

A REVISION OF *ENCARSIA* (HYMENOPTERA: APHELINIDAE) SPECIES FROM IRAN

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Abstract

The genus *Encarsia* Foerster (Hymenoptera: Aphelinidae) contains species which are important biological control agents of whiteflies (Homoptera: Aleyrodidae) and armoured scales (Homoptera: Diaspididae). The taxonomy of the *Encarsia* species known as parasitoids of aleyrodids and coccoids in Iran is revised. Diagnostic descriptions are given for all species and each species is fully illustrated. A dichotomous key is provided to allow the determination of species. Synonym names, host records, species group placement, distribution outside Iran and taxonomic figures are given.

INTRODUCTION

The genus *Encarsia* Foerster (Aphelinidae: Coccophaginae) is a diverse and cosmopolitan group of species usually parasitic on Aleyrodidae (whiteflies), Diaspididae (armoured scales), or themselves (as autoparasitoids) (Polaszek, 1991). A few species are parasitoids of eggs of Lepidoptera (Polaszek, 1991). At present, about 280 valid species of *Encarsia* are recognized (Manzari *et al.* 2002) and new species are continually being described or recognized. The genus *Encarsia* represents one of the most important parasitic groups used in biological control and various species are currently being collected as part of intensive foreign exploration efforts to search for parasitoids of whiteflies of the genus *Bemisia* (Heraty & Polaszek, 2000).

Encarsia is a taxonomically difficult genus. 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. Within *Encarsia*, approximately 29 species groups are recognized by various authors (Viggiani & Mazzone, 1979; Hayat, 1989; Polaszek *et al.* 1992), with as few as 16 groups in the most recent treatment by Hayat (1998). Hosts and distribution of Genus *Encarsia* studied by Hayat, 1989; Polaszek *et al.* 1992; Hayat, 1998; Polaszek *et al.* 1999 and Heraty & Polaszek, 2000.

In spite of the fact that Al-e-Mansoor, 1992 and Ghahari & Hatami, 2000 have studied some aspects of natural enemies of whiteflies including *Encarsia* species from Iran yet the present work gives in detail full descriptions, illustrated figures and dichotomous identification key.

MATERIALS, METHODS AND ABBREVIATIONS

The study was mainly based on material collected over a period of fourteen years in Iran (1988 – 2002). Each sample was given a unique code number and host plant, host whitefly species, date, location and collector. Nymphs of parasitized hosts were kept in emergence chambers and the parasitoids transferred to gelatine capsules or 94% ethanol, where they remained at room temperature until further examination. Whiteflies were identified to species level using the fourth instar pupal case from which the parasitoid had emerged (Martin, 1987).

All specimens used in this study were slide mounted as described by Noyes (1982) with the following modifications: specimens were placed in 10% KOH for 5 – 8 min and incubated at 70 °C using a block heater. The terminology used follows Hayat (1989) with a very few 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 (Polaszek *et al.* 1999). All measurements of antennae and legs refer to the maximal length of the morphological structure in lateral view. Length of antennal segments were taken excluding the intersegmental membranes because they can vary depending on how much the antenna was stretched during slide preparation. Fore wing length is the distance between its most apical point and the proximal end of the submarginal vein, excluding the tegula. Gaster refers to the metasoma without the petiole (metasomal tergite 1). The length of the ovipositor was measured as the distance between the proximal margin of the basal ring to the extreme apex (Figs. 1 – 5) (Polaszek *et al.* 1999; Heraty & Polaszek, 2000). This is different from Hayat (1998) who measured the ovipositor length as the combined lengths of second valvifer and third valvula .

Males are often very difficult to identify without accompanying females. In a few species males are not known. Therefore, the key was designed only for females, but descriptions of males are provided where possible to aid identification of males in samples where males and females are present.

All specimens examined for this study were deposited in Department of Entomology, Islamic Azad University, Science & Research Campus, Tehran-Iran.

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.
UNLP	Universidad Nacional de La Plata, Argentina.
UNP	Universita degli Studi di Napoli, Portici, Italy.
USNM	United States National Museum of Natural History, Washington D.C., U.S.A.
ZDAMU	Zoology Department, Aligarh Muslim University, India.
ZMAN	Zoological Museum of the University of Amsterdam, The Netherlands.
ZSIC	Zoological survey of the India, Calcutta.

Results and Discussion

Of the 18 *Encarsia* species which were found parasitizing aleyrodids and scales in Iran, 13 species parasitized only aleyrodids, and 5 species are the parasitoids of scales. A dichotomous key to the *Encarsia* species is given. The key uses characters that can be readily seen using a standard compound microscope, although identification usually requires contrast enhancement techniques, e.g. phase contrast or differential interference contrast. Diagnostic description of each species is given below.

Key to species of the genus *Encarsia* (female) from Iran

1. Mid tarsi 4-segmented (tarsal formula 5-4-5) Fig.21..... *E. formosa* Gahan
 - Mid tarsi 5-segmented (tarsal formula 5-5-5).....2
2. Scutellar sensilla very closely placed, separated by a distance of about the width of one sensillum or less. Wing fringe short, clearly less than half the disk width.....3

- Scutellar sensilla widely placed, separated by a distance of more than the width of one sensillum. Wing fringe either short or long.....5
- 3. Tergite 7 with 4 setae, only 2 long setae medial to cerci. Ocellar triangle irregularly acuminate. Fore wing with a patch of longer setae near hind margin, Fig.38. Pedicel slightly longer than F1, Fig.37..... *E. sophia* Girault & Dodd
- Tergite 7 with 6 setae, 4 long setae medial to cerci. Ocellar triangle usually reticulate, if acuminate then with a different pattern. Fore wing without any patch of longer setae near hind margin, Fig.16. Pedicel subequal or slightly shorter than in length to F1.....4
- 4. Body with extensive dark pigmentation (at least a large part of the mesoscutum, or two or more gastral tergites, dark. Ovipositor 1.35-1.70 times as long as clava, Fig.15, 1.12-1.28 times as long as middle tibia. F1 as long as F3.....
E. bimaculata Heraty & Polaszek
- Body, including antennae, almost entirely yellow. Ovipositor 2.15-2.60 times as long as clava, 1.40-1.55 times as long as middle tibia. F1 slightly shorter than F3, Fig.34 *E. protransvena* Viggiani
- 5. Wings infuscated below the marginal and/or stigmal veins.....6
- Wings hyaline.....12
- 6. Fore wing with an asetose area only around the stigmal vein, Fig.7
.....*E. acaudaleyrodia* Hayat
- Fore wing with asetose areas around the stigmal and marginal veins, or only around the marginal vein.....7
- 7. Marginal vein of fore wing with an evident asetose area...8
- Marginal and stigmal veins of fore wing with evident asetose areas.....11
- 8. Fore wing with dark band. Metasoma completely dark, Fig.31.....
..... *E. pergandiella* Howard
- Fore wing without dark band. Metasoma not entirely dark.....9
- 9. Antennal clava 3-segmented. F2 slightly longer than F3. Face with one or two brown to dark brown cross bands above the toruli.....10
- Antennal clava 2-segmented. F2 subequal in length to F3, Fig.20. Face without any brown to dark brown cross bands above the toruli.....*E. elegans* Masi
- 10. Fore wing broader (2.5-2.62 times as long as wide), Fig.23. Third valvula less than 0.50 times as long as second valvifer.....*E. perniciosi* (Tower) Hayat

- Fore wing narrow (about 4.1 times as long as wide), Fig.9. Third valvula 0.65 times as long as second valvifer.....*E. aurantii* (Howard)
- 11. Submarginal vein of fore wing with 2 setae. F4 with 2 longitudinal sensilla, Fig.19.....*E. citrina* Craw
- Submarginal vein of fore wing with 1 seta. F4 with 3 longitudinal sensilla, Fig.27.....*E. lounsburyi* Berlese & Paoli
- 12. F1 with at least one longitudinal sensillum.....13
- F1 without any longitudinal sensillum.....14
- 13. Pedicel longer than F1. F1 shorter than F2, F3, and F4 individually, Fig.11. Mesoscutal midlobe, axillae and scutellum with rather fine, but distinctive reticulation, cells with distinct internal striations.....*E. azimi* Hayat
- Pedicel shorter than F1. F1 subequal in length to F2, F3, and F4 individually, Fig.22. Mesoscutal midlobe, axillae and scutellum without rather fine, but distinctive reticulation, cells simple and without distinct internal striations, Fig.23.....*E. inaron* Walker
- 14. Clava either clearly 2-segmented or not apparent.....15
 - Clava clearly 3-segmented.....16
- 15. Mesoscutum with only 4 setae. Distance between anterior pair of scutellar setae larger than between posterior pair, Fig.29. Fore wing 3.2-3.3 times as length as width. Apical spur of middle tibia very short and its length distinctly less than half the length of the very slender basal tarsal segment. Ovipositor shorter than middle tibia. Third valvula 0.55-0.60 times as long as second valvifer, Fig. 30.....*E. mineoi* Viggiani
 - Mesoscutum with 8 setae. Distance between anterior pair of scutellar setae smaller than between posterior pair. Fore wing 2.9-3.2 times as length as width. Apical spur of middle tibia subequal to half the length of the basal tarsal segment. Ovipositor longer than middle tibia. Third valvula 0.37-0.45 times as long as second valvifer, Fig.17.....*E. cibensis* Lopez-Avila
- 16. F1 quadrate or transverse, Fig.28. Basal cell with only 1 seta. Marginal fringe 0.45-0.60 times as long as width of wing.....*E. lutea* (Masi)
 - F1 longer than width. Basal cell with 2-3 setae. Marginal fringe 0.25-0.30 times as long as width of wing17
- 17. Antenna brown. Pedicel as long as or a little longer than F1. F1 slightly longer than F2 and slightly shorter than F3, Fig.13. 8-9 setae on anterior margin of marginal

- vein. T6 with 3+3 setae. Mid lobe of mesoscutum with 4+2+2 or 4+1+2 setae, Fig.14.*E. berleseii* Howard
- Antenna orange-yellow except scape pale yellow. Pedicel shorter than F1. F1 approximately subequal in length to F2 and F3, Fig.25. 5 setae on anterior margin of marginal vein. T6 with 2+2 setae. Mid lobe of mesoscutum with 2+2 setae, Fig.26.....*E. lahorensis* Howard

***Encarsia acaudaleyrodia* Hayat, 1976 (Figs. 6-7)**

Encarsia acaudaleyrodia Hayat, 1976 Entomophaga 21:158. Holotype: India, Rajasthan, Sardar Samand, i.1974 (M. Hayat), ex *Acaudaleyrodes rachipora* (Singh) on *Prosopis juliflora*. (ZSIC, not examined; paratypes examined).

