

The Egyptian species of *Encarsia* (Hymenoptera: Aphelinidae): a preliminary review

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Key words: Egypt; *Encarsia*; Aleyrodidae; Aphelinidae; Diaspididae; parasitoids; biological control; natural enemies.

The species of *Encarsia* Foerster (Hymenoptera: Aphelinidae) known from Egypt are revised. A total of 14 species are treated, including one new species. *E. indifferentis* Mercet, 1929, is synonymised with *E. inaron* (Walker, 1839). All species are fully described or diagnosed, and illustrated. Host records, and species-distributions outside Egypt, are given.

Introduction

Encarsia Foerster, 1878, is a relatively large genus of the Chalcidoid family Aphelinidae Thomson, 1875, currently containing about 280 species. *Encarsia* species are mostly primary parasitoids of whiteflies (Aleyrodidae) and armoured scale insects (Diaspididae), with four species known from aphids (Hormaphididae) (Evans et al., 1995). Males, however, are very often hyperparasitoids of females (or males) of their own or other species (reviewed by Viggiani, 1984; Williams and Polaszek, 1996), and the males of certain species have been recorded as (probably facultative) hyperparasitoids of Psyllidae (Polaszek et al., 1992), and obligate parasitoids of lepidopteran eggs (Polaszek, 1991; Polaszek et al., 1994; Hunter et al., 1996). Species of *Encarsia* have been considered as the most efficacious group of biocontrol agents of whitefly pests on a broad range of agricultural crops. Recently their economic importance has been recognized worldwide and more attention has been given to their taxonomy. This is especially true of the *Encarsia* species parasitic on whiteflies (Huldén, 1986; Rivnay & Gerling, 1987; Polaszek et al., 1992; Krishnan & David, 1996; Schauff et al., 1996; Trjapitzin et al., 1996).

Despite their importance, the identification of many *Encarsia* species is still very difficult. This is for several reasons, including their very small size necessitating laborious slide-mounting for taxonomic study; the poor condition of most of the early (and some recent) type material, their apparent extreme diversity and the existence of complexes of morphologically (virtually) indistinguishable species. Major recent contributions to *Encarsia* taxonomy have been made by Viggiani & Mazzone (1979), Viggiani (1985a, 1986, 1987), Hayat (1989a) and Yasnosh (1989).

Encarsia species of Egypt

The taxonomy of *Encarsia* in Egypt began with Mercet's (1929) description of *E.*

indifferentis. Since then, a further nine species have been recorded, mostly in the economic literature (e.g. Thompson, 1953; Herting, 1972). The present study was instigated as part of a PhD study programme at Cairo University, by the second author, on taxonomy and biology of whitefly parasites in Egypt (Abd-Rabou, 1994).

Material, Methods and Abbreviations

This study provides a preliminary revision of the species of *Encarsia* from Egypt. It is largely based on material collected by rearing in several Governates of Egypt, including Arish, Assiut, Aswan, Giza, New Valley, North Coast and Qalyubiya. In addition, Egyptian specimens in The Natural History Museum in London (largely assembled by the International Institute of Entomology) were studied, as well as the material described by Mercet in the Museo Nacional de Ciencias Naturales in Madrid, Spain.

With few exceptions, specimens examined in this study have been preserved as slide mounts, following the method outlined by Noyes (1982), with certain amendments. Some slides mounted previously in Hoyer's medium were remounted in Canada Balsam. Terminology used follows Hayat (1989) with a very few (self-explanatory) exceptions, including the use of 'mesosoma' instead of 'thorax' (figs 1-5). The former term includes the propodeum (the first abdominal segment in apocritan Hymenoptera, fused to the thorax), the latter does not. The same scale has been followed in drawing the ovipositor, middle tibia and basitarsus from the same specimen in each species. Species are illustrated with the coloration and cuticular sculpture shown on the right-hand side only, the setation on the left-hand side.

Abbreviations of depositories

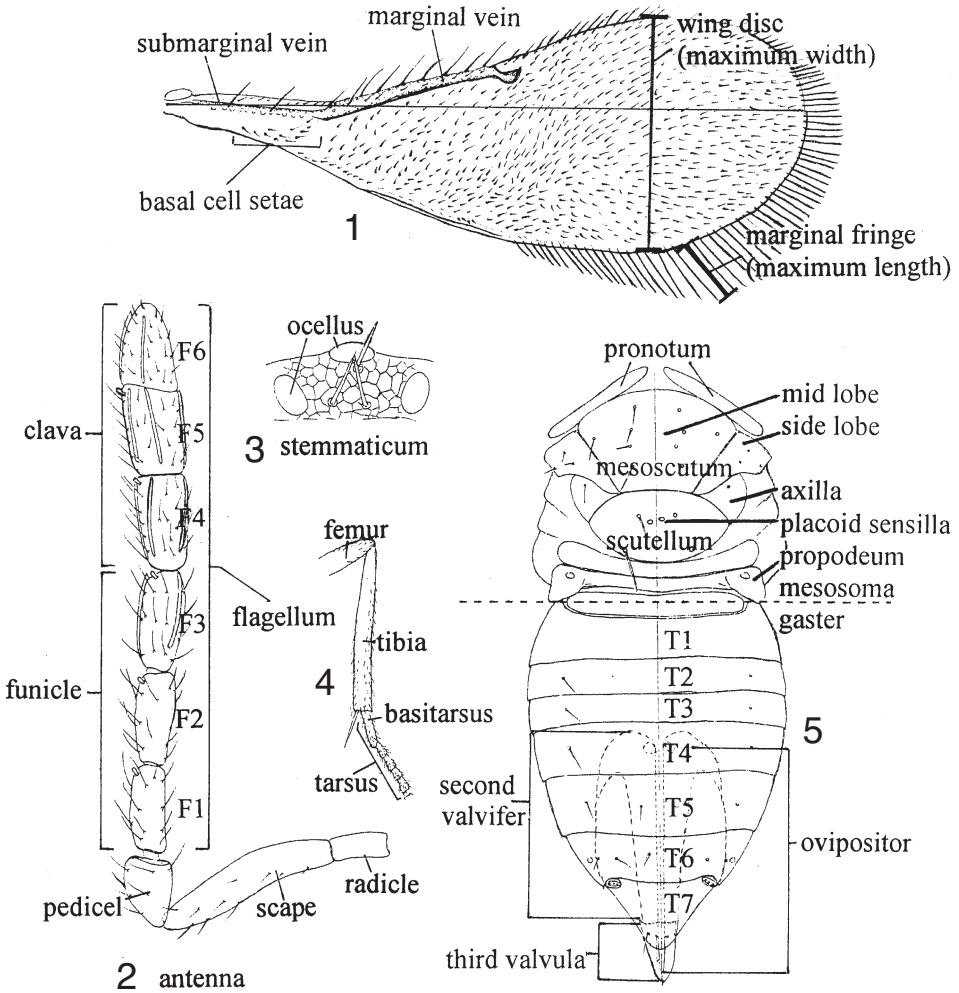
BMNH	The Natural History Museum, London, U.K.
IEUN	Istituto de Entomologia Agraria, Universita degli Studi di Napoli, Portici, Italy.
MNCN	Museo Nacional de Ciencias Naturales, Madrid, Spain.
PRIE	Plant Protection Research Institute, Cairo, Egypt.
RMNH	Nationaal Natuurhistorisch Museum, Leiden, The Netherlands.
USNM	United States National Museum of Natural History, Washington D.C., U.S.A.
ZMAN	Zoological Museum of the University of Amsterdam, The Netherlands.
ZSIC	Zoological survey of India, Calcutta.

Genus *Encarsia* Foerster, 1878

Encarsia Foerster, 1878: 65. Type species: *Encarsia tricolor* Foerster, by monotypy.
For full synonymy see Hayat (1989).

Diagnosis.— Coloration. Variable from entirely pale yellow to completely dark brown, the males generally darker than the females.

Morphology. Head dorsum transverse, twice or more as wide as long; a postocellar bar behind each lateral ocellus. Mandibles usually with three teeth, or two teeth



Figs 1-5. *Encarsia* general morphology: 1. fore wing; 2. antenna (female); 3. stemmaticum; 4. mid leg; 5. mesosoma and gaster (female).

and a truncation; maxillary palps 1-segmented, in a few species 2-segmented, labial palps 1-segmented. Antenna 8-segmented excluding radicle and anellus, often 7-segmented in males; relative dimensions of pedicel and flagellar segments very variable; funicle 2-4 segmented, clava 2-4 segmented, or not apparent.

Pronotum medially membranous; mid lobe of mesoscutum with 0-20 setae, (usually) arranged in bilateral symmetry; each side lobe of mesoscutum with 1-5 setae, usually with 2-3; axillae separated mesally by a distance greater than the maximum length of an axilla, and each with 1 seta; scutellum distinctly wider than long, with 2 pairs of setae and a pair of placoid sensilla, the anterior pair of setae almost always shorter than the posterior pair. Scutellum with reticulate sculpture, becoming longitudinally elongate/reticulate medially. Fore wings with shape, and length of marginal

fringe, variable; submarginal vein shorter than marginal vein, with 2 setae, rarely with 1 or more than 2; basal cell usually with fewer than 10 setae, occasionally more; a variable number of setae on anterior margin of marginal vein; postmarginal vein absent; disc densely or sparsely setose, speculum usually present; hind wings narrow. Legs with tarsal formula 5-5-5, or 5-4-5 in the *cubensis*-, *formosa*-, and *singularis* species-groups.

Gaster with seven tergites (T1-T7); tergite 7 (T7) varying considerably in length and width, from distinctly wider than long to as wide as long or longer than wide; apex of T7 always membranous and pale/translucent; T1 usually without setae, T2-4 with 1-5 setae on each side, T5-6 usually with 2+2 setae (occasionally more) each and T7 with 4 setae (occasionally 6); ovipositor with the relative lengths of the second valvifer and third valvula variable. Ovipositor / mid tibia ratio often useful for species recognition. Male genitalia usually with the phallobase several times as long as wide, with a truncate or rounded apex and without digiti; aedeagus generally longer than phallobase.

Key to species of the genus *Encarsia* (females) from Egypt

- 1. Mid tarsi 4-segmented (fig. 30) tarsal formula 5-4-5 *E. formosa* Gahan
- Mid tarsi 5-segmented, tarsal formula 5-5-5 (e.g. figs 4, 9) 2
- 2. Species with the following combination of characters: Scutellar sensilla very closely placed, separated by a distance of about the width of one sensillum or less (figs 53, 58), F1 at least twice as long as wide (e.g. figs 50, 55), stigmal vein distinctly angled from marginal vein (figs 1, 49, 54). Wing fringe short, clearly less than half the disc width (*E. strenua*-group) 3
- Species without this combination of characters. Scutellar sensilla widely placed, separated by a distance of more than the width of one sensillum (e.g. figs 8, 10). If closely placed (e.g. fig. 27), then F1 less than twice as long as wide (e.g. fig. 25) and stigmal vein smoothly joining marginal vein (e.g. fig 23). Wing fringe either short or long 4
- 3. Submarginal vein with 3 or more setae (fig. 54). Mid lobe of mesoscutum with more than 14 setae (fig. 58) *E. ramsesi* Polaszek **spec. nov.**
- Submarginal vein with 2 setae (fig. 49). Mid lobe of mesoscutum with fewer than 14 setae (fig. 53) *E. protransvena* Viggiani
- 4. Stigmal vein of fore wing with an evident asetose area proximally (figs 7, 19, 40) .5
- Stigmal vein of fore wing without an evident asetose area proximally (e.g. fig. 1). At least one small seta proximal to the stigmal vein 8
- 5. Longest seta on marginal fringe of fore wing equal to or greater than the maximum width of the wing disc (figs 19, 40). Body with many dark markings (figs 20, 41) (*E. citrina*-group) 6
- Longest seta on marginal fringe of fore wing less than the maximum width of the wing disc (fig. 7). Body largely pale (figs 8, 10) (*E. parvella*-group) 7
- 6. Submarginal vein of fore wing with 1 seta (fig. 40) ... *E. lounsburyi* Berlese & Paoli
- Submarginal vein of fore wing with 2 setae (fig. 19) *E. citrina* Craw
- 7. Ovipositor 1.2x or more as long as mid tibia (figs 8, 9). Axillae dark anteriorly (fig. 8) *E. acaudaleyrodis* Hayat

- Ovipositor shorter than, or up to 1.1x as long as, mid tibia (figs 9, 10). Axillae pale (fig. 10), very rarely dark anteriorly *E. mineoi* Viggiani
8. F1 with at least one longitudinal sensillum (fig. 35) *E. inaron* Walker
 - F1 without any longitudinal sensilla (e.g. fig. 18) 9
9. Gaster, except apex of T7, largely brown to dark brown (figs 13, 16, 27, 48) 10
 - Gaster with distinctly pale, unpigmented areas (figs 39, 46) 13
10. Face with one or two brown to dark brown cross bands above the toruli (antennal insertions; fig. 24). Side lobes of mesoscutum each with three setae (fig. 27). Antennal clava 2-segmented (fig. 25) *E. elegans* Masi
 - Face without dark brown cross bands above the toruli. Side lobes of mesoscutum each with two or fewer setae (figs 13, 16). Antennal clava 3-segmented (figs 14, 18) 11
11. Ovipositor very short, clearly much shorter than mid tibia (fig. 13)
 *E. aurantii*(Howard)
 - Ovipositor either subequal in length to the mid tibia (figs 16, 17) or slightly shorter 12
12. Antennal clava broadly ovoid; F1 quadrate or transverse (fig. 45)
 *E. lutea* (Masi) (dark form)
 - Antennal clava narrow, pointed; F1 longer than wide (fig. 18)
 *E. berlesei* (Howard)
13. Third valvulae dark, in contrast to the remainder of the ovipositor (figs 46-48) ...14
 - Third valvulae pale, not contrasting with the remainder of the ovipositor (fig. 39) .
 *E. lahorensis* (Howard)
- 14 Third valvulae elongate, approximately 0.40 × as long as the ovipositor (fig. 47)
 *E. davidi* Viggiani
 - Third valvulae shorter, not more than 0.35 × as long as the ovipositor, and usually less (figs 46, 48) *E. lutea* (Masi) (pale form)

