, 241E. (309). *Encarsia lutea* (Masi), female, 228E.

### Addenda

The descriptions of the following species came to my notice when the present paper was completed and sent for publication. Therefore, the species could not be included in the key.

#### 52. *Encarsia adrianae* Lopez-Avila

*Encarsia adrianae* Lopez-Avila, 1987: 425. Female. Male. Descendants of specimens from Rawalpindi, Pakistan (BMNH).

Host: *Bemisia tabaci*

Distribution: Pakistan

Comments: This species appears very close to, if not conspecific with, *E. azimi*, and runs to that species in the key (couplets 54 and 70). Some of the specimens from silwood Park, Ascot, (descendants of the material from Rawalpindi) were seen by me, but I have not commented up on them because Dr. B.R. Subba Rao informed me that Mr. Lopez-Avila was planning to publish on the species. In those specimens, the base of the gaster is narrowly brown to dark brown, not uniformly bright yellow to whitish. In the classification outlined in this paper, *adrianae* should belong to *inaron*-group.

#### 53. *Encarsia cibcensis* Lopez-Avila

*Encarsia cibcensis* Lopez-Avila, 1987: 427. Female. Male. Descendants of specimens from Rawalpindi, Pakistan (BMNH).

Host: *Bemisia tabaci*

Distribution: Pakistan

Comments: This species runs near *E. perflava* Hayat (key couplet 32) and differs from that species in having F1 quadrate, clava apparently 3-segmented, disc of fore wing with a distinct bare strip along wing margin beginning apex of stigmal and ending at about proximal end of retinaculum, and middle tibial spur about two-thirds the length of basitarsus. The male antenna (male unknown for *perflava*) is quite distinctive by the larger and longer F3 which is provided with papilliform sensilla. Lopez-Avila places this species in *lutea*-group, but it seems best placed in *perflava*-group.

### Reference

Lopez-Avila, A. 1987. Two new species of *Encarsia* Foerster (Hymenoptera: Aphelinidae) from Pakistan, associated with the cotton whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae). Bull. Ent. Res., 77: 425-430.