Diagnosis of female:- Length 0.48-0.64 mm.

Head:- Pale, clypeus very distinctly and deeply pigmented, labrum reddish-brown, 2 brownish bars behind lateral ocelli, a faint brown spot on each side of occipital foramen. Head in frontal aspect 1.35 times wider than height. Antennae dark except clava yellow brown. Antennal sockets placed near to facial margin and spaced by a distance equal to the major diameter of a socket. Mandible with two teeth and a dorsal truncation. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1,1,4,2. F1 slightly longer than width, approximately 0.65 times as long as pedicel. F2 1.25 times as long as F1, a little shorter than F3. F3 and F4 subequal. Clava 0.72 times as long as funicle. F1 and F2 without longitudinal sensilla. Mouth margin reddish brown and its fossa about two-fifth the width of frontovertex at anterior ocellus. Ocelli arranged in obtuse triangle. Frontovertex nearly 3 times wider than dorsal eye width. Eyes glabrous.

Mesosoma:- Largely pale, pronotum, mid lobe of mesoscutum anteriorly, axillae anteriorly and propodium 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 3.08 times as long as width, marginal fringe 0.57 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. Costal cell with a single row of short setae. Hind wings approximately 8.25 times as long as width, marginal fringe much longer than width of disk. Tarsal formula 5-5-5.

Metasoma:- Yellow with pale venter, 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 middle tibia, or longer and in dry specimens appears to extend to near the base of the gaster.

Male:- Generally darker than the female, with the typical appearance of a male *Encarsia*. Antenna with funicle segments elongate. T10 and sometimes T8 testaceous yellow. F5 and F6 of the antenna partially fused. Genitalia without digiti and with the phallus strongly exerted. Length 0.45 – 0.52 mm.

Species group placement:- *E. parvella*-group.

Distribution outside Iran:- Egypt, India, Spain (Canary Islands).

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

Material examined:- Mazandaran (North of Iran, south of Caspian sea): Sari, 3s, 1u, 19.ix.2001 (H. Ghahari) ex *Acaudaleyrodes citri* on *Citrus medica* (Rutaceae). Isfahan (center of Iran): Isfahan, 2s, 13.vii.1999 (H. Ghahari) ex *Acaudaleyrodes citri* on *Ziziphus spina – christi* (Rhamnaceae). Isfahan: Isfahan, 1s, ix.1989 (M. Amir-Nazari) ex *Acaudaleyrodes citri* on *Citrus* sp.

Comments:- *E. acaudaleurodes* is very similar to *E. mineoi* Viggiani. The slight differences between *E. acaudaleyrodes* and *E. mineoi* were compared by Hayat (1989) and Polaszek *et al.* (1999). Since the northern regions of Iran is widely allocated to culture of citrus plants and *Acaudaleyrodes citri* together with other aleyrodids are the major pests of *Citrus* spp., therefore *E. acaudaleyrodes* can be applied as the efficient natural enemy in biological control programs.

***Encarsia aurantii* (Howard, 1894) (Figs. 8-10)**

Coccophagus aurantii Howard, 1894 Insect Life 6:31. Syntypes: ss, U.S.A.: California, San Gabriel 9.v.1887 (D.W. Coquillett) ex *Aspiditus aurantii* var. *citrinus* (?USNM, not examined).

Prospalta aurantii (Howard): Howard, 1894 Insect Life 7: 508.

Prospaltella aurantii (Howard): Howard, 1908 Ann. Ent. Soc. Am. 1: 293; Compere, 1936. University of California, Publications in Entomology 6: 493; Peck, 1963 Can. Ent. Suppl. 30: 275. *Encarsia aurantii* (Howard); Hafez, 1988 J. Appl. Ent. 106: 185; Viggiani & Mazzone, 1979 Boll. Lab. Ent. Agr. Portici 36: 47. Hayat, 1986 Oriental Insects 20: 160.

Diagnosis of female:- Length 0.42- 0.58 mm.

Head:- Orange-brown, occiput and post- ocellar bars darker, frontovertex slightly yellow (lemon or golden). Antennae pallid. 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 width, and slightly longer than the quadrate F3. F4-f6 subequal, clava clearly 3-segmented and approximately 1.47 times as long as funicle. Clava 3-segmented.

Mesosoma:- Largely yellow-orange dorsally, pronotum, near anterior half of mid lobe of mesoscutum, axillae, mesopleuron, propodeum brown to dark brown. In 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. Hind tibia slightly shorter than middle tibia. 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 infuscated below marginal vein, about 4.1 times as long as wide, marginal fringe 0.45 times 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. Hind wings about 8 times as long as width, fringe 1.50 times of wing width. 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 middle tibia, third valvula 0.65 times as long as second valvifer.

Male: - Unknown.

Species group placement:- *E. aurantii*-group

Distribution outside Iran:- Virtually cosmopolitan.

Hosts:- Diaspididae: *Parlatoria olea* Colvee, *Lepidosaphes gloverii* Packard and *Aonidiella citrina* (Coquillet). Other hosts recorded: *Aonidiella aurantii* (Maskell),

Aonidiella orientalis (Newstead), *Aonidomytilus espinosai* (Porter), *Aspidiotus destructor* Signoret, *Aspidotus hederæ* Vallot, *Chrysomphalus aonidum* (L.), *Chrysomphalus dictyospermi* (Morgan), *Chrysomphalus ficus* Ashmead, *Hemiberlesia lataniae* (Signoret), *Hemiberlesia rapax* (Comstock), *Lepidosaphes beckii* (Newman), *Lepidosaphes newsteadi* Sulc, *Leucaspis japonica* Cockerell, *Lingdingaspis fusca* (Maskell), *Melanaspis obscura* (Comstock), *Pinnaspis strachani* (Cooley), *Quadraspidiotus ostreaeformis* (Curtis), *Quadraspidiotus perniciosus* Comstock .

Material examined:- Mazandaran: Ghaemshahr, 3s, 14.iv.2000 (H. Ghahari) ex *Aonidiella citrina* on *Citrus limetta* (Rutaceae); Ramsar, 1s, 8.ix.2001 (H. Ghahari), ex *Lepidosaphes gloverii* on *Citrus medica* (Rutaceae). Gilan (North of Iran): Roodbar, 2s, 23.iv.2002 (H. Ghahari) ex *Parlatoria olea* on *Olea europea* (Oleaceae). Fars: Shiraz, 2s, 5.vi.1993 (A.A. Ahmadi) ex *Aonidiella orientalis* on *Citrus* sp.

***Encarsia azimi* Hayat, 1986 (Fig. 11)**

Trichapous indicus Azim & Shafee, 1980 Journal of the Bombay Natural History Society 76: 335. Holotype s, India, Tamil Nadu, Ootacamund, 24.vi.1968. (S.A. Shafee), exaleyrodid on *Nerium* (Apocynaceae) (ZDAMU, not examined). Preoccupied by *Prospaltella indica* Shafee, 1973 J. Ent. Res. 6: 255.

Encarsia azimi Hayat, 1986 Oriental Insects 20: 160. Replacement name for *indicus* Azim & Shafee; Hayat, 1989 Oriental Insects 23: 62; Huang & Polaszek, 1998 J. Nat. Hist. 32: 1845.

Encarsia adrianae Lopez-Avila, 1987 Bull. Ent. Res. 77: 425. Holotype s, Pakistan, Rawalpindi, iv.1985 ex *B. tabaci* on *Lantana camara* [ex culture UK, Ascot, Silwood Park, 26. Viii. 1986 (A. Lopez-Avila) ex *B. tabaci*] (BMNH), paratype examined). Synonymy by Hayat, 1998 Memoirs on Entomology, International 13: 202.

Encarsia adrianae Lopez-Avila: Polaszek *et al.* 1992 Bull. Ent. Res. 82: 381.

Diagnosis of female:- Length 0.45-0.65 mm.

Head:- Yellow, frontovertex and occiput above foramen pale yellow. Occiput below largely yellow brown; Antenna yellow with pedicel brown and apical segments slightly darkened. Pedicel longer than F1. F1 distinctly shorter than F2 and F3. F1 at least 1.5 times as long as width. Flagellum with the following numbers longitudinal sensilla: F1: 2, F2: 2, F3: 3, F4: 3, F5: 2, F6: 2. Clava 2-segmented.