Encarsia acaudaleyrodis Hayat, 1976
(figs 6-9)

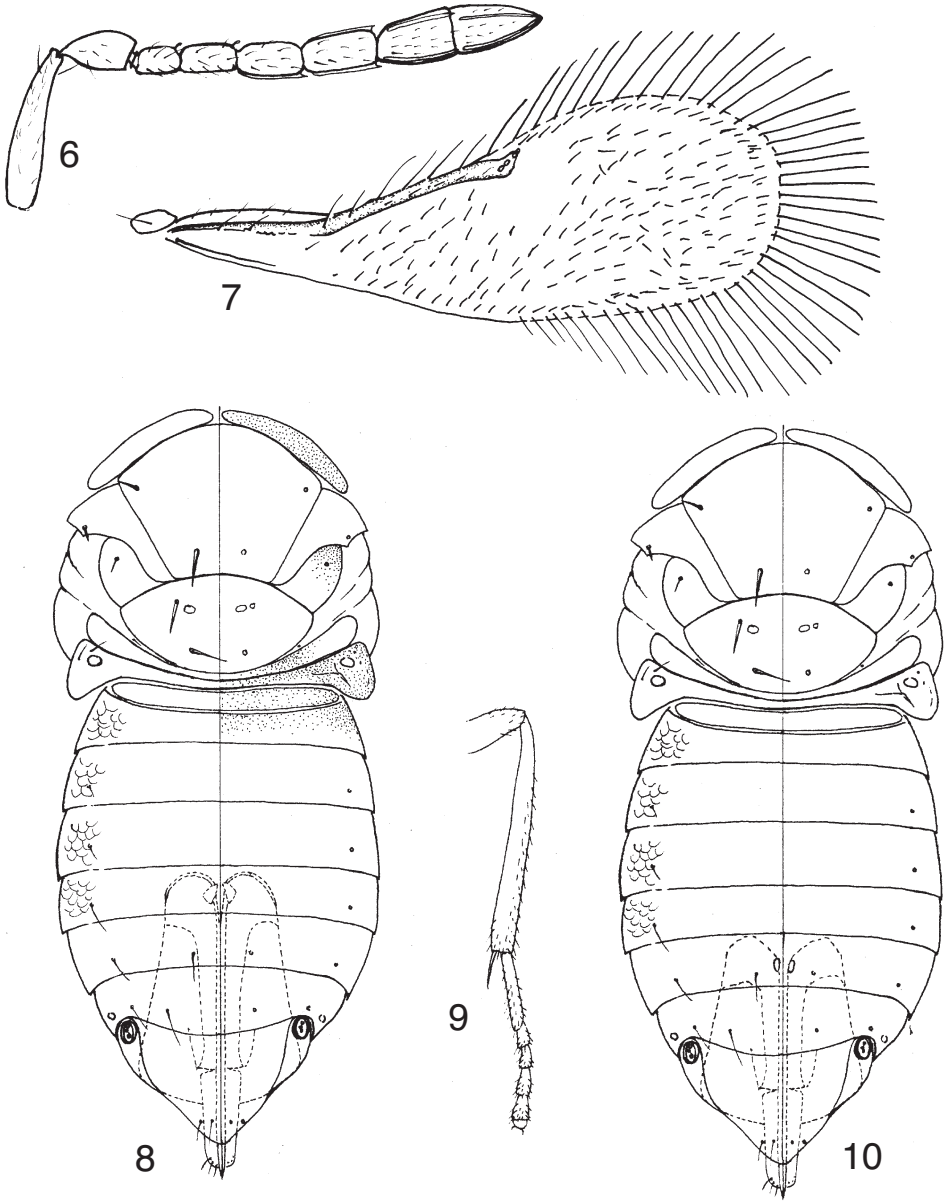
Encarsia acaudaleyrodis Hayat, 1976: 158. Holotype: India, Rajasthan, Sardar Samand, i.1974 (M. Hayat) (ZSIC, not examined; paratypes examined).

Material.— 1 ♀, New Valley, Dakhla 15.iv.1992 (S. Abd-Rabou) ex *Tetraleurodes leguminicola* (BMNH).

Diagnosis of female.

Head.—Pale, post-ocellar bars darker, clypeus very distinctly and deeply pigmented. Antennae dark. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1,1,4,2. F1 slightly longer than wide, approximately 0.6 × as long as pedicel. F2 1.25 × as long as F1, a little shorter than F3. F3 and F4 subequal. Clava 0.7 × as long as funicle. F1 and F2 without longitudinal sensilla.

Mesosoma.—Largely pale, pronotum, mid lobe of mesoscutum anteriorly, axillae anteriorly and propodeum darker. Fore wing hyaline. Legs pale. Mid lobe of mesoscutum and axillae with elongate/reticulate sculpture. Mid lobe of mesoscutum with 2+2 setae, and each side lobe of mesoscutum with only 1 seta. Placoid sensilla on scutellum distantly placed, distance between anterior pair of scutellar setae a little



Figs 6-9. *Encarsia acaudaleyrodis* Hayat, 6. antenna (female); 7. fore wing; 8. mesosoma and gaster; 9. mid leg. Fig. 10. *Encarsia mineoi* Viggiani, mesosoma and gaster.

greater than that between posterior pair. Fore wing approximately $3.1 \times$ as long as wide, marginal fringe $0.55 \times$ as long as width of wing. An asetose area present around the stigmal vein, and the wing apex slightly indented. Two setae on submarginal vein, 5-6 setae on anterior margin of marginal vein, 2-3 setae in basal cell. Tarsal formula 5-5-5.

Metasoma.— Largely pale, petiole and T1 darker. Petiole without sculpture. T2-T7 with 1+1, 1+1, 1+1, 2+2, 1+1 and 4 setae, respectively. Ovipositor $1.2 \times$ as long as mid tibia, or longer.

Male.— Generally much darker than the female, with the typical appearance of a male *Encarsia*. F5 and F6 of the antenna partially fused.

Species group placement.— *E. parvella* group *sensu* Hayat, 1989.

Distribution outside Egypt.— India, Spain (Canary Islands).

Hosts.— Aleyrodidae: *Tetraleurodes leguminicola* Bink. Other hosts recorded: *Acaudaleyrodies citri* (Priesner & Hosny), *A. rachipora* (Singh), *Bemisia tabaci* (Gennadius).

Remarks.— The differences between *E. acaudaleyrodies* and *E. mineoi* Viggiani (see below) are very slight. We have examined a long series of paratypes of *E. acaudaleyrodies*, the single Egyptian female listed above, and females from the Canary Islands. Of *E. mineoi* we have examined the type material from Libya, as well as numerous specimens from Egypt listed below, as well as material from Israel, Sudan and mainland Spain. Viggiani (1982) drew attention to differences in the antennal configuration and bodily coloration. Essentially the funicle is slightly shorter in *E. acaudaleyrodies* and the axillae are darker. An apparently more reliable difference concerns the ovipositor length. In *E. mineoi* the ovipositor is either shorter than, or up to $1.1 \times$ as long as, the mid tibia. In *E. acaudaleyrodies* it is $1.2 \times$ as long as the mid tibia, or longer. Given that the two species appear to occur sympatrically (at least in Egypt), their extreme morphological similarity, and the fact that they share at least two hosts (*A. citri* and *B. tabaci*), further studies should be undertaken in order to confirm that they really are distinct species.

Encarsia aurantii (Howard, 1894)
(figs 11-14)

Coccophagus aurantii Howard, 1894: 231. Syntypes: ♀♀, U.S.A.: California, San Gabriel 9.v.1887 (D.W. Coquillett) ex *Aspidiotus aurantii* var. *citrinus* (?USNM, not examined).

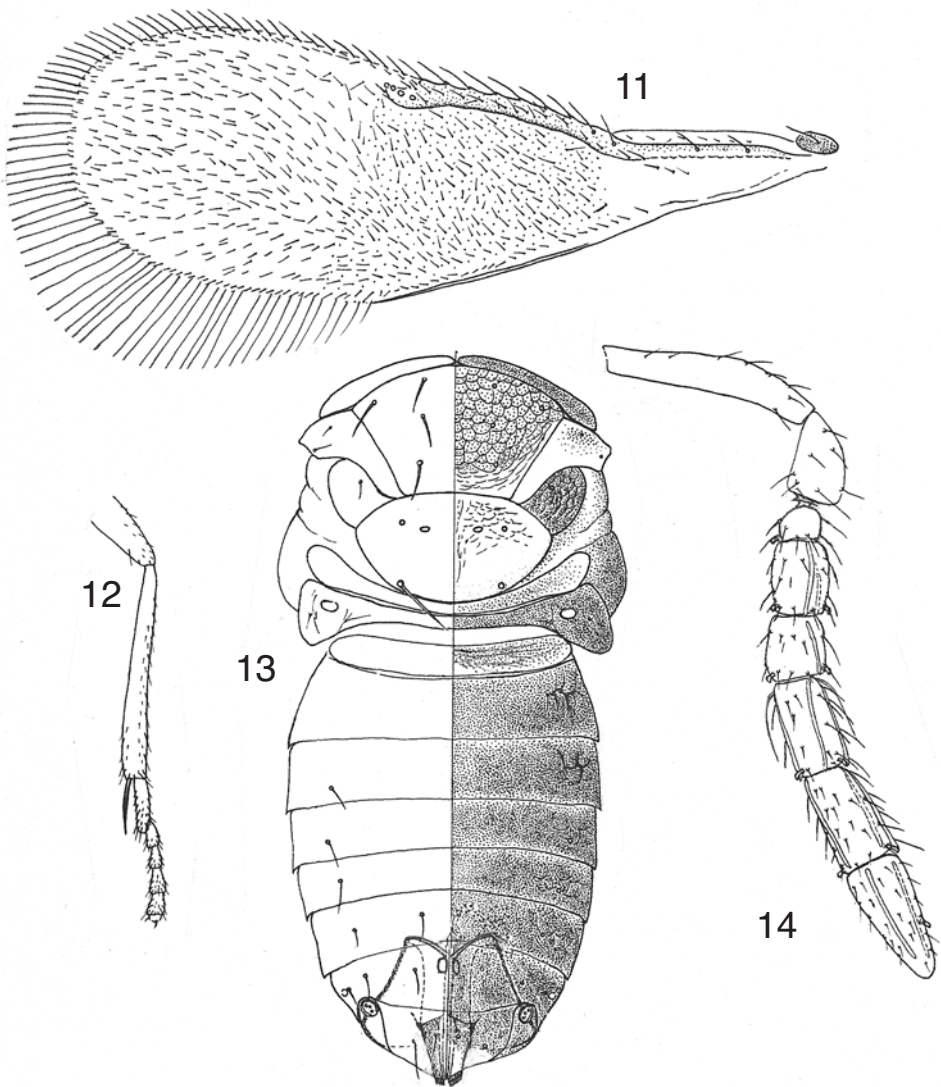
Encarsia aurantii; Hafez, 1988: 185; Viggiani & Mazzone, 1979: 47.

Material.— 5 ♀♀, North Coast, 150 km west of Alexandria 24.xi.1994 (S. Abd-Rabou) ex *Parlatoria oleae* on *Olea europea* (BMNH, PRIE, RMNH). 1 Qalyubia 12.xii.1994 (S. Abd-Rabou) (BMNH).

Diagnosis of female.

Head.— Orange-brown, occiput and post-ocellar bars darker. Antennae dark. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1,1,3,3. Pedicel much larger than the minute F1; F1 quadrate, F2 about $2 \times$ F1, longer than wide, and slightly longer than the quadrate F3. F4-F6 subequal, clava approximately $1.5 \times$ as long as funicle.

Mesosoma.— Largely yellow-orange dorsally, pronotum, near anterior half of mid lobe of mesoscutum, axillae, mesopleuron, propodeum brown to dark brown. In



Figs 11-14. *Encarsia aurantii* (Howard), 11. fore wing; 12. mid leg; 13. mesosoma and gaster; 14. antenna (female).

slide mounts the mesosoma appears largely brown because of the dark prosternum, propleura and prepectus showing through. Fore wing infuscated below marginal vein. Legs yellow except hind coxae and femora. Mid lobe of mesoscutum and axillae with reticulate sculpture. Scutellum with very large, sculptured cells. Mid lobe of mesoscutum with 4+2+2 setae, and each side lobe of mesoscutum with 2 setae. Placoid sensilla on scutellum distantly placed, distance between anterior pair of scutellar setae a little greater than that between posterior pair. Fore wing about 4.1 × as long as wide, marginal fringe 0.42 × as long as width of wing. 2 setae on submarginal vein, 7-

9 setae on anterior margin of marginal vein, 4-6 setae in basal cell. Tarsal formula 5-5-5.

Metasoma.— Petiole and gaster brown to dark brown. Third valvulae pale brown. Petiole with sculpture. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor unusually short, just over half the length of the mid tibia, third valvula 0.66 × as long as second valvifer.

Male.— Unknown.

Species group placement.— *E. aurantii*-group *sensu* Viggiani & Mazzone, 1979.

Distribution outside Egypt.— Virtually cosmopolitan.