Mesosoma:- Brown, except Pronotum and axillae a little dark. Scutellar sensilla widely separated, approximately 6-7 times the width of a sensillum. Mesoscutal

midlobe, axillae and scutellum with rather fine, but distinctive reticulation, cells with distinct internal striations. Midlobe usually with 8 setae. Distance between anterior pair of scutellar setae larger than that between posterior pair. Fore wing hyaline or subhyaline with infuscation below submarginal vein, 2.5-2.7 times as long as its maximal width. Marginal fringe 0.30-0.35 times as long as wing width. Basal cells of fore wings with 3-6 setae; marginal vein with 5-7 setae. Legs pallid to white, hind coxae brown at base. Tarsal formula 5-5-5. Apical spur of mid tibia shorter than half the length of the basal tarsal segment.

Metasoma:- Pale yellow to white except tergum I narrowly across base and petiole dark brown. Gaster with terga I-VII usually with 2+2, 2+2, 2+2, 2+2, 1+2+1, 2+2, and 6 setae, respectively. Ovipositor not exerted and slightly shorter than or subequal to middle tibia. Third valvula 0.35-0.45 times as long as second valvifer.

Male:- Body brown with mesoscutal midlobe posteriorly and scutellum lighter. Legs brown, tibiae and tarsi light brown. Apical two segments of antenna fused and sensilla partly overlapping.

Species group placement:- *Encarsia inaron*-group

Distribution outside Iran:- Australia, India, Italy, Japan, Pakistan, Spain, Taiwan.

Hosts:- *Bemisia tabaci* Gennadius. *Alurolobus rhododendri* (Takahashi), *Dialeurodes piperis* Takahashi, *Odontaleyrodes rhododendri* (Takahashi), *Parabemisia myricae* (Kuwana), *Rhachisphora fici* (Takahashi) (recorded as *Dialeurodes citri*), *Lipaleyrodes* sp., *Trialeurodes vaporariorum*.

Material examined:- Kerman (Eastern south of Iran): Jiroft, 3s, 1u, 17.vii.2001 (M. Afshar) ex *Bemisia tabaci* on *Hibiscus esculentum* (Leguminosae). Fars: Darab, 1s, 14.viii.1990 (H. Al-e-Mansoor) ex *Bemisia tabaci* on *Gossypium hirsutum*.

***Encarsia berlesii* (Howard, 1906) (Figs. 12-14)**

Prospalta berlesii Howard, 1906 Ent. News 17: 291. Syntypes ss, USA: Washington, D.C., vi.1906 ex *Diaspis pentagona* (Targioni) (USNM, not examined).

Prospaltella berlesii Priesner & Hosny, 1940 Bull. Soc. Ent. Egypte 24: 63.

Encarsia berlesii Viggiani & Mazzone, 1979 Boll. Lab. Ent. Agr. Portici 36: 47; Hayat, 1986 Oriental Insects 20: 160.

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 1.90 times as long as width, 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 two setae. Placoid sensilla on scutellum rather distinctly 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 times as long as width. Marginal fringe approximately 0.30 times as long as width of wing. 2 setae on submarginal vein, 8-9 setae on anterior margin of 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 times as long as second valvifer.

Male.- Unknown.

Species group placement:- *E. berlesi*-group.

Distribution outside Iran:- Virtually cosmopolitan.

Hosts:- Diaspididae: *Chrysomphalus dictyospermi* Morgan. Other hosts recorded: *Pseudaulacaspis pentagona* (Targionii) (BMNH, PRIE, RMNH), *Melanaspis obscurus* (Comstock), *Pinnaspis minor* (Maskell), *Pinnaspis strachani* Cooley .

Material examined:- Mazandaran: Sari, 2s, 15.iv.1991 (A. Habibian), ex *Chrysomphalus dictyospermi* on *Citrus aurantium* (Rutaceae).

***Encarsia bimaculata* Heraty & Polaszek, 2000 (Figs 15-16)**

Encarsia bimaculata Heraty & Polaszek, 2000 Journal of Hymenoptera Research 9: 155-157. Holotype s, India, Tabarbhani, 19.vii.1994 (ex culture Gainesville, Florida, R. Nguen, autoparasitoid, M92018) (USNM, not examined).

Diagnosis of female

Head:- Yellow with a transverse brown band, transverse olliculate (as in fingerprint), ocellar triangle similar, but sculpture somewhat areolate; yellow except for a pale

transverse band of brown across back of head; dorsal setae slight. Antenna yellow basally, slightly darkened apically. Pedicel slightly longer than F1. F1 2-2.2 times as long as breadth and as long as F3. Clava 3-segmented. Maxillary palps 1-segmented. Mandibles 3 / 3 dentate, marginal teeth acute.

Mesosoma:- Yellow except pronotum, a large anteromedian patch on middle lobe of mesoscutum, axillae, propodeum and petiole brown. Mesosoma with light hexagonally areolate sculpture dorsally; midlobe with 4 pairs of setae, setae delicate and about equal in size, side lobe with 3 pairs, axilla with 2 pairs (lateral pair minute) and scutellum with 2 pairs. Fore wing hyaline, slightly infuscate near base of marginal vein. Mid lobe of mesoscutum with 8 setae, arranged symmetrically. Scutellar sensilla close together, separated by a distance of about their width or less. Distance between anterior pair of scutellar setae distinctly smaller than between posterior pair. Fore wing 2.5-2.8 times as long as width. Marginal fringe 0.35-0.40 times as long as wing width. Apical spur of middle tibia longer than half the length of the basal tarsal segment. Mid tibial spur 0.44 as long as the basitarsus. Tarsal formula 5-5-5.

Metasoma:- Mostly yellow except brown at base and occasionally with a faint brown patch on 5th and 6th tergite. Ovipositor entirely yellow, 1.12-1.28 times as long as the length of the middle tibia, 1.35-1.70 times as long as clava, 0.6 times as long as gaster (base to tip of third valvula). Third valvula stout, 0.32-0.35 times as long as second valvifer, 1.6-2.2 times as long as breadth, slightly extruded beyond epigium.

Male:- Colour pattern similar to female, but darker. Head with a transverse brown band. Wings may be weakly infuscate in the basal half. Antenna with 6 flagellomeres, apical two segments of flagellum fused.

Species group placement:- *Encarsia strenua*-group.

Distribution outside Iran:- Australia, Hong Kong, India, Indonesia, Israel, Mexico, Papua New Guinea, Philippines, Possibly Sudan, Thailand, USA (Florida, Texas?).

Hosts.- Aleyrodidae: *Bemisia argentifolii*. The following additional hosts have been recorded *Bemisia tabaci*, *Trialeurodes vaporariorum*.

Material examined:- Isfahan: Isfahan, 3s, 2u, 9.v.2001 (H. Ghahari) ex *B. argentifolii* on *Magnolia grandiflora*.

***Encarsia cibcensis* Lopez-Avila, 1987 (Figs 17-18)**

Encarsia cibcensis Lopez-Avila, 1987 Bull. Ent. Res. 77: 427. Holotype s (ex culture UK, Ascot, Silwood Park) *B. tabaci* on beans, 26.Viii.1986 (A. Lopez-Avila), origin: Pakistan,

Rawalpindi, ex *B. tabaci* on *Lantana camara*, iv. 1985 (A.I. Mohyuddin), (BMNH, examined).

Encarsia cibcensis: Polaszek *et al.* 1992 Bull. Ent. Res. 82: 381; Huang & Polaszek, 1998 J. Nat. Hist. 32: 1856.

Diagnosis of female

Head:- Yellow, apical segments of antenna slightly darker. Clava 2-segmented and not very distinctly defined. Pedicel longer than F1. F1 distinctly shorter than F2 and F3.

Mesosoma:- Yellow. Fore wing hyaline with slightly darkened area near base of marginal vein and with sparse setation and poorly defined, bare area adjacent to leading edge. Mid lobe of mesoscutum with 4-7 setae. Scutellar sensilla widely separated (approximately 4 times the width of a sensillum). Distance between anterior pair of scutellar setae smaller than between posterior pair. Fore wing 2.9-3.2 times as long as width. Marginal fringe 0.60-0.62 times as long as width. Tarsal formula 5-5-5. Apical spur of mid tibia subequal to half the length of the basal tarsal segment.

Metasoma:- Yellow. Ovipositor 1.25-1.30 times the length of the middle tibia. Third valvula 0.37-0.45 times as long as second valvifer.

Male:- Unknown.

Species group placement:- *E. cibcensis* *E. perflava*-group

Distribution outside Iran:- Australia, Pacific Islands, India, Pakistan, Taiwan.

Hosts:- Aleyrodidae: *Bemisia tabaci* Gennadius; *Aleuroclava* (= *Aleurotuberculatus*) *neolitseae* Takahashi. The following additional hosts have been recorded *Aleurotrachelus caerulescens* Singh, *Aleurotuberculatus ficicola* Takahashi, *Dialeurodes agalmae* Takahashi, *Pealius mori* (Takahashi), *Singhius hibisci* (Kotinsky), *Taiwanaleyrodes meliosmae* Takahashi.

Material examined- Khorasan (East of Iran): Mashad, 2s, 24.xi.2001 (M. Hosseini) ex *B. tabaci* on *Amaranthus retroflexus* (Amaranthaceae). Kerman: Jiroft, 1.viii.2000 (M. Afshar) ex *Aleuroclava neolitseae* on *Calendula arvensis* (Compositae).

Comments:- *Encarsia cibcensis* is characterized by the distinct bare area near the leading edge of the fore wing distally from the stigmal vein and continuing along the margin towards the hind margin

Encarsia citrina (Craw, 1891) (Fig. 19)

Coccophagous citrinus Craw, 1891 Bulletin of the California State Board of Horticulture, Division of Entomology 57: 25, Syntypes: ss, U.S.A. California, San Gabriel Valley, 1889

(ex *Aspidiotus citrinus*) lost. Neotype s designated by De Bach & Rose, 1981 Proc. Ent. Soc. Wash. 83: 671, same data as syntypes (USNM, not examined).

Aspidiotiphagous citrinus Priesner & Hosny, 1940 Bull. Soc. Ent. Egypte 24: 60; Herting, 1972 Section A Host or prey / enemy Volume 2 Homoptera. Commonwealth Agricultural Bureaux, Commonwealth Institute of Biological Control.

: 168; Hafez, 1988 J. Appl. Ent. 106: 185.

Encarsia citrina Viggiani & Mazzone, 1979 Bolletino del Laboratorio di Entomologia Agraria 'Filippo Silvestri', Portici 36: 47; Hayat, 1986 Oriental Insects 20: 161.

Diagnosis of female

Head:- Orange-yellow except clypeus, malar space, postocellar bars, 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. F3 distinctly shorter than F4. Clava distinctly longer than pedicel and funicle combined. Lengths of flagellar segments vary from slightly to distinctly longer than width. Flagellum with the following numbers of longitudinal sensilla: F1: 0, F2: 0, F3: 0, F4: 2, F5: 3, F6: 3. Eyes with fine minute setae.

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, hind femora brown in basal half. 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 the posterior pair. Fore wing distinctly narrow, about 4.00 times as long as width, with a bare area around the stigmal vein and sparsely setose on disk; marginal fringe long, 1.22 times 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. T1-T6 with wide-meshed reticulations on sides, smooth in middle. Ovipositor slightly shorter than middle tibia and basitarsus combined, third valvula approximately half as long as second valvifer.

Male:- Unknown.

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

Distribution outside Iran:- Cosmopolitan.

Hosts:- Diaspididae: *Parlatoria zizyphi* Lucas; *Lepidosaphes* (= *Insulaspis*) *beckii* Newman. The following additional hosts have been recorded: *Aonidiella aurantii* (Maskell), *Aonidiella citrina* (Coquillett), *Aonidiella lauri* Bouche, *Aonidiella taxus* Leonardi, *Aspidiotus destructor* Signoret, *Aspidiotus nerii* Bouche, *Aulacaspis rosae* Bouche, *Aulacaspis tubercularis*, *Carulaspis visci* Schrank, *Chionaspis berlesi* Leonardi, *Chionaspis lepneyi* Balachowsky, *Chrysomphalus aonidum* (L.), (= *Chrysomphalus ficus* Ashmead), *Chrysomphalus dictyospermi* Morgan, *Coccus hesperidum*, *Lepidosaphes pallidula* (Williams), *Cornuaspis* (= *Lepidosaphes*) *bekii* (Newman), *Cornuaspis gloverii* (Packard), *Diaspidiotus alni* Marchal, *Diaspidiotus ancylus* Putnam, *Diaspidiotus gigas* Thiem & Gernck, *Diaspidiotus ostreaeformis* Curtis, *Diaspidiotus prunorum* Laing, *Diaspidiotus pyri* Licht, *Diaspidiotus perniciosus* Comstock, *Diaspidiotus zonatus* (Frauenfeld) (= *hungaricus* Kosztarab), *Diaspis boisduvalii* Signoret, *Diaspis bromeliae* Kerner, *Diaspis colypteroides* Costa, *Diaspis echinocactii* Bouche, *Dynaspidiotus britannicus* Newstead, *Dynaspidiotus californica* (Coleman), *Fiorinia florinae* Targioni, *Furchadiaspis zamiae* Morgan, *Hemiberlesia cyanophyllii* Signoret, *Hemiberlesia lataniae* (Signoret), *Hemiberlesia palmae* Morgan, *Hemiberlesia pitysochila* Takagi, *Hemiberlesia rapax* Comstock, *Kuwanaspis bambusae* Kuwana, *Kuwanaspis pseudoleucaspis* Kuwana, *Lepidosaphes pallida* Green, *Lepidosaphes pinnaeformis* (Bouche), *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 olea* Colvee, *Parlatoria pergandii* Comstock, *Parlatoria zizyphi* (Lucas), *Phenacaspis pinifoliae* Fitch, *Pinnaspis aspidistrae* Signoret, *Pinnaspis buxi* Bouche, *Pinnaspis strachani* Cooley, *Pseudaonidia duplex* Cockerell, *Pseudaonidia paeoniae* Cockerell, *Selenaspis articulatus* (Morgan), *Unaspis evonymi* Comstock, *Unaspis yanonensis* (Kuwana), *Lepidosaphes tapleyi* Williams, *Quadraspidiotus perniciosus* Comstock .

Material examined:- Mazandaran: Ramsar, 4s, 16.x.1988 (A. Habibian) ex *Parlatoria zizyphi* on *Citrus sinensis* (Rutaceae); Savadkooh, 2s, 11.viii.1999 (H. Ghahari) ex *Lepidosaphes beckii* on *Citrus medica* (Rutaceae).

***Encarsia elegans* Masi, 1911 (Fig. 20)**

Encarsia elegans Masi, 1911 Boll. Lab. Zool. Gen. Agr. R. Sc. Sup. Agr. Portici 5: 147. Holotype s, Italy: Catanzaro, v. ex *Aleurolobus olivinus* (Silvestri) (IEUN, examined).

Encarsia elegans Priesner & Hosny, 1940 Bull. Soc. Ent. Egypte 24: 61; Thompson, 1953 Section 2. Host parasite catalogue. Part 2: 18; Herting, 1972 Section A Host or prey / enemy Volume 2 Homoptera. Commonwealth Agricultural Bureaux, Commonwealth Institute of Biological Control.: 104; Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 84; 1987: 140.

Encarsia bifasciifacies Hayat, 1989 Oriental Insects 23: 58. Synonymized by Huang & Polaszek, 1998 J. Nat. Hist. 32.

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 space 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 and F4 equal in length. Flagellum with the following numbers of longitudinal sensilla: 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 separately by about 2-3 times their own maximum diameter, distance between anterior pair of scutellar setae subequal to that between posterior pair. Fore wing about 2.8 times as long as width. Marginal fringe 0.25 times 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 times as long as second valvifer.

Male:- Coloration and morphology as 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 Iran:- China, Egypt, India, Italy, Pakistan.

Hosts.- Aleyrodidae: *Aleurolobus niloticus* Priesner & Hosny (= *A. marlatti* Quaintance). Other hosts recorded: *Aleurolobus olivinus*. (Silvestri), *Aleurolobus rhododendri* Takahashi

Material examined:- Golestan (North of Iran): Gonbad, 3, 30.ix.2001 (H. Ghahari) ex *Aleurolobus niloticus* on *Amaranthus blitoides* (Amaranthaceae).

Comments:- *E. elegans* is a widespread species in the old world

***Encarsia formosa* Gahan, 1924 (Fig. 21)**

Encarsia formosa Gahan, 1924. Proc. U.S. Natn. Mus. 65, 14. Syntypes ss, U.S.A, Idaho, Twin Falls (USNM, not examined).

Encarsia formosa: Ferriere, 1965 Fauna de l'Europe et du Bassin Mediterranean 1: 137; Nikolskaya & Yasnosh, 1966 Opredeleteli po Faune SSSR 91: 266; Viggiani & Mazzone, 1979 Boll. Lab. Ent. Agr. Portici 36: 45; Hulden, 1986 Finland. Not. Ent. 66: 18; Rivnay & Gerling, 1987 Entomophaga 32: 465; Viggiani, 1987 Boll. Lab. Ent. Agr. Portici 44: 144; Liao *et al.*, 1987 Bijing, China, Science Press: 151; Jiang & Petzold, 1988 Gesunde Pflanzen 40: 494; Yasnosh, 1989 Proceedings of the Zoological Institute, Leningrad 191: 110; Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 382; Viggiani & Ren, 1993 Boll. Lab. Ent. Agr. Portici 43: 226; Abd-Rabou, 1994 Faculty of Science, University of Cairo: 28; Liu & Stansly, 1996 Ann. Ent. Soc. Am. 89: 386; Huang & Polaszek, 1998 J. Nat. Hist. 32: 1881; Polaszek *et al.*, 1999 Zool. Med. Leiden. 73 (6): 146.

Diagnosis of female

Head:- Brown to dark brown. Antennae yellow, antennal tip slightly darker. Antennal formula 1, 1, 4, 2. Clava 2-segmented. Pedicel longer than F1. F1 1.70 times as long

as width, shorter than F2 and F3. F2 and F3 subequal in length. 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 wing hyaline. Legs yellow except fore and hind coxae basally brown. Apical spur shorter than half the length of the basal tarsal segment. Mid lobe of mesoscutum, axillae and 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. Scutellar sensilla widely separated (approximately 7 times the width of a sensillum). Distance between anterior pair of scutellar setae subequal to distance between posterior pair. Fore wing about 2.4 times as long as width. Marginal fringe 0.25-0.32 times as long as width of wing. 2 setae on submarginal vein, 3-4 setae in basal cell. Tarsal formula

5-4-5.