Hosts.— Diaspididae: *Aonidiella aurantii* (Maskell), *Parlatoria oleae* Colvée. The following additional hosts have been recorded: *Aonidiella citrina* (Coquillet) *Aonidiella orientalis* (Newstead), *Aonidomytilus espinosai* (Porter), *Aspidiotus destructor* Signoret, *A. hederæ* Vallot, *Chrysomphalus aonidum* (L.), *C. dictyospermi* (Morgan), *C. ficus* Ashmead, *Hemiberlesia lataniae* (Signoret), *H. rapax* Comstock, *Lepidosaphes beckii* (Newman), *L. newsteadii* Sulc, *Leucaspis japonica* Cockerell, *Lingdingaspis fusca* (Maskell), *Melanaspis obscura* (Comstock), *Pinnaspis strachani* (Cooley), *Quadraspidotus ostreaeformis* (Curtis), *Q. perniciosus* Comstock.

Remarks.— Hafez (1988) mentions *E. aurantii* as a rare parasitoid of *A. aurantii* in Egypt.

Encarsia berlesei (Howard, 1906)
(figs 15-18)

Prospalta berlesei Howard, 1906: 291. Syntypes ♀ ♀, USA: Washington, D.C., vi.1906 ex [*Pseudaulacaspis* as] *Diaspis pentagona* (Targioni) (USNM, not examined).

Prospaltella berlesei; Priesner & Hosny, 1940: 63.

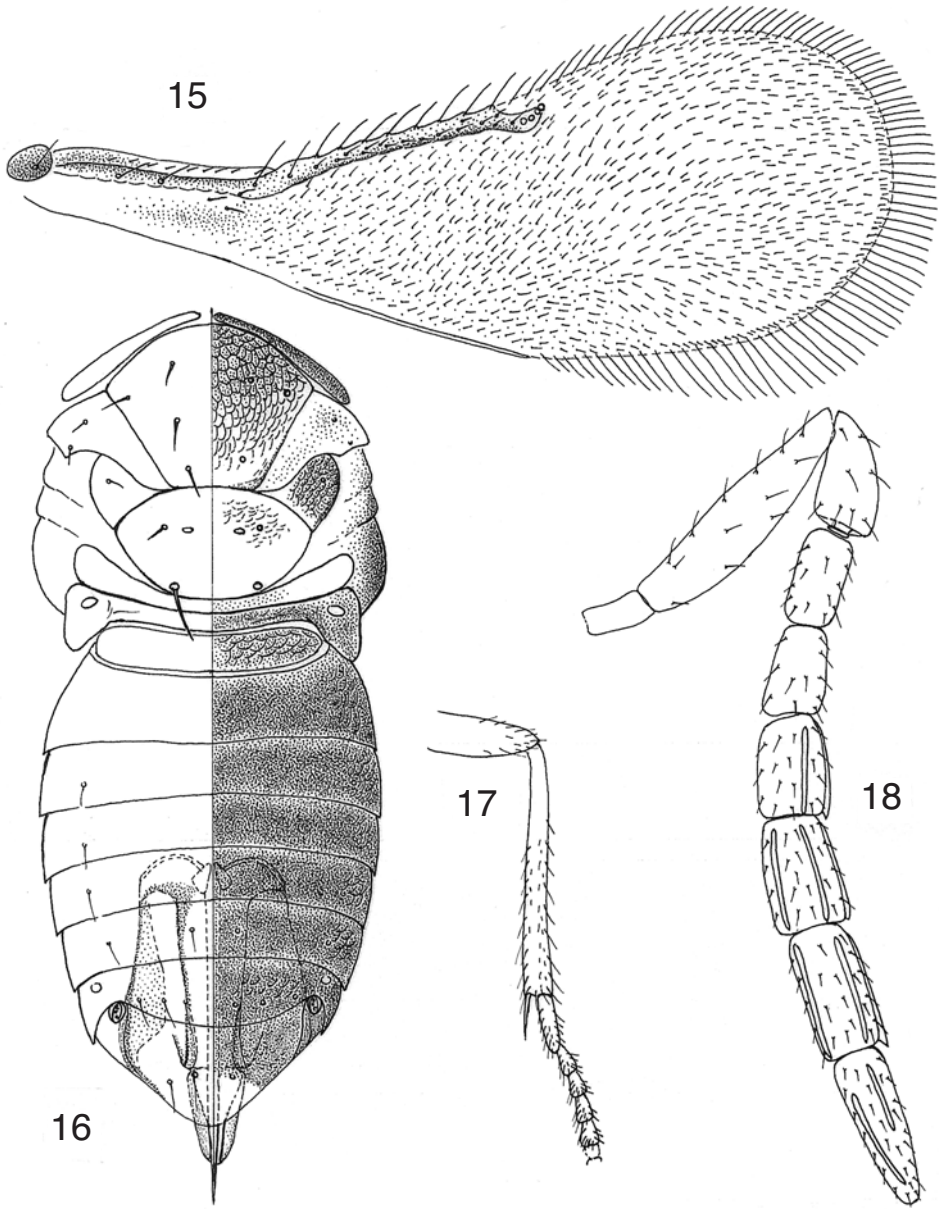
Encarsia berlesei; Viggiani & Mazzone, 1979: 47.

Material.— 10 ♀ ♀, Alexandria 18.v.1929 (M. Kamal) ex *Pseudaulacaspis pentagona* (BMNH, PRIE, RMNH).

Diagnosis of female.

Head.— Orange-yellow except clypeus, malar space, occiput brown to dark brown. Antenna brown. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1,1,3,3. Pedicel as long as or a little longer than F1; F1 1.91 × as long as wide, slightly longer than F2 and slightly shorter than F3. F3 wider than F1 and F2 respectively. Flagellum with the following numbers of longitudinal sensilla: F1:0, F2:0, F3:2, F4:3, F5:3, F6:3.

Mesosoma.— Yellow except pronotum, near anterior half of mid lobe of mesoscutum, axillae, mesopleuron, propodeum brown to dark brown. Legs yellow except all femora, fore tibia, fore basitarsus, hind coxa brown. Fore wing hyaline, infuscated below marginal vein. Mid lobe of mesoscutum and axillae with reticulate sculpture. Mid lobe of mesoscutum with 4+2+2 or 4+1+2 setae. Each side lobe of mesoscutum with 2 setae. Placoid sensilla on scutellum rather distantly placed, distance between anterior pair of scutellar setae approximately equal to, or a little greater than, that between posterior pair. Fore wing about 2.45 × as long as wide. Marginal fringe 0.29 × as long as width of wing. 2 setae on submarginal vein, 8-9 setae on anterior margin of



Figs 15-18. *Encarsia berlesei* (Howard), 15. fore wing; 16. mesosoma and gaster; 17. mid leg; 18. antenna (female).

marginal vein, 2-3 setae in basal cell. Tarsal formula 5-5-5.

Metasoma.— Petiole brown. Gaster brown to dark brown except apex of T7. Third valvulae pale to brown. Petiole with distinct sculpture. T2-T7 with 1+1, 1+1, 1+1, 2+2, 3+3 and 4 setae, respectively. Ovipositor about as long as middle tibia and basitarsus combined, third valvula 0.42 × as long as second valvifer.

Male.— Unknown.

Species group placement.— *E. berlesei* group *sensu* Viggiani & Mazzone, 1979.

Distribution outside Egypt.— Virtually cosmopolitan.

Hosts.— Diaspididae: *Pseudaulacaspis pentagona* (Targioni). The following additional hosts have been recorded: *Melanaspis obscurus* (Comstock), *Pinnaspis minor* (Maskell), *Pinnaspis strachani* Cooley (Huang & Polaszek, 1998).

Remarks.— Priesner & Hosny mentioned that *E. berlesei* was not widely distributed in Egypt, probably confined to the coastal region.

Encarsia citrina (Craw, 1891)
(figs 19-22)

Coccophagus citrinus Craw, 1891: 25, Syntypes: ♀♀, U.S.A. California, San Gabriel Valley, 1889 [ex *Aspidiotus citrinus*] lost. Neotype ♀ designated by DeBach & Rose, 1981: 671, same data as syntypes (USNM, not examined).

Aspidiotiphagus citrinus; Priesner & Hosny, 1940: 60; Herting, 1972: 168; Abdel-Fattah & El-Saadany, 1979: 155; El-Nahal et al., 1980:316; Hafez, 1988: 185.

Encarsia citrina; Viggiani & Mazzone, 1979: 47.

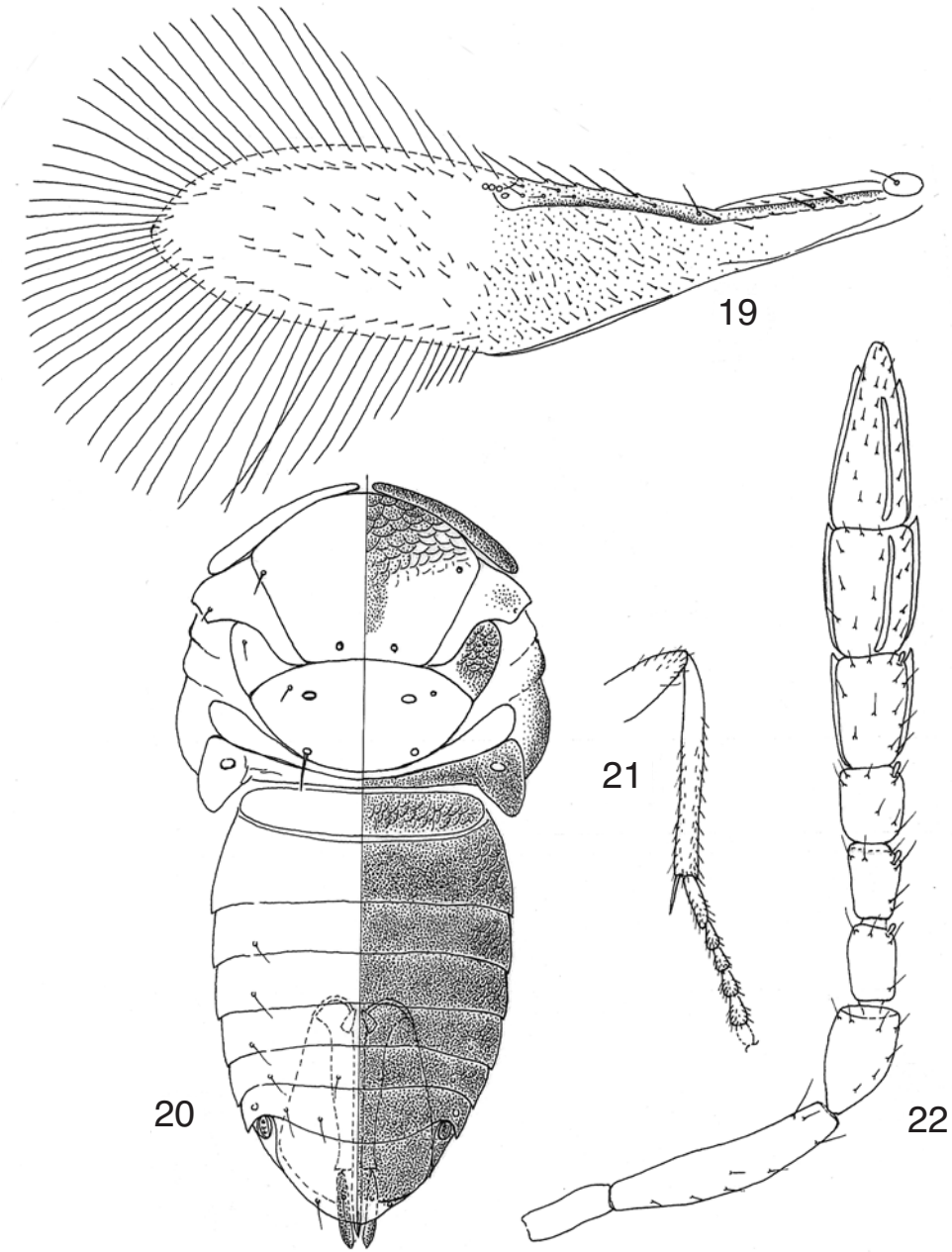
Material.— 12 ♀♀, (no locality) ex *Inulaspis pallidula* on *Mangifera indica* (CIEA20873) (BMNH). 1 ♀, Dokki-Giza 14.ix.92 ex *Parlatoria ziziphi* (Lucas) on *Citrus* (PRIE).

Diagnosis of female.

Head.— Orange-yellow except clypeus, malar space, occiput dark brown. Antenna brown. Antennal formula 1,1,3,3. Pedicel longer than F1. F1, F2 and F3 all approximately equal in length and progressively broader. Clava distinctly longer than pedicel and funicle combined. Flagellum with the following numbers of longitudinal sensilla: F1:0, F2:0, F3:0, F4:2, F5:3, F6:3.

Mesosoma.— Yellow except pronotum, axillae, mesopleuron, propodeum brown to dark brown. Fore wings hyaline, infuscated below marginal vein. Legs yellowish to slightly dusky, hind coxae dark brown. Mid lobe of mesoscutum with faint reticulate sculpture and with 2+2 setae. Each side lobe of mesoscutum and each axilla with 1 seta. Placoid sensilla on scutellum distantly placed, distance between anterior pair of scutellar setae distinctly greater than that between posterior pair. Fore wing distinctly narrow, about 4.00 × as long as wide, with a bare area around the stigmal vein and sparsely setose on disc; marginal fringe long, 1.22 × as long as width of wing. Two setae on submarginal vein, 4-6 (usually 4) setae on anterior margin of marginal vein, 1 seta in basal cell. Tarsal formula 5-5-5.

Metasoma.— Third valvulae dark brown. Gaster dark brown except apex of T7 yellow. Petiole with distinct sculpture. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor slightly shorter than middle tibia and basitarsus combined, third valvula approximately half as long as second valvifer.



Figs 19-22. *Encarsia citrina* ((Craw), 19. fore wing; 20. mesosoma and gaster; 21. mid leg; 22. antenna (female).

Male.— Unknown.

Species group placement.— *E. citrina* group.

Distribution outside Egypt.— Cosmopolitan.

Hosts.— Diaspididae: *Parlatoria ziziphi* (Lucas), *Lepidosaphes* (= *Insulaspis*) *pallidula* (Williams). Recorded from the following additional hosts in Egypt: *Cornuaspis* (as *Lepidosaphes*) *beckii* (Newman), *Lepidosaphes tapleyi* Williams (Abdel-Fattah & El-Saadany, 1979; El-Nahal et al., 1980).

Also recorded from the following (Huang & Polaszek, 1998): *Aonidiella aurantii* (Maskell), *A. citrina* (Coquillett), *A. lauri* Bouché, *A. taxus* Leonardi, *Aspidiotus destructor* Signoret, *A. nerii* Bouché, *Aulacaspis rosae* Bouché, *Carulaspis visci* Schrank, *Chionaspis berleseii* Leonardi, *Chionaspis lepineyi* Balachowsky, *Chrysomphalus aonidium* (L.) (= *C. ficus* Ashmead), *C. dictyospermi* Morgan, *Coccus hesperidum*, *Cornuaspis* (= *Lepidosaphes*) *gloverii* (Packard), *Diaspidiotus alni* Marchal, *D. ancylus* Putnam, *D. gigas* Thiem & Gernck, *D. ostreaeformis* Curtis, *D. prunorum* Laing, *D. pyri* Licht, *D. perniciosus* Comstock, *D. zonatus* (Frauenfeld) (= *hungaricus* Kosztarab), *Diaspis boisduvalii* Signoret, *D. bromeliae* Kerner, *D. colypteroides* Costa, *D. echinocacti* Bouché, *Dynaspidotus britannicus* Newstead, *D. californica* (Coleman), *Fiorinia fioriniae* Targioni, *Furchadiaspis zamiae* Morgan, *Hemiberlesia cyanophylli* Signoret, *H. lataniae* (Signoret), *H. palmae* Morgan, *H. pitysophila* Takagi, *H. rapax* Comstock, *Kuwanaspis bambusae* Kuwana, *K. pseudoleucaspis* Kuwana, *Lepidosaphes pallida* Green, *L. pinnaeformis* (Bouché), *Leucaspis pusilla* Loew, *Leucaspis signoreti* Targioni, *Lindingaspis rossi* Maskell, *Lopholeucaspis japonica* Cockerell, *Pseudaulacaspis pentagona* (Targioni), *Lepidosaphes ulmi* L., *Melanaspis terebricosa* Comstock, *Odonaspis secreta* Cockerell, *Parlatoria oleae* Colvée, *P. pergandii* Comstock, *P. ziziphi* (Lucas), *Phenacaspis pinifoliae* Fitch, *Pinnaspis aspidistrae* Signoret, *P. buxi* Bouché, *P. strachani* Cooley, *Pseudoaonidia duplex* Cockerell, *P. paeoniae* Cockerell, *Selenaspis articulatus* (Morgan), *Unaspis evonymi* Comstock, *U. yanonensis* (Kuwana).

Encarsia davidi Viggiani & Mazzone, 1980
(fig. 47)

Encarsia lutea; Rosen, 1966: 57 (misidentification).

Encarsia davidi Viggiani & Mazzone, 1980: 55. Holotype ♀, Israel: Nazareth, 10.iv.1975 ex *Acaudaleyrodes citri* on *Ceratonia siliqua*; Abd-Rabou & Viggiani, 1998: 12. (IEUN, examined).

Material.— 6 ♀♀, Aswan 20.ii.1991 (S. Abd-Rabou) ex *Tetraleurodes leguminicola* on *Acacia tortilis* (BMNH, PRIE, RMNH). 1 ♀, Aswan 21.xii.1991 (S. Abd-Rabou) ex *Bemisia tabaci* on *Lantana camara* (BMNH).

Diagnosis of female.

Head.— Orange-yellow except a small dark spot next to each ocellus. Antennae dark from pedicel to F6. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1,1,3,3. Pedicel about twice as long as F1; F1 quadrate, shorter and narrower than F2 and F3, which are subequal.

Mesosoma.— Largely yellow, the following dark: pronotum, propodeum. Mid lobe of mesoscutum with 4+2+2 setae, occasionally an additional seta or pair of setae present. Each side lobe of mesoscutum with 3 setae. Placoid sensilla on scutellum

rather distantly placed, distance between anterior pair of scutellar setae a little greater than that between posterior pair. Fore wing with marginal fringe $0.25 \times$ as long as width of wing. Two setae on submarginal vein, 1-2 setae in basal cell. Tarsal formula 5-5-5. Mid tibial spur as long as corresponding basitarsus.

Metasoma.— Largely yellow, the following dark: petiole and anterior part of T1. T2-T7 dark laterally in some specimens. Third valvulae conspicuously dark. Petiole without distinct sculpture, T1-T2 with some reticulate sculpture laterally. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor shorter than middle tibia and basitarsus combined, third valvula $0.40 \times$ as long as ovipositor.

Male.— Typical of the *E. lutea*-group, with F1-F3 forming an enlarged, specialised sensory complex, F5 and F6 fused.

Species group placement.— *E. lutea*-group.

Distribution outside Egypt.— Israel (see below).

Hosts.— Aleyrodidae: *Tetraleurodes leguminicola* (Takahashi). The following additional hosts have been recorded: *Acaudaleyrodes citri*, *Aleurolobus niloticus* Priesner & Hosny.

Remarks.— It is not certain whether or not this is the first record for Egypt. Viggiani & Mazzone (1980) recorded *E. davidi* from several localities in Israel, and from "El Hamma". El Hamma is in Tunisia, and Wâdi El Hamma is in Egypt. We are not aware of any locality in Israel called El Hamma.

In addition to examining the type material of *E. davidi*, we have studied the types of *E. abatei* (Viggiani, 1982). While we are unable to note any reliable differences between material of the two species, we refrain from synonymising them pending further study of this taxonomically difficult group of species.

Encarsia elegans Masi, 1911
(figs 23-27)

Encarsia elegans Masi, 1911: 147. Holotype ♀, Italy: Catanzaro, v. ex *Aleurolobus olivinus* (Silvestri) (IEUN, examined).

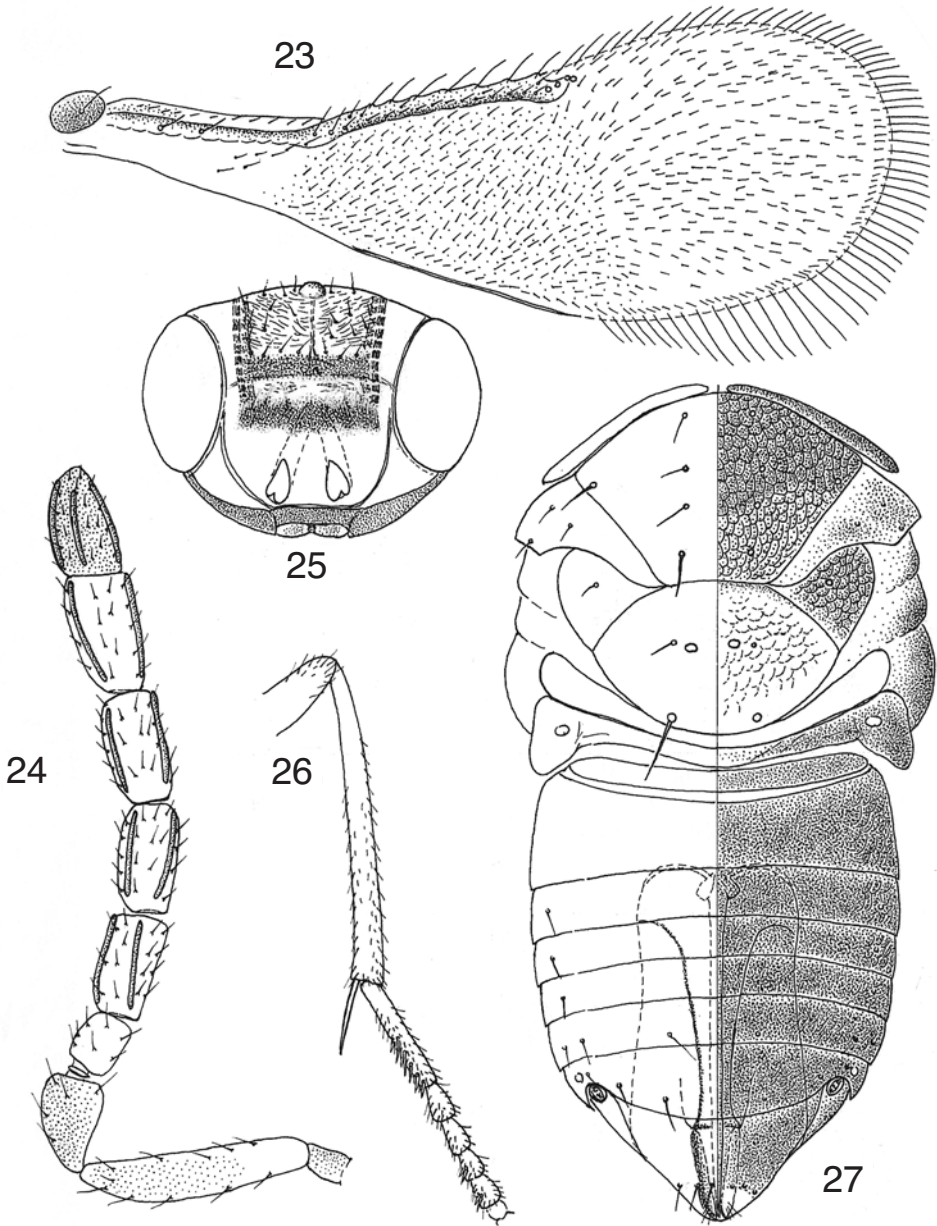
Encarsia elegans; Priesner & Hosny, 1940: 61; Thompson, 1953: 18; Herting, 1972: 104; Viggiani, 1985b: 84; 1987: 140.

Encarsia bifasciaefacies Hayat, 1989: 58. Synonymised by Huang & Polaszek, 1998.

Material.— 7 ♀♀, Assiut, 9.iii.1993 (S. Abd-Rabou) ex *Aleurolobus niloticus* on *Ziziphus* spec. (BMNH, PRIE, RMNH). 10 ♀♀, Aswan, 22.i.1977 (F.D. & R.W. Bink) ex *A. niloticus* (BMNH, ZMAN).

Diagnosis of female.

Head.— Pale, except the following dark: a narrow band extending across the clypeus and the malar space, fading just before the lower orbits; another well-defined band across the face, equidistant from the fore ocellus and lower toruli; a third, less well-defined band just below the fore ocellus, often absent or obscure; inner margins of ocelli on stemmaticum, occiput. Antenna yellow, anterior half of scape and pedicel brown, F6 dark brown, longitudinal sensilla on flagellar segments dark brown. Maxillary palps and labial palps 1-segmented. Antennal formula 1,1,4,2. Pedicel longer than F1, but shorter than F2; F1 $1.2 \times$ as long as wide, distinctly shorter than F2; F2, F3, F4 equal in length. Flagellum with the following numbers of longitudinal sensilla:



Figs 23-27. *Encarsia elegans* Masi, 23. fore wing; 24. antenna; 25. head; 26. mid leg; 27. mesosoma and gaster.

F1:0, F2:2-3, F3:2-3, F4:3-4, F5:2-4, F6:3-4.

Mesosoma.— Pale, except the following dark: pronotum, anterior half of mid lobe of mesoscutum, side lobes of mesoscutum partly, mesopleuron, axillae, propodeum (except middle). Fore wing infuscated below marginal vein. Legs pale yellow to white except middle coxa partly brown, hind coxa and femora brown. Mid lobe of mesoscutum and axillae with reticulate sculpture, and with 9-13 setae, arranged as two robust lateral setae, and a variable number of central setae, odd numbers of central; setae being more common than even numbers. Each side lobe of mesoscutum with 3 setae. Placoid sensilla on scutellum relatively closely placed, separated by about 2-3 × their own maximum diameter, distance between anterior pair of scutellar setae subequal to that between posterior pair. Fore wing about 2.8 × as long as wide. Marginal fringe 0.25 × as long as width of wing. 2 setae on submarginal vein, 7-9 setae on anterior margin of marginal vein, 6 setae in basal cell. Tarsal formula 5-5-5.

Metasoma.— Petiole and gaster dark except apex of T7 yellow. Third valvulae brown to dark brown. T2-T7 with 1+1, 1+1, 1+1, 2-3+2-3, 2-3+2-3 and 4-7 setae, respectively. Ovipositor shorter than middle tibia and basitarsus combined, third valvula 0.3 × as long as second valvifer.

Male.— Coloration and morphology as for female, except the following: Face without any cross bands, fore wing not infuscated below the marginal vein. Antennae with abundant longitudinal sensilla, F5 and F6 completely separate.

Species group placement.— *E. elegans* group.

Distribution outside Egypt.— China, India, Italy, Pakistan (Masi, 1911; Huang & Polaszek, 1998).

Hosts. Aleyrodidae: *Aleurolobus marlatti* (Chou *et al.*, 1996), *A. niloticus*, *A. olivinus* (Silvestri) (Masi, 1911), *A. rhododendri* Takahashi (Huang & Polaszek, 1998).