Metasoma:- Petiole brown to dark. 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 sensillae. Tarsal formula 5-4-5. Male genitalia as long as middle tibia.

Species group placement:- *E. luteola*-group

Distribution outside Iran:- Cosmopolitan.

Hosts:- Aleyrodidae: *Bemisia tabaci* Gennadius, *Trialeurodes vaporariorum* Westwood. The following additional hosts have been recorded: *Aleuroglandulus malangae* Russel, *Aleurotrachelus trachoides* (Back), *Aleyrodes lonicerae* Walker, *Aleyrodes proletella* (L.), *Aleyrodes spiraeoides* Quaintance, *Dialeurodes chittenderi* Laing, *Dialeurodes citri* (Ashmead).

Material examined:- Fars (South of Iran): Shiraz, 1s, 12.vii.1989 (H. Al-e-Mansoor), ex *Bemisia tabaci* on *Gossypium hirsutum* (Malvaceae). Tehran: Karaj, 1s, 5.ix.1993 (S. Farrokhi) ex *Trialeurodes vaporariorum* on *Phaseolus vulgaris* var. *contender* (Leguminosae). Western Azarbayjan (Western north of Iran): Ourmieh, 1s, 25.vi.1992 (M.H. Bahrami) ex *Trialeurodes vaporariorum* on *Phaseolus vulgaris*. Isfahan: Isfahan, 3s, 1u, 18.xii.1998 (H. Ghahari) ex *Bemisia tabaci* on *Amaranthus spinosus*

(Chenopodiaceae). Mazandaran: Ghaemshahr, 3s, 1u, 26.ii.2001 (H. Ghahari) ex *Trialeurodes vaporariorum* on *Vicia faba* (Leguminosae). Golestan: Gorgan, 2s, 3.v.2001 (Z. Karimian) ex *Bemisia tabaci* on *Corchorus olitorius* (Tiliaceae).

Comments:- *E. formosa* is a successful agent for biological control of *Trialeurodes vaporariorum* in the greenhouses, *Bemisia tabaci* in the fields, and probably other aleyrodids.

***Encarsia inaron* (Walker, 1839) (Figs 22-23)**

Aphelinus Inaron Walker, 1839 Monographia Chalciditum 1 London: 10. Lectotype s, [designated by Graham, 1976]; [UK] (Haliday) [no other data] (NMI, examined).

Encarsia inaron Graham, 1976 Syst. Ent. 1: 142; Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 383; Abd-Rabou 1998 Boll. Lab. Ent. Agr. Portici 54:12.

Aphelinus Idaeus Walker, 1839 Monographia Chalciditum 1 London: 12. Synonymized by Graham, 1976 Syst. Ent. 1: 142.

Encarsia partenopea Masi, 1909 Boll. Lab. Zool. Gen. Agr. R. Sc. Sup. Agr. Portici 4: 32. Holotype s; Italy: Campania, Portici, ex aleyrodid on *Phillyrea* (UNP) [not examined]. Thompson, 1953 Section 2. Host parasite catalogue. Part 2: 19. Synonymized by Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 383.

Encarsia indifferents Mercet, 1929 Eos 5: 220. Holotype s, Egypt: [?Giza] (A. Alfieri) [?1919]. (MNCN, examined).

Trychaporus aleyrodis Mercet, 1930 Eos 6: 196. Syntype 4u, 12s; France: ex *A. prolella* (MNCN) [examined]. Synonymized by Polaszek *et al.*, 1992 Bull. Ent. Res. 82:383.

Encarsia borealis Hulden, 1986 Finland. Not. Ent. 66: 18. Synonymized by Huang & Polaszek, 1998 J. Nat. Hist. 32.

Encarsia brassicae Shafee & Darvas, 1984 Ind. J. Syst. Ent. 1 (2): 29. Synonymized by Hayat, 1989 Oriental Insects 23.

Diagnosis of female: Length 0.60-0.70 mm.

Head:- Brown to dark brown except mouth margins and malar space darker. Antenna brown. Antennal formula 1, 1, 4, 2; F1 longer than pedicel and about as long as F2-F4 individually. F2 slightly shorter than F3. 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. Clava 2-segmented.

Mesosoma:- Brown to dark brown. Fore wing approximately 2.5 times as long as width, infusate below submarginal vein, the infuscation getting pale below marginal vein, or most of the disc except basal cell, hyaline. Basal cell with 5-8 setae. Marginal vein with 7-9 setae. Hind wing 7-8 times as long as width. Legs yellow except coxae and (in dark specimens) mid and hind femora, brown. Mid tibial spur at most 0.5 of basitarsus. Hind tibia subequal in length to middle tibia. 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, less than 0.5 of second valvifer. T1-T7 with 0-1+0-1, 2+2, 2+2, 2-3 + 2-3, 2+2, 2+2 and 4 setae, respectively. Ovipositor pallid and shorter than middle tibia and basitarsus combined.

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

Species group placement:- *E. inaron*-group .

Distribution outside Iran:- Egypt, India, North Africa, Pakistan, Taiwan, Introduced into North America, almost regions of Asia and Africa.

Hosts:- *Siphoninus phillyrea* Haliday, *Trialeurodes vaporariorum* Westwood. The following additional hosts have been recorded: *Acaudaleyrodes citri* Priesner & Hosny, *Aleyrodes lonicera* (Walker), *Aleyrodes proletella* (L.), *Aleyrodes singularis* Danzig, *Asterobemisia carpini* (Koch), *Asterobemisia paveli* (Zahradnik), *Bemisia tabaci* Gennadius, *Bemisia* sp., *Bulgarialeurodes cotesii* (Maskell), *Pealius quercus* (Signoret), *Siphoninus immaculatus* (Heeger).

Material examined:- Fars: Shiraz, 2s, 1u, 5.v.1992 (H. Al-e-Mansoor) ex *Siphoninus phillyrea* on *Ulmus carpinifolia* (Ulmaceae). Isfahan: Isfahan, 5s, 3u, 11.viii.1997 (H. Ghahari) ex *S. phillyrea* on *Ulmus campestris* (Ulmaceae). Mazandaran: Savadkooh, 2s, 2u, 5.x.1998 (H. Ghahari) ex *Trialeurodes vaporariorum* on *Rosa beggariana* (Rosaceae).

Comments:- *E. inaron* is a widespread species and rather efficient parasitoid for controlling of the greenhouse whitefly. *E. inaron* constitutes a complex of cryptic

species, which morphometric and molecular analysis of the *E. inaron* species-group was detailed studied by Manzari *et al* (2002) and a new species was described as *E. estrellae* Manzari & Polaszek.

***Encarsia lahorensis* (Howard, 1911) (Figs 24-26)**

Prspaltella lahorensis Howard, 1911 J. Econ. Ent. 4: 132. Lectotype s, (designated by Hayat, 1981 Orient. Ins. 14: 466) Pakistan, Lahore, xi.1910 (R.S. Woglum) (USNM, not examined).

Encarsia lahorensis, Viggiani & Mazzone, 1979 Boll. Lab. Ent. Agr. Portici 36: 46; Hayat, 1981 Orient. Ins. 14: 466; 1986: 161.

Diagnosis of female: Length 0.61-0.68 mm.

Head:- Pale yellow. Antenna orange-yellow except scape pale yellow. Head dorsum strongly transverse (apparently shrunken), approximately 3 times as wide as length. Mandibles with 2 teeth. Antennal formula 1, 1, 3, 3. Pedicel shorter than F1; F1 2.8 times as long as width, approximately equal to F2 and F3. F4 shortest segment of the flagellum. 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, marginal fringe about 1.3 times as long as width. Hind wing approximately 6.5 times as long as width. Legs pale yellow. Mid tibial spur slightly longer than half of basitarsus length. Mid 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 of scutellar setae fine and short. Fore wing approximately 2.6 times as long as width. Marginal fringe 0.26 times 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 times 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:- *E. lahorensis*-group.

Distribution outside Iran:- China, Egypt, India, Pakistan; Introduced to Italy and USA.

Hosts:- Aleyrodidae: *Aleyrodes elevatus* Silvestri. The following additional hosts have been recorded: *Dialeurodes citri* (Ashmead), *Dialeurodes kirkaldyi* (Kotinsky), *Tuberaleyrodes machili* Takahashi.

Material examined:- Khorasan: Mashad, 2s, 1u, 9.vi.2001 (M. Hosseini) ex *Aleyrodes elevatus* on *Corchorus trilocularis* (Tiliaceae). Mazandaran: Ramsar, 1s, 31.vii.1999 (H. Ghahari) ex *Dialeurodes citri* on *Citrus bigaradia* (Rutaceae).

***Encarsia lounsburyi* (Berlese & Paoli, 1916) (Fig. 27)**

Prospaltella lounsburyi Berlese & Paoli, 1916 Redia 11: 305. Syntypes ss, Madeira, ex *Chrysomphalus dictyospermi* Morgan, (?ISZA, not examined).

Aspidiotiphagous lounsburyi, Priesner & Hosny, 1940 Bull. Soc. Ent. Egypte 24: 60.

Encarsia lounsburyi, Viggiani & Mazzone, 1979 Boll. Lab. Ent. Agr. Portici 36: 47.