Remarks.— *E. elegans* was first recorded from Egypt by Priesner & Hosny (1940), and later by Abd-Rabou (1994). It is a widespread species in the Old World.

Encarsia formosa Gahan, 1924
(figs 28-31)

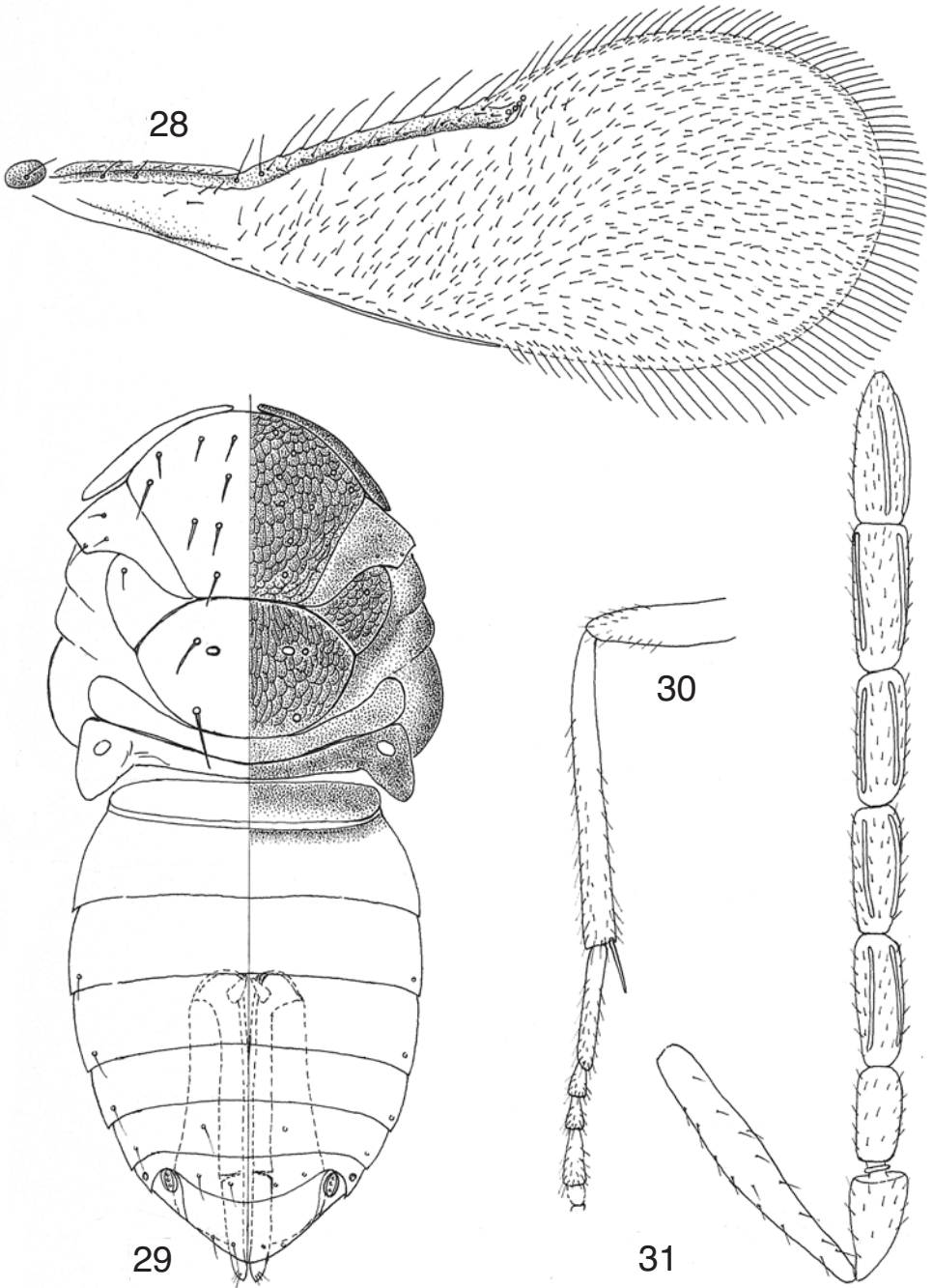
Encarsia formosa Gahan, 1924: 14. Syntypes ♀ ♀, [U.S.A.:] Idaho, Twin Falls (USNM, not examined).
Encarsia formosa; Abd-Rabou, 1994: 28; Liu & Stansly, 1996: 386.

Material.— No specimens from Egypt were examined during the present study.

Diagnosis of female.

Head.— brown to dark brown. Antennae yellow to dusky. Antennal formula 1,1,4,2. Pedicel longer than F1. F1 1.70 × as long as wide, shorter than F2 and F3. Flagellum with the following numbers of longitudinal sensilla: F1:0, F2:2, F3:2, F4:3, F5:3, F6:2.

Mesosoma.— Brown to dark brown, occasionally mid lobe of mesoscutum with black spots. Fore wings hyaline. Legs yellow except fore and hind coxae basally brown. Mid lobe of mesoscutum, axillae, propodeum with distinct reticulate sculpture. Mid lobe of mesoscutum with 18-20 setae. Each side lobe of mesoscutum with 3 setae and each axilla with 1 seta. Placoid sensilla on scutellum distantly placed, dis-



Figs 28-31. *Encarsia formosa* Gahan, 28. fore wing; 29. mesosoma and gaster; 30. mid leg; 31. antenna.

tance between anterior pair of scutellar setae approximately equal to that between posterior pair. Fore wing about $2.37 \times$ as long as wide. Marginal fringe $0.28 \times$ as long as width of wing. 2 setae on submarginal vein, 6-7 setae on anterior margin of marginal vein, 3-4 setae in basal cell. Tarsal formula 5-4-5.

Metasoma.— Petiole brown to dark brown. Gaster yellow except, narrowly, anterior margin of T1 brown. Third valvulae pale. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor shorter than middle tibia, third valvula $0.60 \times$ as long as second valvifer.

Male.— Head brown, ocellar area, clypeus, malar space dark brown. Mesosoma (including scutellum), petiole and gaster brown to dark brown. Antenna 8-segmented, not clavate. Pedicel short, $0.53 \times$ as long as F1. Each segment of flagellum with 5-6 longitudinal sensilla. Tarsal formula 5-4-5. Male genitalia as long as middle tibia.

Species group placement.— *E. luteola* group (Gahan, 1924; Polaszek et al., 1992).

Distribution outside Egypt.— Cosmopolitan.

Hosts.— Aleyrodidae: *Aleuroglandulus malangae* Russell, *Aleurotrachelus trachoides* (Back), *Aleyrodes lonicerae* Walker, *A. prolella* (L.), *A. spiraeoides* Quaintance, *Bemisia tabaci* (Gennadius), *Dialeurodes chittendeni* Laing, *D. citri*, *Trialeurodes vaporariorum* (Westwood).

Remarks.— *E. formosa* was introduced into Egypt by the Ministry of Agriculture in 1992 for the control of *B. tabaci* "B" biotype (Abd-Rabou, 1994). Interestingly, specimens identified as *E. formosa* (by USNM taxonomists) were collected from the Nile Delta in the same year (Liu & Stansly, 1996; L. Lacey pers. comm.).

Encarsia inaron (Walker, 1839)
(figs 32-35)

Aphelinus Inaron Walker, 1839: 10. Lectotype ♀, [designated by Graham, 1976]; [UK] (Haliday) [no other data] (NMI, examined).

Encarsia inaron; Graham, 1976: 142; Polaszek et al., 1992: 383; Abd-Rabou & Viggiani, 1998: 12.

Aphelinus Idaeus Walker, 1839: 12. Synonymized by Graham, 1976.

Encarsia partenopea Masi, 1909: 32. Thompson, 1953: 19. Synonymised by Polaszek et al., 1992.

Encarsia indifferentis Mercet, 1929: 220. Holotype ♀, Egypt: [?Giza] (A. Alfieri) [?1919]. (MNCN, examined). **Syn. nov.**

Trychaporus aleyrodis Mercet, 1930: 196. Synonymised by Polaszek et al., 1992.

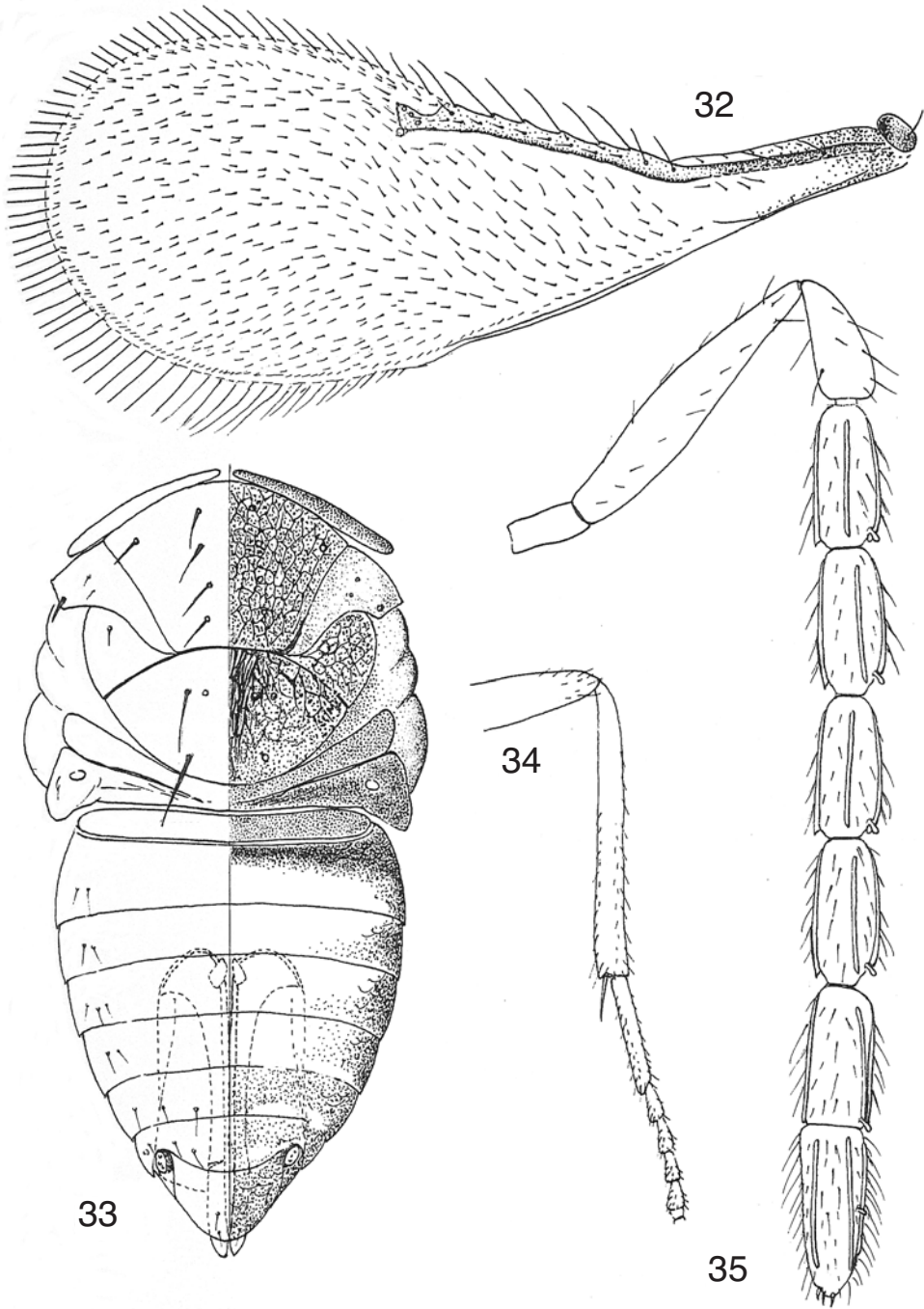
Encarsia borealis Huldén, 1986: 18. Synonymised by Huang & Polaszek, 1998.

Encarsia brassicae Shafee & Darvas, 1984: 29. Synonymised by Hayat, 1989.

Material.— 1 paratype ♂ of *Encarsia indifferentis* Mercet. EGYPT [?Giza] (A. Alfieri) [?1919] (MNCN). 4 ♀♀, 2 ♂♂, Qalyubiya 12.xii.1994 (S. Abd Rabou) ex *Trialeurodes vaporariorum* on *Ricinus communis* (BMNH, PRIE, RMNH). 1 ♀, Assiut, 20.x.1990 (S. Abd Rabou) ex *Siphoninus phillyreae* on *Punica granatum* (PRIE). 1 ♀, same data except 7.ix.1991 (BMNH). 12 ♀♀, 12 ♂♂, Fayoum, 16.x.1930 (H. Priesner) ex *Aleyrodes* sp (sic) on *P. granatum* (BMNH). 1 ♂, Nag Hammadi, 18.xi.1930 (S. Afifi & M.S. Hassan) ex *S. phillyreae* (as *S. granati*) on *P. granatum* (BMNH).

Diagnosis of female.

Head.— Brown to dark brown. Antenna brown. Antennal formula 1,1,4,2; F1 longer than pedicel, and about as long as F2-F4 individually. Flagellum with the following numbers of longitudinal sensilla: F1:1-2, F2:2-3, F3:3-4, F4:3-4, F5:2-3, F6:3.



Figs 32-35. *Encarsia inaron* (Walker), 32. fore wing; 33. mesosoma and gaster; 34. mid leg; 35. antenna.

Mesosoma.— Brown to dark brown. Fore wing hyaline, except base. Legs yellow except coxae, and (in dark specimens) mid and hind femora, brown. Mid lobe of mesoscutum, scutellum and axillae with distinct reticulate sculpture, longitudinal on the central scutellum. Mid lobe of mesoscutum with 10-14 setae. Each side lobe of mesoscutum with 3 setae. Placoid sensilla on scutellum slightly distantly placed, distance between anterior pair of scutellar setae greater than that between posterior pair. Marginal fringe of fore wing very short. Tarsal formula 5-5-5.

Metasoma.— Petiole brown to dark brown. Gaster variable, from largely pale to largely brown. Third valvulae pale. T1-T7 with 0-1+0-1, 2+2, 2+2, 2-3+2-3, 2+2, 2+2 and 4 setae. Ovipositor shorter than middle tibia and basitarsus combined.

Male.— Entirely brown. Structural details essentially as for female, except ovipositor, and antenna with abundant longitudinal sensilla on all segments. No sensorial complex present, antennomeres all separated.

Species group placement.— *E. inaron* group (= *E. partenopea* group, sensu Viggiani & Mazzone, 1979).

Distribution.— Taiwan. Europe, North Africa, Asia. Introduced into North America.

Hosts.— Aleyrodidae: *Acaudaleyrodes citri*, *Aleyrodes lonicerae* (Walker), *A. prolella* (L.), *A. singularis* Danzig, *Asterobemisia carpini* (Koch), *A. paveli* (Zahradnik), *B. tabaci*, *Bulgarialeurodes cotesii* (Maskell), *Bemisia* spec., *Pealius quercus* (Signoret), *Siphoninus immaculatus* (Heeger), *S. phillyreae* (Haliday), *T. vaporariorum* (Westwood).

Remarks.— Mercet (1929) described *E. indifferentis* as distinct from *E. inaron* (as *E. partenopea*) on the basis of colour differences in the gaster, and having weaker mesosomal sculpture. Regarding colour, Laudonia & Viggiani (1995) have shown that gastral colour varies considerably in this species. The mesosomal sculpture of the female holotype of *E. indifferentis* is well within the range of variation encountered in *E. inaron*.

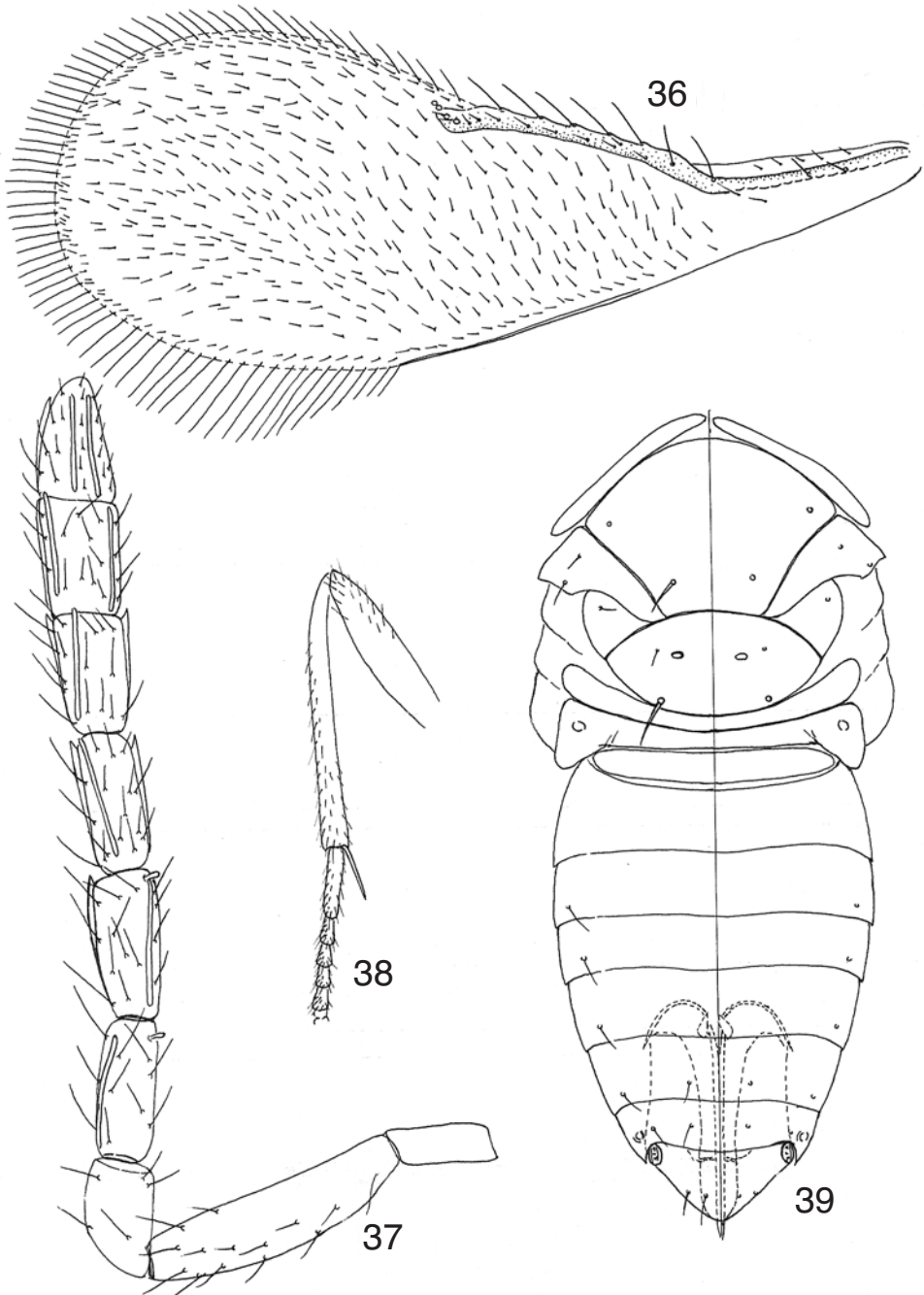
In the French translation (Mercet, 1931) of the description of *E. indifferentis* a locality (Giza), collection date (13.iii.1919) and host record (*Chionaspis striata* Newstead on *Cupressus sempervirens*) were added. It seems almost certain that these data were added in error. None appears in the original description or on the type specimens. Ferrière (1965) treated *E. indifferentis* as a valid species, without commenting on its affinities.

E. inaron is a widespread species, with many synonyms (see above). *E. longicornis* Mercet and *E. siphonini* Silvestri may constitute additional synonyms, but further study is necessary to confirm this. It is entirely possible that *E. inaron* constitutes a complex of cryptic species which may require more advanced taxonomic techniques to separate. If this is proven in future, then some of the available names above may need to be revised. However, on current evidence there is no reason to retain them as separate.

Encarsia lahorensis (Howard, 1911)
(figs 36-39)

Prospaltella lahorensis Howard, 1911: 132. Lectotype ♀, (designated by Hayat, 1981) Pakistan, Lahore, xi.1910 (R.S. Woglum) (USNM, not examined).

Encarsia lahorensis; Viggiani & Mazzone, 1979: 46.



Figs 36-39. *Encarsia lahorensis* (Howard) 36. fore wing; 37. antenna; 38. mid leg; 39. mesosoma and gaster.

Material.— 1 ♀, 1 ♂, El Khatatba 16.xii.1992 (S. Abd-Rabou) ex *Dialeurodes citri* on *Citrus* (BMNH). 2 ♀♀, Qalyubiya 20.ix.1996 (S. Abd-Rabou) ex *Dialeurodes citri* on *Citrus* (BMNH, RMNH).

Diagnosis of female.

Head.— Pale yellow. Antenna orange-yellow except scape pale yellow. Mandibles with 2 teeth. Antennal formula 1,1,3,3. Pedicel shorter than F1; F1 2.7 × as long as wide, approximately equal to F2 and F3; Clava shorter than funicle, each segment of clava approximately equal in length; Flagellum with the following numbers of longitudinal sensilla: F1:1, F2:2, F3:3, F4:3, F5:3, F6:3.

Mesosoma.— Entirely yellow. Fore wings hyaline. Legs pale yellow. Mid lobe of mesoscutum with 2+2 setae. Each side lobe of mesoscutum with 2 setae. Placoid sensilla on scutellum distantly placed, distance between anterior pair of scutellar setae equal to or slightly greater than that between posterior pair, anterior pair of scutellar setae fine and short. Fore wing approximately 2.6 × as long as wide. Marginal fringe 0.26 × as long as width of wing. 2 setae on submarginal vein, 5 setae on anterior margin of marginal vein, 2 setae in basal cell. Tarsal formula 5-5-5.

Metasoma.— Entirely yellow. Third valvulae pale. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor shorter than middle tibia, third valvula 0.39 × as long as second valvifer.

Male.— Structural details as for female, except antennae (8-segmented, F5 & F6 slightly fused, no sensorial complex) and genitalia. Coloration differing markedly; gaster and mesosoma extensively dark brown.

Species group placement.— Uncertain, placed by Viggiani & Mazzone (1979) in the *E. lahorensis*-group, which was followed by Hayat (1989).

Distribution outside Egypt.— China, India, Pakistan; introduced into Italy and USA.

Hosts.— Aleyrodidae: *Dialeurodes citri*. Also recorded from the following hosts: *D. kirkaldyi*, *Tuberaleyrodes machili* Takahashi (Huang & Polaszek, 1998).

Encarsia lounsburyi (Berlese & Paoli, 1916)
(figs 40-43)

Prospaltella lounsburyi Berlese & Paoli, 1916: 305. Syntypes ♀♀, Madeira, ex *Chrysomphalus dictyospermi* Morgan, (?ISZA, not examined).

Aspidiotiphagus lounsburyi; Priesner & Hosny, 1940: 60.

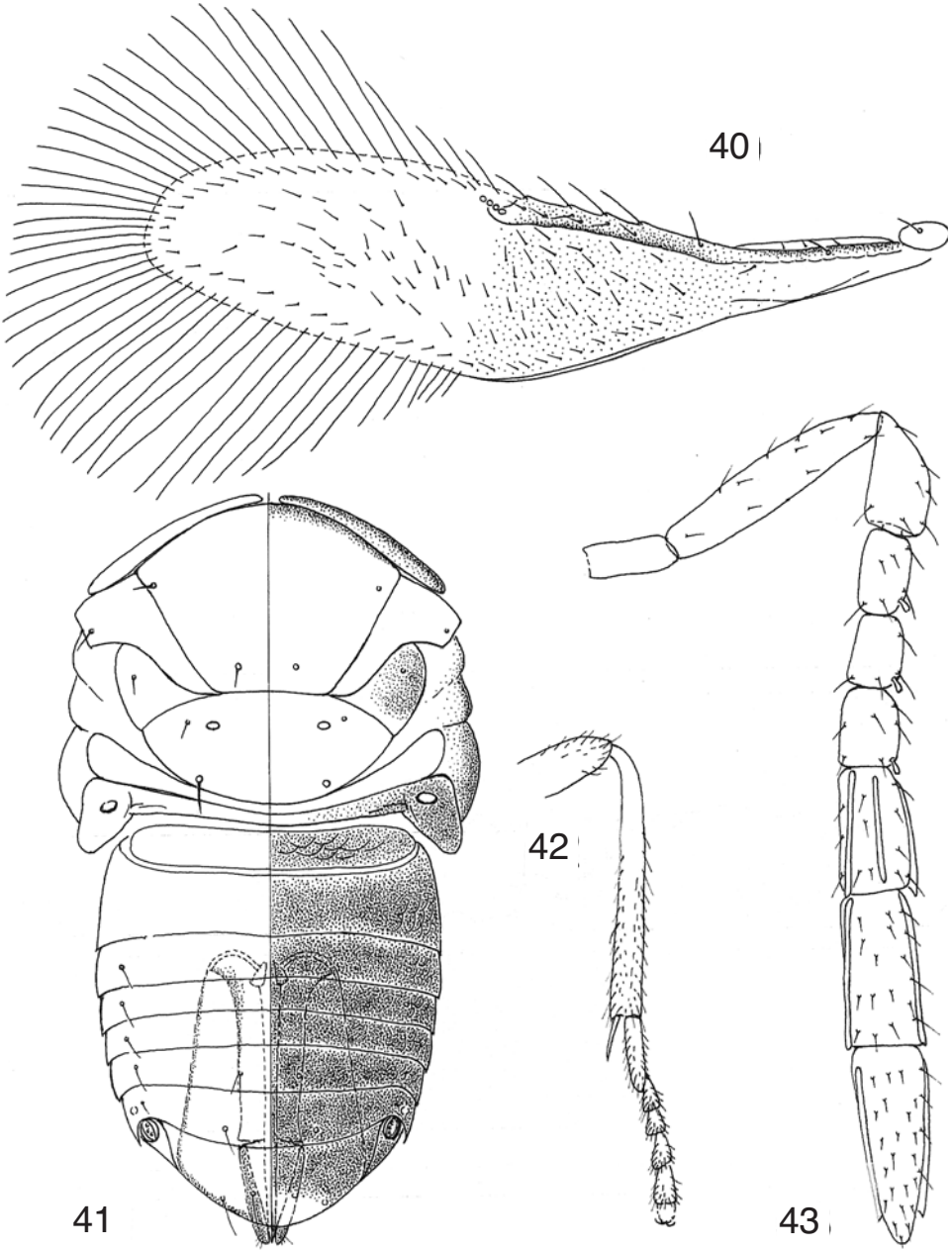
Encarsia lounsburyi; Viggiani & Mazzone, 1979: 47.

Material.— 2 ♀♀, Alexandria, Antoniades' Garden 29.vii.1930 (H. Priesner) ex *Parlatoria proteus* (BMNH).

Diagnosis of female.