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 times as long as width, 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 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 width, 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 Iran:- Cosmopolitan and widely introduced.

Hosts.- Diaspididae: *Parlatoria pergandei* Comstock. The following additional hosts have been recorded: *Abgrallaspis* (as *Aspidiotus*) *cyanophyllii* (Signoret), *Aspidiotus nerii* Bouche (as *A. hederae*), *Chrysomphalus aonidium* (L.) (as *C. ficus*), *C. personatus* Comstock, *Diaspis echinacti* (Bouche), *Hemiberlesia lataniae* (Signoret) (as *Diaspidiotus*), *Fiorinia fiorinae* (Targionii), *Lepidosaphes pinnaeformis* (Bouche), *Lineaspis* (as *Chionaspis*) *striata* (Newstead), *Aonidiella aurantii* (Maskell), *Chrysomphalus dictyospermi* (Morgan), *Carulaspis juniperi* (Bouche) (= *visci* Schrank), *Chrysomphalus aonidium* (L.), *Chrysomphalus* sp., *Cornuaspis* (= *Lepidosaphes*) *beckii* (Newman), *Hemiberlesia* sp., *Parlatoria proteus* (Curtis), *ziziphi* (Lucas).

Material examined:- Mazandaran: Sari, 2s, 28.ix.2000 (H. Ghahari) ex *Parlatoria pergandei* on *Cammelia japonica*. Mazandaran: Ghaemshahr, 1s, 3.viii.2001 (H. Ghahari) ex *Parlatoria ziziphi* on *Hedera helix*.

Comments:- *E. lounsburyi* is very similar to *E. citrina*, and can be distinguished from it mainly by the number of setae on the submarginal vein, 1 seta in *E. lounsburyi*, 2 setae in *E. citrina*. Also on the base of Hayat's record (1989), fore wings of *E. lounsburyi* with longer marginal fringe than *E. citrina* and petiole with fine sculpture.

***Encarsia lutea* (Masi, 1909) (Fig. 28)**

Prospaltella lutea Masi, 1909 Boll. Lab. Zool. Gen. Agr. R. Sc. Sup. Agr. Portici 4: 25. Syntypes 2♂♂, Italy: Campania, Portici (IEUN, examined).

Prospaltella lutea; Shalaby *et al.*, 1991 J. agr. Res. 69: 209.

Encarsia lutea; Ferriere, 1965 Fauna de l'Europe et du Bassin Mediterranean 1: 132; Viggiani & Mazzone, 1979. Lab. Ent. Agr. Portici 36: 46; 1980: 51; Hayat, 1989 Oriental Insects 23: 48; Viggiani, 1987 Boll. Lab. Ent. Agr. Portici 44: 155; Ren, 1988 Advances in parasitic Hymenoptera Research. Leiden and New York.

: 396; Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 384; 1999: 154; Viggiani & Ren, 1993 Boll. Lab. Ent. Agr. Portici 43: 223; Schauff *et al.*, 1996 Proc. Ent. Soc. Wash. 98: 21; Abd-Rabou 1998 Boll. Lab. Ent. Agr. Portici 54: 12. Huang & Polaszek, 1998 J. Nat. Hist. 32: 1912-1914.

Diagnosis of female: Length 0.50-0.57 mm.

Head:- Yellow pale except antenna yellow brown. Mouth fossa less than 0.5 of frontovertex width. Mandibles with 2 teeth and a truncation. Maxillary palps and labial palps 1-segmented. Antennal formula 1, 1, 3, 3. Pedicel distinctly 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. Clava 3-segmented. Eyes with fine and pale setae.

Mesosoma:- Yellow except pronotum, anteromedian patch on mesoscutum, axillae and propodeum largely brown. Fore wings hyaline. Hind wing 8.5-9.5 times as long as width, fringe approximately 1.5 times as long as width. Legs pale yellow, hind tibia subequal in length to middle tibia. Apical spur of middle tibia distinctly longer than half the length of the basal tarsal segment. Mid lobe of mesoscutum with 4-8 setae. Placoid sensilla on scutellum distantly placed, approximately 9 times the width of a sensillum. Distance between anterior pair of scutellar seta greater than that between posterior pair. Fore wing about 2.75 times as long as width. Marginal fringe 0.45-0.60 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.

Metasoma:- Yellow except brown at base and laterally more or less darkened. 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, and 0.95-1.20 times as long as clava; third valvula black, strongly contrasting with the remainder of the ovipositor which is pale; third valvula 0.34-0.38 times as long as second valvifer.

Male:- Length 0.45-0.55 mm. Body dark brown, mesoscutellar midlobe posteriorly, scutellum and legs lighter. Head brown except on top with pale areas. Antenna yellow, basal two flagellar segments with distinct sensorial complex, apical two segments fused.

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

Distribution outside Iran:- Cosmopolitan.

Hosts.- Aleyrodidae: *Bemisia tabaci*, *Aleurolobus marlattii* Quaintance. The following additional hosts have been recorded: *Acaudaleyrodes citri*, *Aleurocanthus cinnamomi* Takahashi, *Aleurocanthus zizyphi*, *Aleurolobus niloticus*, *Aleurolobus rhododendri* Takahashi, *Aleurolobus setigerus* Quaintance & Baker, *Aleurolobus wunni* (Ryberg), *Aleuroplatus pectiniferus* Quaintance & Baker, *Aleurotrachelus rubi* Takahashi, *Aleurotrachelus* sp., *Aleurotuberculatus aucubae* (Kuwana), *Aleurotuberculatus ficicola* Takahashi, *Aleurotuberculatus psidii* (Singh), *Aleyrodes lonicerae*, *Aleyrodes proletella*, *Asterobemisia carpini*, *Asterobemisia atraphaxius* (Danzig), *Bemisia argentifolii*, *Bemisia ovata* (Goux), *Bemisia porteri* Corbett, *Bemisia salicaria* Danzig, *Bulgarialeurodes cotesii*, *Dialeurodes citri*, *Dialeurodes fici*, *Dialeurodes formosanensis* Takahashi, *Dialeurodes kirkaldyi*, *Dialeurodes* sp., *Pealius mori*, *Pealius setosus* Danzig,

Siphoninus phillyreae, *Singhius hibisci*, *Taiwanaleyrodes meliosmae*, *Tetralicia* sp., *Trialeurodes abutiloneus* (Haldeman).

Material examined:- Fars: Darab, 1s, 5.vi.1990 (A.A. Ahmadi) ex *Bemisia tabaci* on *Gossypium hirsutum* (Malvaceae). Isfahan: Pardis, 1.iv.1998 (H. Ghahari) ex *Aleurolobus marlatti* on *Verbena officinalis* (Verbenaceae). Mazandaran: Behshahr, 20.v.2002 (H. Ghahari) ex *A. marlatti* on *Abutilon foliosum*.

Comments:- Although there is considerable colour variation between different populations of *E. lutea*, but populations from Australia and the Pacific Islands differ from each other by a single point mutation in the D2 expansion region of the 28S ribosomal DNA gene region (Babcock *et al.*, 2001).

***Encarsia mineoi* Viggiani, 1982 (Figs 29-30)**

Encarsia mineoi Viggiani, 1982 J. Ent. Soc. Southern Africa 45: 27 Holotype s, Libya, Sidi Mesri, 10.vi.1969 (G. Mineo) ex *B. tabaci*; Abd-Rabou, 1998 Boll. Lab. Ent. Agr. Portici 54: 12 (IEUN, not examined); Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 386; 1999: 156.

Diagnosis of female:

Head:- Pale, post-ocellar bars darker, clypeus very distinctly and deeply pigmented. Antennae dark. Mandibles with 2 teeth and an internal truncation. Maxillary palps 2-segmented, labial palps 1-segmented. Antennal formula 1, 1, 4, 2. F1 longer than width, approximately 0.60 times as long as pedicel. F2 1.3 times as long as F1, a little shorter than F3. F3, F4 and pedicel subequal. Clava 0.7 times as long as funicle. F1 and F2 without longitudinal sensilla. Eyes with short setae.

Mesosoma:- Largely pale, pronotum, mid lobe of mesonotum anteriorly and propodeum slightly darker. Propodeum twice as long as metanotum and with 2 setae near each respiratory spiracle. 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, approximately 5-6 times the width of a sensillum. Distance between anterior pair of scutellar setae a little greater than that between posterior pair. Fore wing hyaline. Fore wing approximately 3.25 times as long as wide, marginal fringe 0.60 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. Apical spur of middle tibia very short and its

length distinctly less than half the length of the very slender basal tarsal segment. 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 inserted in middle of gaster, slightly exerted, shorter than, or up to 1.1 times as long as, middle tibia. Third valvula 0.55-0.60 times as long as second valvifer. Second valvifer about two-fifths as long as the entire ovipositor.

Male:- Generally much darker than the female, with the typical appearance of a male *Encarsia*. Antenna with subequal funicular segments, provided with 2-3 linear sensilla on one side. F5 and F6 of the antenna partially fused.

Species group placement:- *E. parvella*-group

Distribution outside Iran:- Australia, Egypt, Israel, Libya, Spain, Sudan.

Hosts:- Aleyrodidae: *Acaudaleyrodes citri*, *Trialeurodes vaporariorum*. The following additional hosts have been recorded): *Bemisia tabaci*, *Siphoninus phillyreae*.