Head.— Yellow, clypeus, malar sulcus, occiput, postocellar bars behind lateral ocelli brown to dark brown. Antennal formula 1,1,3,3. Pedicel longer than F1; F1 1.7 × as long as wide, approximately equal to F2 and F3. Flagellum with the following numbers of longitudinal sensilla: F1:0, F2:0, F3:0, F4:3, F5:3, F6:3.

Mesosoma.— Yellow except pronotum, anterior margin of mid lobe of mesoscutum, axillae, mesopleuron, propodeum brown to dark brown. Antenna brown yellow



Figs 40-43. *Encarsia lounsburyi* (Berlese & Paoli), 40. fore wing; 41. mesosoma and gaster; 42. mid leg; 43. antenna.

except base of scape and radicle pale yellow. Fore wings hyaline, infuscated below marginal vein. Legs pale yellow. Mid lobe of mesoscutum with 2+2 setae. Each side lobe of mesoscutum and each axilla with 1 seta. Placoid sensilla on scutellum distantly placed, distance between anterior pair of scutellar setae greater than that between posterior pair. Fore wing narrow, about $4.0 \times$ as long as wide, with an asetose area around stigmal vein. Marginal fringe $1.25 \times$ as long as width of wing; only 1 seta on submarginal vein, 4 setae on anterior margin of marginal vein, 1 seta in basal cell. Tarsal formula 5-5-5.

Metasoma.— Petiole brown. Gaster brown to dark brown except apex of T7 yellow. Third valvulae brown. Petiole with distinct sculpture. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor shorter than middle tibia and basitarsus combined, third valvula $0.55 \times$ as long as second valvifer.

Male.— Unknown.

Species group placement.— *E. citrina*-group.

Distribution outside Egypt.— Cosmopolitan, and widely introduced.

Hosts.— Diaspididae: *Parlatoria proteus* (Curtis). As well as *P. proteus*, the following additional hosts have been recorded in Egypt (Priesner & Hosny, 1940): *Abgralaspis* (as *Aspidiotus*) *cyanoophylli* (Signoret), *Aspidiotus nerii* Bouché (as *A. hederiae*), *Chrysomphalus aonidum* (L.) (as *C. ficus*), *C. personatus* Comstock, *Diaspis echinocacti* (Bouché), *Hemiberlesia lataniae* (Signoret) (as *Diaspidiotus*), *Fiorinia fioriniae* (Targioni), *Lepidosaphes pinnaeformis* (Bouché), *Lineaspis* (as *Chionaspis*) *striata* (Newstead). Huang & Polaszek (1998) recorded the following, additional hosts: *Aonidiella aurantii* (Maskell), *Chrysomphalus dictyospermi* (Morgan), *Carulaspis juniperi* (Bouché) (= *visci* Schrank), *Chysomphalus aonidum* (L.), *Chrysomphalus* spec., *Cornuaspis* (= *Lepidosaphes*) *beckii* (Newman), *Hemiberlesia* spec., *Parlatoria ziziphi* (Lucas).

Remarks.— *E. lounsburyi* is very close to *E. citrina* (Craw). The main difference between the two species is the number of setae on the submarginal vein, 1 seta in *E. lounsburyi*, 2 in *E. citrina*.

Encarsia lutea (Masi, 1909)

(figs 44-46, 48)

Prospaltella lutea Masi, 1909: 25. Syntypes 2 ♀♀, Italy: Campania, Portici (IEUN, examined).

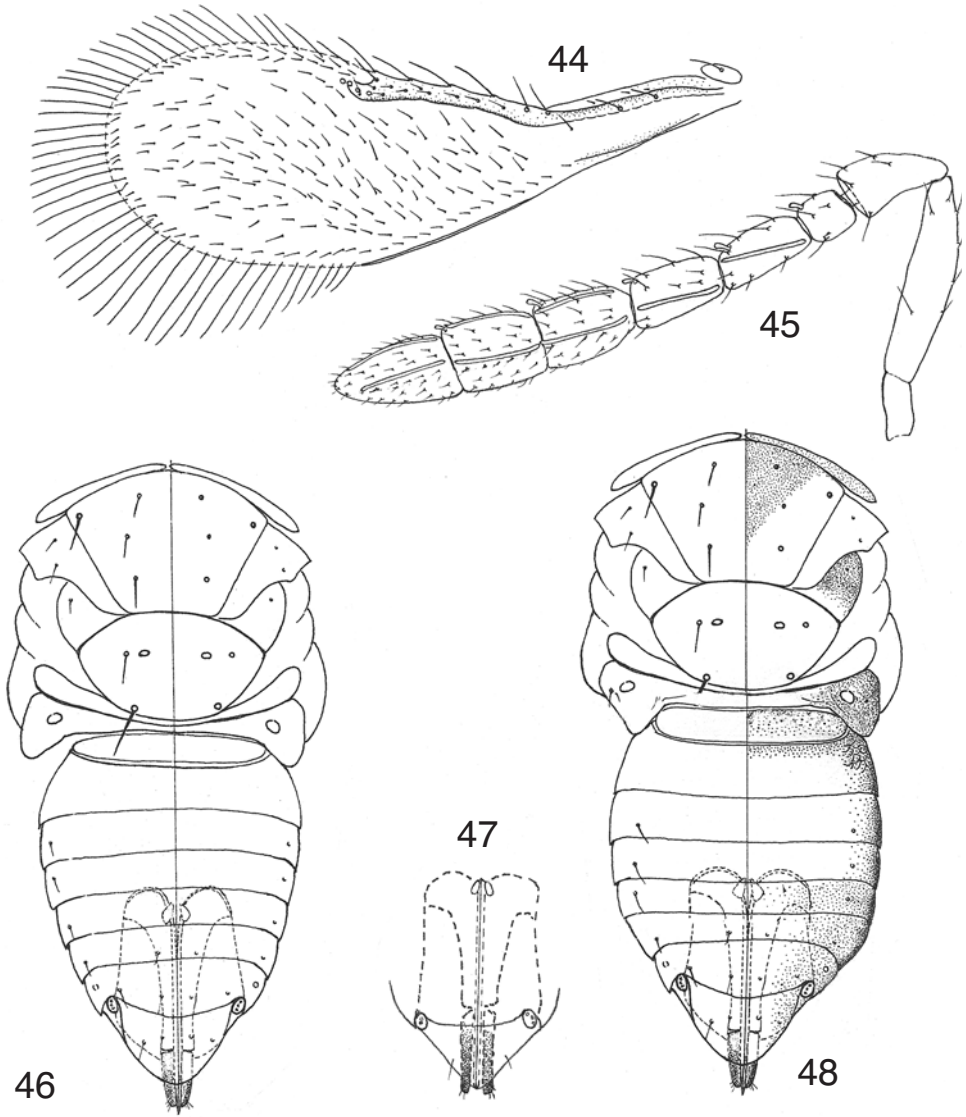
Prospaltella lutea; Shalaby et al., 1991: 209.

Encarsia lutea; Ferrière, 1965: 132; Viggiani & Mazzone, 1979: 46; 1980: 51; Hayat, 1989: 48; Viggiani, 1987: 155; Polaszek et al., 1992: 384; Abd-Rabou & Viggiani, 1998: 12.

Material.— 2 ♀♀, 1 ♂, Arish 7.ix.1991 (S. Abd-Rabou) ex *Siphoninus phillyreae* on *Punica granatum* (BMNH, RMNH). 2 ♀♀, Aswan 22.i.1977 (F.D. & R.W. Bink) ex *Aleurocanthus zizyphi* Priesner & Hosny (BMNH, ZMAN). 3 ♂♂, between Aswan and Luxor 6-15.v.1992 (R. & L. Burkhart) ex *Bemisia tabaci* on ?*Lantana* (BMNH). 4 ♂♂, Cairo 14-17.v.1992 (R. & L. Burkhart) ex *Bemisia tabaci* on *Lantana* (BMNH). 2 ♀♀, Kobba 28.ix.1930 (H. Priesner) ex *Aleurodes* (sic) on rose (BMNH). 3 ♀♀, Qalyubiya 12.xii.1994 (S. Abd-Rabou) ex *Trialeurodes vaporariorum* on *Ricinus communis* (BMNH, RMNH). 3 ♀♀, 1 ♂, Qalyubiya 27.x.1990 (H.W. Browning) (BMNH). 3 ♀♀, 3 ♂♂, Shebin El Kom 1979 (E.L. Said) CIE A10878 ex *Bemisia tabaci* (BMNH).

Diagnosis of female.

Coloration variable, from entirely yellow with third valvulae at least distally



Figs 44-46, 48. *Encarsia lutea* (Masi), 44. fore wing; 45. antenna; 46. mesosoma and gaster (pale form); 46. mesosoma and gaster (dark form). Fig. 47. *Encarsia davidi* Viggiani & Mazzone, ovipositor.

brown to black in striking contrast, to yellow with the following pale brown: axillae, petiole and T1, lateral gaster. Antenna yellow. Fore wings hyaline. Legs pale yellow.

Mandibles with 2 teeth and a truncation. Maxillary palps and labial palps 1-segmented. Antennal formula 1,1,3,3. Pedicel longer than F1; F1 usually quadrate, slightly shorter than F2 and F3 respectively. Flagellum with the following numbers of longitudinal sensilla: F1:0, F2:0, F3:0-1, F4:2, F5:2-3, F6:2-3. Mid lobe of mesoscutum with 6-8 setae. Each side lobe of mesoscutum with 2-3 setae. Placoid sensilla on scutellum

distantly placed, distance between anterior pair of scutellar setae greater than that between posterior pair. Fore wing about $2.71 \times$ as long as wide. Marginal fringe $0.54 \times$ as long as width of wing. 2 setae on submarginal vein, 4-6 setae on anterior margin of marginal vein, 1 seta in basal cell. Tarsal formula 5-5-5. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor shorter than middle tibia and basitarsus combined, third valvula $0.33 \times$ as long as second valvifer.

Male.— Antenna with a strongly developed sensorial complex on F1-F3.

Species group placement.— *E. lutea* group.

Distribution outside Egypt.— Cosmopolitan.

Hosts.— Aleyrodidae: *Aleurocanthus zizyphi*, *Bemisia tabaci*, *Siphoninus phillyreae*, *Trialeurodes vaporariorum*. The following additional hosts have been recorded (Huang & Polaszek, 1998): Aleyrodidae: *Acaudaleyrodes citri*, *Aleurocanthus cinnamomi* Takahashi, *Aleurolobus marlatti* (Quaintance), *A. niloticus*, *A. rhododendri* Takahashi, *A. setigerus* Quaintance & Baker, *A. wunni* (Ryberg), *Aleuroplatus pectiniferus* Quaintance & Baker, *Aleurotrachelus rubi* Takahashi, *Aleurotrachelus spec.*, *Aleurotuberculatus aucubae* (Kuwana), *A. ficicola* Takahashi, *A. gordoniae* Takahashi, *A. jasmini* Takahashi, *A. malloti* Takahashi, *A. melastomae* Takahashi, *A. psidii* (Singh), *Aleyrodes loniceriae*, *A. proletella*, *Asterobemisia carpini*, *A. atraphaxius* (Danzig), *Bemisia argentifolii*, *B. ovata* (Goux), *B. porteri* Corbett, *B. salicaria* Danzig, *Bulgarialeurodes cotesii*, *Dialeurodes citri*, *D. fici*, *D. formosanensis* Takahashi, *D. kirkaldyi*, *Dialeurodes spec.*, *Pealius mori*, *P. setosus* Danzig, *Singhius hibisci*, *Taiwanaleyrodes meliosmae*, *Tetralicia spec.*, *Trialeurodes abutiloneus* (Haldeman).

Species group placement.— *E. lutea* group.

Distribution outside Egypt.— Cosmopolitan.

Remarks.— As noted by several authors (e.g. Huang & Polaszek, 1998, Viggiani & Ren, 1993), there is considerable colour variation between populations of *E. lutea*. This species-group is currently being studied in detail.

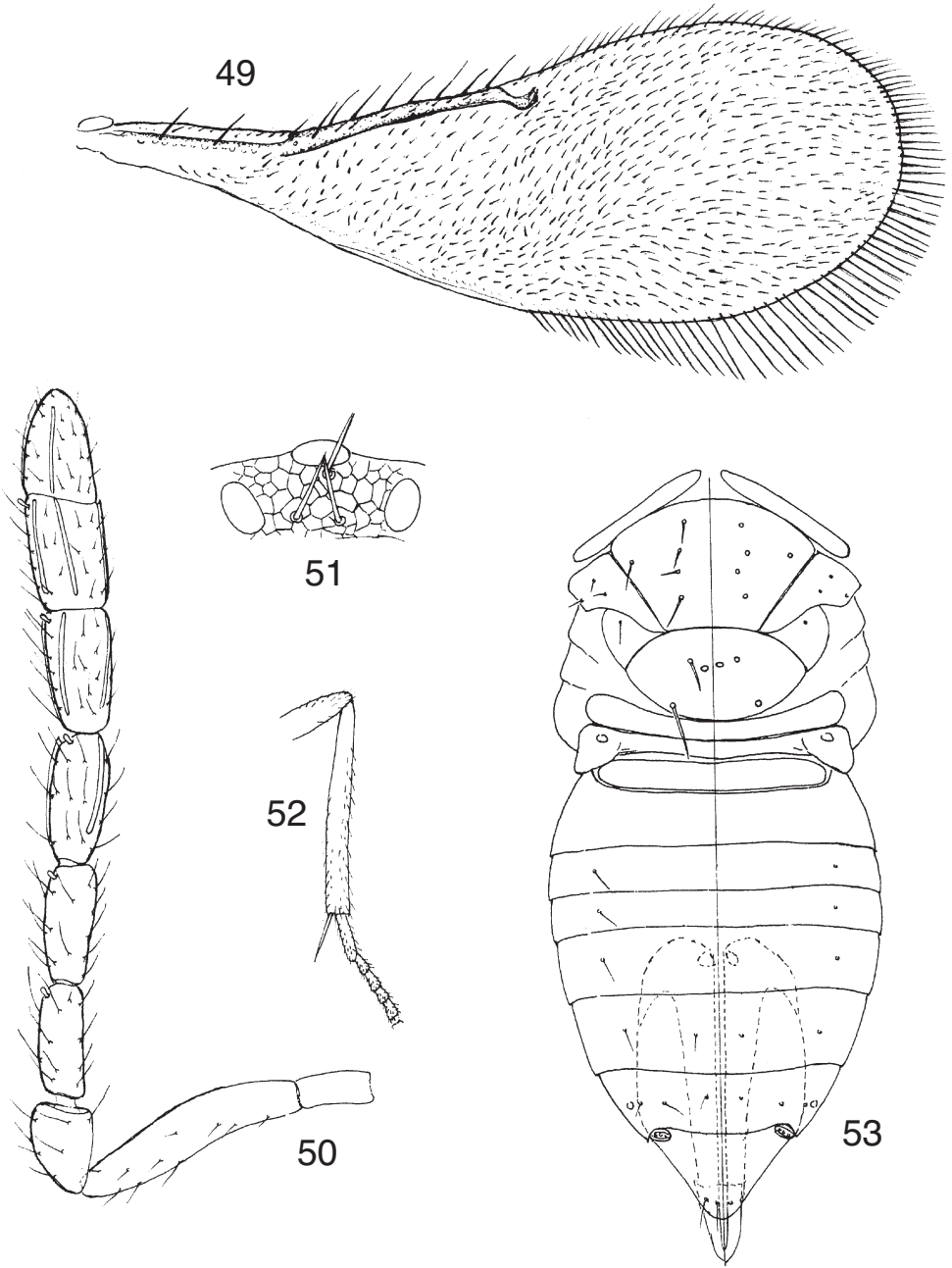
Encarsia mineoi Viggiani, 1982
(fig. 10)

Encarsia mineoi Viggiani, 1982: 27 Holotype: ♀, Libya, Sidi Mesri, 10.vi.69 (G. Mineo) ex *B. tabaci*; Abd-Rabou & Viggiani, 1998: 12 (IEUN, examined).

Material.— 2 ♀♀, Arish, 7.ix.1991 (S. Abd-Rabou) ex *Siphoninus phillyreae* on *Punica granatum* (BMNH, RMNH). 1 ♀, 1 ♂, Cairo, PPRI grounds 13.ii.1992 (H.W. Browning) ex *Bemisia tabaci* (BMNH). 1 ♀, Luxor 28.i.1977 (F.D. & R.W. Bink) ex *B. tabaci* (ZMAN). 2 ♀♀, Qalyubiya vii.1991 (S. Abd-Rabou) ex *Bemisia tabaci* (BMNH). 1 ♀, Qaliubiya, Tukh site #1 27.x.1990 (H.W. Browning) ex *Acaudaleyrodes citri* (BMNH). 4 ♂♂, Qalyubiya 12.xii.1994 (S. Abd-Rabou) ex *Trialeurodes vaporariorum*, with *Encarsia inaron*, on *Ricinus communis* (BMNH, PRIE, RMNH).

Diagnosis of female.

Head.— Pale, post-ocellar bars darker, clypeus very distinctly and deeply pigmented. Antennae dark. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1,1,4,2. F1 longer than wide, approximately $0.6 \times$ as long as pedicel. F2 $1.3 \times$ as long as F1, a little shorter than F3. F3 and F4 subequal. Clava $0.7 \times$ as long as funicle. F1 and F2 without longitudinal sensilla.



Figs 49-53. *Encarsia protransvena* Viggiani, 49. fore wing; 50. antenna; 51. stemmaticum. 52. mid leg; 53. mesosoma and gaster.

Mesosoma.— Largely pale, pronotum, mid lobe of mesoscutum anteriorly and propodeum slightly darker. Fore wing hyaline. Legs pale. Mid lobe of mesoscutum and axillae with elongate/reticulate sculpture. Mid lobe of mesoscutum with 2+2 setae, and each side lobe of mesoscutum with only 1 seta. Placoid sensilla on scutellum distantly placed, distance between anterior pair of scutellar setae a little greater than that between posterior pair. Fore wing approximately 3.1 × as long as wide, marginal fringe 0.55 × as long as width of wing. An asetose area present around the stigmal vein, and the wing apex slightly indented. Two setae on submarginal vein, 5-6 setae on anterior margin of marginal vein, 2-3 setae in basal cell. Tarsal formula 5-5-5.

Metasoma.— Gaster largely pale, petiole and T1 darker. Petiole without sculpture. T2-T7 with 1+1, 1+1, 1+1, 2+2, 1+1 and 4 setae, respectively. Ovipositor shorter than, or up to 1.1x as long as, mid tibia.

Male.— Generally much darker than the female, with the typical appearance of a male *Encarsia*. F5 and F6 of the antenna partially fused.

Species group placement.— *E. parvella* group sensu Hayat, 1989.

Distribution outside Egypt.— Israel, Libya, Spain, Sudan.

Hosts.— *Acaudaleyrodes citri*, *Bemisia tabaci*, *Siphoninus phillyreae*. Males have been reared, presumably as hyperparasitoids, from *T. vaporariorum*.

Hosts.— Aleyrodidae: ?*Acaudaleyrodes citri*, *Bemisia tabaci*.

Remarks.— See *E. acaudaleyrodis*, above.

Encarsia protransvena Viggiani, 1985
(figs 49-53)

Encarsia protransvena Viggiani, 1985b: 89. Holotype ♀, U.S.A.: Florida, Broward Co[unty]. F[or]t. Lauderdale, ix.1984 (C.R.R. Thompson) ex *Dialeurodes kirkaldyi* (IEUN, examined).

Encarsia strenua; Polaszek et al., 1992: 388 (misidentification, in part, of *E. protransvena*); Booth & Polaszek, 1996: 73; Schaufuff et al., 1996: 29 (misidentification of *E. protransvena*).

Material.— 1 ♀, Qalyubiya 20.ix.1996 (S. Abd-Rabou) ex *Dialeurodes citri* on *Citrus* (BMNH).

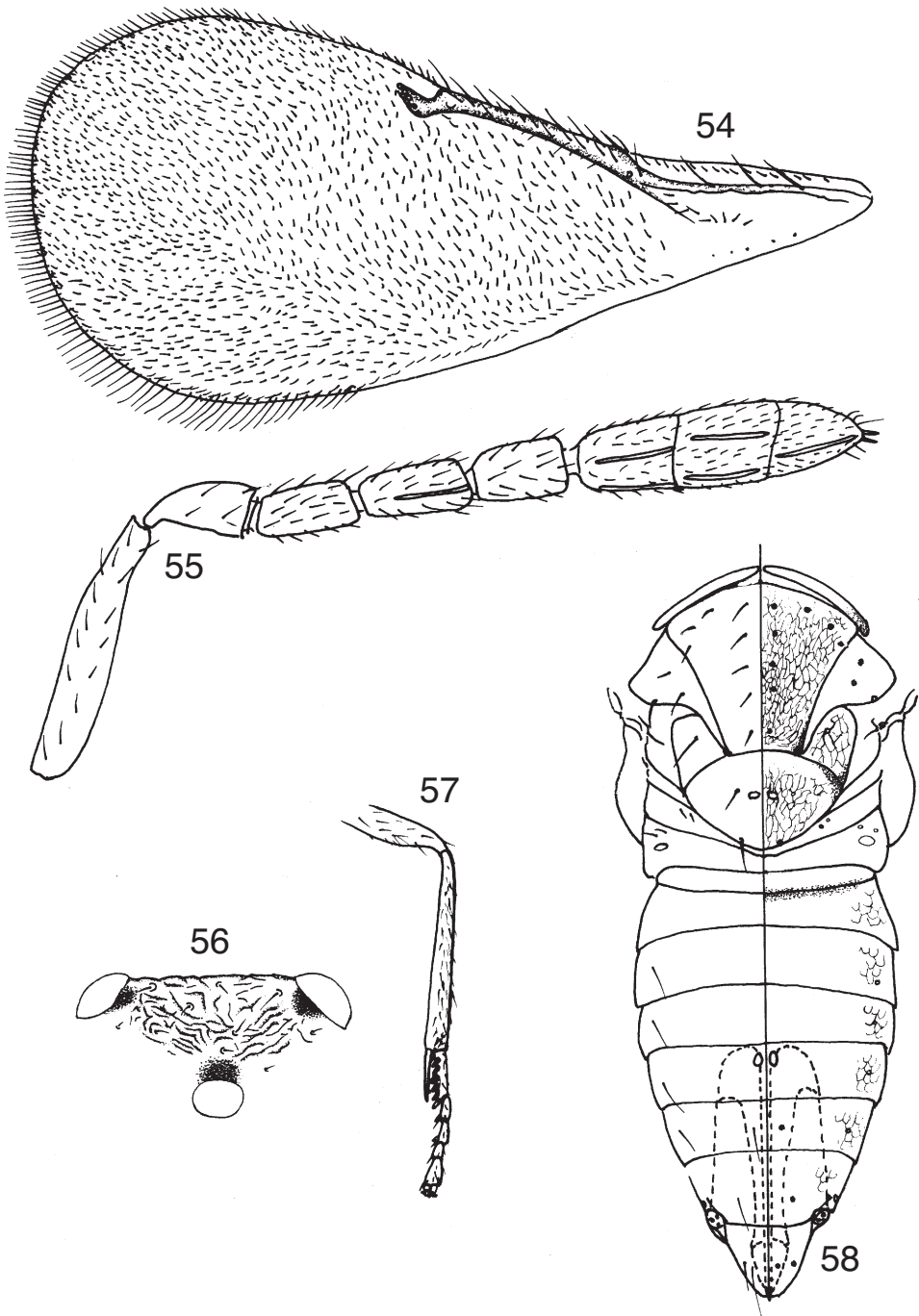
Diagnosis of female.

Head.— Pale. Antenna yellow to brown-yellow. Head, including stemmaticum, largely with reticulate sculpture. Antennal formula 1,1,3,3. Pedicel slightly shorter than, or approximately equal to, F1; F1 slightly shorter than, or approximately equal to, F2. F1-F3 increasing very slightly in length, or adjacent segments approximately equal.

Mesosoma.— Yellow to pale yellow. Fore wings hyaline. Legs yellow. Mid lobe of mesoscutum with 4+2+2+2 setae. Each side lobe of mesoscutum with 3 setae. Placoid sensilla on scutellum distinctly closely placed, separated by less than their own maximum diameter, distance between anterior pair of scutellar setae distinctly less than that between posterior pair. Maximum width of fore wing 2.5-4 × length of longest marginal fringe seta. 2 setae on submarginal vein.

Metasoma.— Yellow to pale yellow. Third valvulae pale. T2-T7 with 1+1, 1+1, 1+1, 2+2, 3+3 and 4 setae, respectively. Ovipositor longer than middle tibia and basitarsus combined, ovipositor 1.3-1.4 × as long as mid tibia.

Male.— Unknown.



Figs 54-58. *Encarsia ramsesi* spec. nov. 54. fore wing; 55. antenna; 56. stemmaticum; 57. mid leg; 58. mesosoma and gaster.

Species group placement.— *E. strenua* group.

Distribution outside Egypt.— China, Puerto Rico, Spain, USA.

Hosts.— Aleyrodidae: *Dialeurodes citri*. Also recorded from the following hosts: *Bemisia tabaci* (Kotinsky), *D. citrifolii* (Morgan), *D. kirkaldyi*, *Trialeurodes packardii* (Morrill) (Huang & Polaszek, 1998).

Remarks.— This constitutes the first record of this species for Egypt.

Encarsia ramsesi Polaszek **spec. nov.**
(figs 54-58)

Material.— Holotype ♀, Egypt, New Valley, Dakhla 15.iv.1992 (S. Abd-Rabou) ex *Ramsesseus follioti* (BMNH). Paratypes 7 ♀♀, 3 ♂♂, same data as holotype (BMNH, PRIE, RMNH). 4 ♀♀, Kharga 16.iv.1992 (S. Abd-Rabou) ex *R. follioti* (PRIE).

Description of female.

Head.— Yellow to pale yellow. Antenna yellow to brown-yellow. Largely with aciculate sculpture, including stemmaticum. Antennal formula 1,1,3,3. Pedicel, F1 and F2 subequal, slightly longer than F3. Clava clearly 3-segmented.

Mesosoma.— Pale. Fore wings hyaline. Legs yellow. Mid lobe of mesoscutum unusually setose, with (up to) 10+2+2+2+2 setae. Each side lobe of mesoscutum with 3 setae. Placoid sensilla on scutellum distinctly closely placed, separated by less than their own maximum diameter, distance between anterior pair of scutellar setae slightly less than that between posterior pair. Maximum width of fore wing about 8 × length of longest marginal fringe seta. 3-4 setae on submarginal vein. Mid tibial spur robust, as long as longest side of corresponding basitarsus.

Metasoma.— Yellow. Third valvulae pale. T2-T7 with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor length approximately equal to middle tibia and basitarsus combined, ovipositor 1.25 × as long as mid tibia.

Male.— Unknown.

Species group placement.— *E. strenua* group.

Distribution outside Egypt.— Known only from Egypt, as is the host.

Host.— Aleyrodidae: *Ramsesseus follioti* Zahrádnik.

Remarks.— So far the only known endemic Egyptian species.

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