Material examined:- Mazandaran: Sari, 2s, 10.iv.1997 (H. Ghahari) ex *Acaudaleyrodes citri* on *Citrus decumana*. Khorasan: Mashad, 1s, 1u, 25.ix.1999 (M. Hosseini) ex *Trialeurodes vaporariorum* on *Citrullus colocynthis* (Cucurbitacea).

Comments:- *E. mineoi* is very closed to *E. acaudaleyrodes* (see above) and perhaps these species are conspecific (Polaszek *et al.*, 1999). The most reliable difference is the ovipositor length, which is, in *E. mineoi*, shorter than, or up to 1.1 times the length of the middle tibia, and in *E. acaudaleyrodes* 1.2 times as long as the middle tibia (Polaszek *et al.*, 1999). Males of *E. mineoi* were reared by Polaszek *et al.* (1999) and presumably as hyperparasitoids, from *T. vaporariorum*.

***Encarsia pergandiella* Howard, 1907 (Fig. 31)**

Encarsia pergandiella Howard, 1907 United States Department of Agricultural Technical Series 12: 78, Holotype s, USA, Washington, D.C., 25.ix.1900 (T. Pergande), ex *Aleyrodes* [probably *Trialeurodes* sp.] on *Xanthium strumarium* (USNM, not examined).

Encarsia versicolor Girault, 1908 Psyche 15: 53. Synonymy by Peck, 1951 United States Department of Agriculture, Agriculture Monograph 2: 438.

Aleurodiphilus pergandiellus (Howard): De Bach & Rose, 1981 Proc. Ent. Soc. Wash. 83: 666.

Encarsia bemisiae De Santis, 1981 Revista Brasileira Entomologia 25: 37. Preoccupied by *bemisiae* Ishii, 1938. Holotype s, Brazil, Sao Paulo, Campinas, *B. tabaci*

(Lourencao), (UNLP, not examined). Synonymy by Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 387.

Encarsia tabacivora Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 82. Replacement name for *bemisiae* De Santis. Synonymy by Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 387.

Diagnosis of female

Head:- Predominantly pale. Antenna slender, yellow, apex slightly darkened, slender and with 2-segmented clava. Pedicel longer than F1. F1 subequal to, or slightly shorter than F2 and slightly shorter than F3. Clava 2-segmented.

Mesosoma:- Pale, except pronotum, mesoscutellar midlobe and axillae largely brown. Fore wing with infuscated band behind marginal vein and with bare area near leading edge. Scutellar sensilla widely separated (approximately 6 times the width of a sensillum). Distance between anterior pair of scutellar setae subequal to distance between posterior pair. Fore wing about 3.5 times as long as width. Marginal fringe of fore wing 0.70-0.75 times as long as wing width. Apical spur of middle tibia shorter than half the length of the relatively long and slender basal tarsal segment. Tarsal formula 5-5-5.

Metasoma:- Entirely dark brown. Ovipositor almost as long as the length of the middle tibia. Third valvula 0.60-0.70 times as long as second valvifer.

Male.- Head and body predominantly brown, mid lobe of mesoscutum, scutellum and legs lighter. Antenna with F5 and F6 partly fused.

Species group placement:- Placed in *E. pergandiella*-group

Distribution outside Iran:- Australia, Brazil, Colombia, Costa Rica, El Salvador, Grenada, Guadeloupe, Guatemala, Honduras, Israel, Italy, Mexico, USA, Puerto Rico, Venezuela.

Hosts:- Aleyrodidae: *Trialeurodes vaporariorum*. The following additional hosts have been recorded: *Aleyrodes* sp., *Aleurodicus dispersus*, *Aleuroglandulus malangae*, *Aleuroplatus coronata* (Back), *Aleuroplatus elemerae* Mound & Halsey, *Aleurothrixux floccosus* (Maskell), *Aleurotrachelus trachoides* (Quaintance), *Dialeurodes citri*, *Dialeurodes kirkaldyi*, *Trialeurodes abutiloneus*, *Trialeurodes floridensis*, *Trialeurodes vaporariorum*, *Trialeurodes variabilis* (Quaintance).

Material examined:- Isfahan: Isfahan, 3s, 2u, 15.vi.1998 (H. Ghahari) ex *Trialeurodes vaporariorum* on *Hibiscus trionum* (Malvaceae).

Comments:- *E. pergandiella* was likely introduced to Iran in 1990s and its morphology, biology, and efficiency was studied on *T. vaporariorum*. *E. pergandiella* displays considerable variation both in coloration and in the length of antennal segments (Polaszek *et al.*, 1992). This species is similar to *E. mineoi* (see above), 5-segmented tarsi of the middle legs and a bare area near the leading edge of the fore wing, but unlike in *E. mineoi*, the metasoma is completely dark brown.

***Encarsia perniciosi* (Tower) Hayat, 1981 (Figs 32-33)**

Prospaltella perniciosi Tower, 1913 Ann. Ent. Soc. Am. 6: 125. s, u, U.S.A., Amherst, (Mass. State Col. Amherst). Peck, 1963 Can. Ent. Suppl. 30: 280-282, San Jose and Red Scale races. Ferriere, 1965 Fauna de l'Europe et du Bassin Mediterranean 1: 160. Nikol Skaya & Jasnosh, 1966 Opredeliteli po Faune SSSR 91: 281.

Encarsia perniciosi (Tower) Hayat, 1981 Orient. Ins. 14: 466; 1986 Oriental Insects 20: 163.

Diagnosis of female: Length 0.52-0.75 mm.

Head:- Brown except the frontovertex and upper part of occiput lemon to pale orange yellow; antennae yellow brown; pedicel brown; post ocellar bars dark; face dusky, usually with a brown cross band above toruli. Head in front view nearly one third broader than high. Mouth fossa nearly 0.5 of frontovertex width. F1 quadrate and F2 relatively shorter than F1, otherwise F1 may vary from quadrate to distinctly longer than wide; F2 usually slightly longer than F3. Clava 3-segmented.

Mesosoma:- Dark brown to nearly black except the scutellum yellow to white. Legs pallid to white except the base of fore coxae and base of fore femur suffused brown; hind coxa and femur dark brown. Hind tibia subequal in length to middle tibia. Fore wing infuscated below marginal vein, otherwise hyaline. Fore wing 2.5 to 2.65 times as long as width; basal cell with 2-4 setae; marginal vein with 6-9 setae; marginal fringe from slightly longer than one sixth to two fifth of wing width. Hind wing 7 times as long as width. Tarsal formula 5-5-5.

Metasoma:- Dark brown except tergite VII orange brown; venter varying from pallid to dark brown. Petiole plus metasoma a little longer than mesosoma. Third valvula less than 0.50 of second valvifer.

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

Species group placement:- *E. aurantif*-group.

Distribution outside Iran:- China, India, Pakistan, Russia, USA. Nearly cosmopolitan (Hayat, 1989).

Host:- Diaspididae: *Quadraspidiotus perniciosus*.

Material examined:- Gilan: Rasht, 3s, 2u, 30.vi.1997 (H. Ghahari) ex *Quadraspidiotus perniciosus* on *Populus nigra nigra*. Mazandaran: Ghaemshahr, 1.iii.1998 (H. Ghahari) ex *Q. perniciosus* on *Robinia viscosa*.

***Encarsia protransvena* Viggiani, 1985 (Figs 34-36)**

Encarsia protransvena Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 89. Holotype s, U.S.A.: Florida, Broward Co[unty]. F[or]t. Lauderdale, ix.1984 (C.R.R. Thompson) ex *Dialeurodes kirkaldyi* (IEUN, examined).

Encarsia protransvena Naguyen & Hamon, 1989 Ent. Circular (Gainesville, Florida Department of agriculture) 323: 2; Polaszek *et al.*, 1999 Zool. Med. Leiden. 73 (6): 158.

Encarsia strenua; Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 388 (misidentification, in part, of *E. protransvena*); Booth & Polaszek, 1996 Brighton Crop Protection Conference Pests and Diseases 1996: 73; Schauff *et al.*, 1996 Proc. Ent. Soc. Wash. 9: 29 (misidentification of *E. protransvena*).

Diagnosis of female

Head:- Pale, except small spots of brown along inner margins of ocelli. Vertex weakly areolate, ocellar triangle areolate. Antenna yellow to brown-yellow, with 6 flagellomeres. 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 and slightly shorter than F3. F1-F3 increasing very slightly in length, or adjacent segments approximately equal. Clava 3-segmented. Maxillary palp 1-segmented. Mandibles 3 / 3 dentate, teeth sharp or blunt.

Mesosoma:- Yellow to pale yellow, with weak hexagonally areolate sculpture dorsally. Fore wings hyaline. Tarsal formula 5-5-5. Legs yellow. Apical spur of middle tibia longer than half the length of the basal tarsal segment. Mid lobe of mesoscutum with 4+2+2+2 setae. Mid lobe of mesoscutum with 8-10 setae, side lobe with 3 pairs, axilla with 2 pairs (lateral pair minute). 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 times length of longest marginal fringe seta. Marginal fringe 0.28-0.35 times as long as wing width. 2 setae on submarginal vein.

Metasoma:- Yellow to pale yellow. Third valvulae pale, 1.8-2.6 times as long as breadth, and approximately 0.30 times as long as second valvifer. 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, 1.40-1.55 times as long as middle tibia, 2.15-2.60 times as long as clava, 0.6-0.7 times as long as metasoma (base to tip of third valvula).

Male:- Overall coloration pale brown, darker brown pattern on head and mesosoma similar to *E. bimaculata* female. Gaster entirely brown. Setation pattern of mesosoma and metasoma as in female, but difference in size of setae on midlobe of mesoscutum much less. Costal cell with 9-10 small setae and basal area with 5-7 setae. Basitarsomere of middle leg with only 2 pegs. Antenna with 5 flagellomeres, apical 2 flagellomeres (5 and 6) fused with linearia overlapping.

Species group placement:- *E. strenua*-group.

Distribution outside Iran:- Australia, Cayman Islands, China, Colombia, Egypt, Hawaii, Honduras, Puerto Rico, Spain, Taiwan, USA, Vieques Island.

Hosts:- Aleyrodidae: *Trialeurodes packardii* (Morrill). The following additional hosts have been recorded: *Aleurotrachelus rubi* Takahashi, *Bemisia argentifolii* Bellows & Perring, *Bemisia tabaci* (Gennadius), *Dialeurodes citri* (Ashmead), *Dialeurodes citrifolii* (Morgan), *Dialeurodes kirkaldyi* (Kotinsky), *Parabemisia myricae* (Kuwana), *Trialeurodes abutiloneus* (Haldeman), *Trialeurodes variabilis* (Quaintance). Diaspididae: *Aspidiotus* sp., *Parlatoria ziziphi*.

Material examined:- Isfahan: Najaf-Abad, 2s, 1u, 11.ix.1998 (H. Ghahari) ex *Trialeurodes packardii* on *Juglans regia*.

Comments:- *E. protransvena* can be separated from other members of the *strenua*-group by the shorter ovipositor and third valvula, more delicate antenna (clava only slightly broader than the funicle) and longer fore wing (Heraty & Polaszek, 2000).

***Encarsia sophia* (Girault & Dodd, 1915) (Figs 37-38)**

Coccophagous sophia Girault & Dodd, 1915 of the Bureau of sugar Experiment Stations, Queensland Division of Entomology 2: 49, 56. Syntypes s, Australia, Cairns (QM, Brisbane, type no. Hy. 2926, examined).

Prospaltella transvena Timberlake, 1926 Proceedings of the Hawaiian Entomological Society 6: 312-315. Holotype s, USA, Hawaii, Oahu, reared from *Trialeurodes* [as

Aleyrodes] *vaporariorum* on tomato (BPBM, type no. 5690, not examined). Synonymy by Heraty & Polaszek, 2000 Journal of Hymenoptera Research 9: 163.

Prospaltella sublutea Silvestri, 1931 Bolletino della Societa Entomologica Italiana 63: 20-22. Syntypes s, Somalia, Duca [?], (IEUN, not examined). Synonymy by Gerling & Rivnay in Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 90.

Prospaltella flava Shafee, 1973 J. Ent. Res. 6: 254. Holotype s, India, Uttar Pradesh, Aligarh. Synonymy by Hayat, 1989 Oriental Insects 23: 72. Preoccupied by *flavus* Compere, 1936 University of California, Publications in Entomology 6: 300. Synonymy questionable (Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 90) because type material reared from coccid.

Encarsia sophia: Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 249. Change of combination.

Encarsia transvena: Gerling & Rivnay in Viggiani, 1985 Boll. Lab. Ent. Agr. Portici 42: 90-92. Change of combination.

Encarsia shafeei Hayat, 1986 Oriental Insects 20: 163. Replacement name for *E. flava* (Shafee).

Encarsia transvena; Hayat, 1989 Oriental Insects 23: 71-73; 1998 Memoirs on Entomology, International 13: 205-207; Polaszek *et al.*, 1992 Bull. Ent. Res. 82: 388-389; Schauff *et al.*; 1996 Proc. Ent. Soc. Wash. 98: 31-33; Huang & Polaszek, 1998 J. Nat. Hist. 32: 1954-1956.

Diagnosis of female:

Head:- Yellow, including the area encompassed by the ocelli, with transversely strigose surface sculpture. Pedicel slightly longer than F1. F1 approximately as long as F2 and F3. Clava 3-segmented.

Mesosoma:- Yellow, pronotum and axillae anteriorly and metasoma occasionally slightly darkened. Fore wing with a patch of longer setae near hind margin. Mid lobe of mesoscutum with 8-10 setae. Scutellar sensilla close together, separated by a distance of about their width or less. Distance between anterior pair of scutellar setae distinctly smaller than between posterior pair. Fore wing 2.6-2.7 times as long as width. Marginal fringe 0.35-0.42 times as long as wing width. Tarsal formula 5-5-5. Apical spur of middle tibia slightly longer than half the length of the basal tarsal segment.

Metasoma:- Ovipositor 1.15-1.23 times as long as the length of the middle tibia and 1.60-1.95 times as long as clava. Third valvula 0.25-0.32 times as long as second valvifer. Tergite 7 with 2 setae between cercal plates.

Male:- Unknown.

Species group placement:- Placed in *E. strenua*-group

Distribution outside Iran:- Cosmopolitan in the Old World, introduced in the New World. Afrotropical: Burundi, Cape Verde, Ivory Coast, Morocco, Niger (Hayat, 1998); Sierra Leon, Somalia. Oriental: Hawaiian Islands, Hong Kong, India (Hayat, 1989); Indonesia, Sri Lanka (Hayat, 1998); Pakistan (Hayat, 1989); People's Republic of China (Huang & Polaszek, 1998); Taiwan, Thailand. Palearctic: Japan, Spain.

Hosts:- Aleyrodidae: *Trialeurodes ricini* (Misra). The following additional hosts have been recorded: *Acaudaleyrodes rachipora* (Singh), *Aleurocybotus indicus* David & Subramaniam, *Bemisia* (= *Aleyrodes*) *hibisci*, *Alurodicus dispersus* Russell, *Aleurolobus niloticus*, *Bemisia afer* (Priesner & Hosny), *Bemisia tabaci*, *Dialeurodes citri*, *Parabemisia myricae* (Kuwana), *Pealius longispinus* Takahashi, *Pealius hibisci* (Kotinsky), *Trialeurodes vaporariorum*. Aphididae: *Aphis sacchari* Zehntner?. Coccidae:?. Psyllidae: *Diaphorina citri* Kuwayama . The psyllid hosts are correct, although possibly *E. sophia* is a hyperparasitoid on *Tamarixia radiata* (Waterston) , so the aphid and coccid associations also may be "primary" hosts of hyperparasitic males.

Material examined:- Isfahan: Isfahan, 2s, 2.viii.1999 (H. Ghahari) ex *Trialeurodes ricini* on *Ricinus communis* (Euphorbiaceae).

Comments:- This constitutes the first record of this species for Iran. *E. sophia* is the most distinctive species in the *strenua*-group and can be recognized by the transversely striate ocellar triangle, a patch of longer setae in the posterior half of the wing disk and presence of only 4 setae on Mt7 (Polaszek *et al.*, 1992).

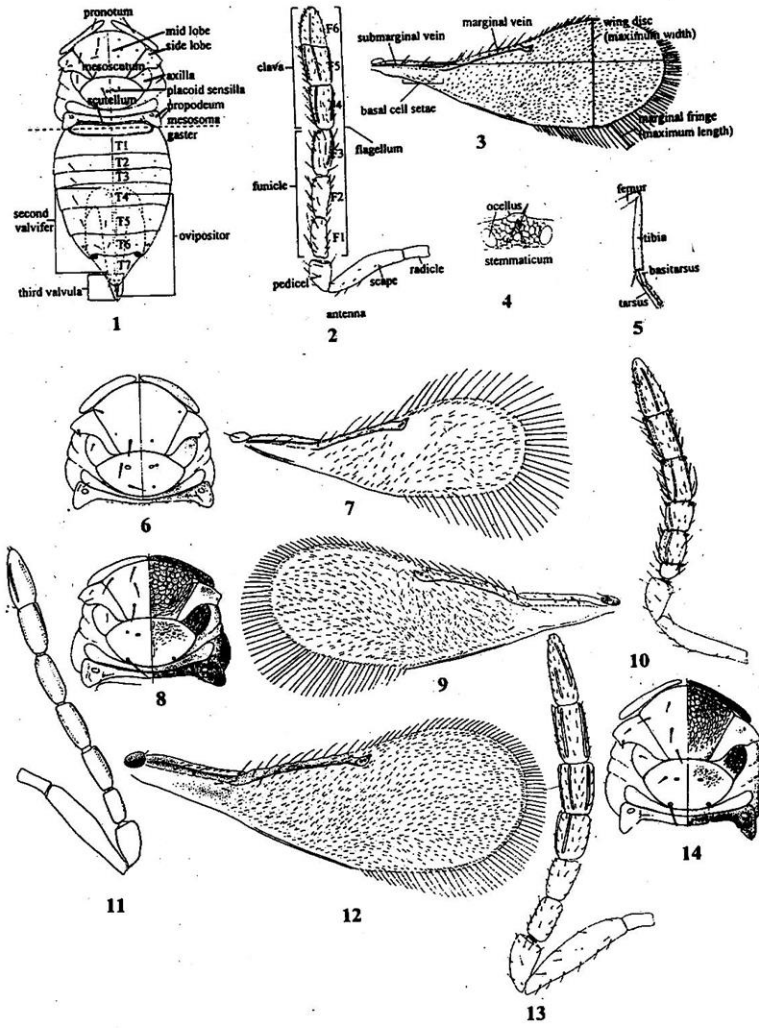
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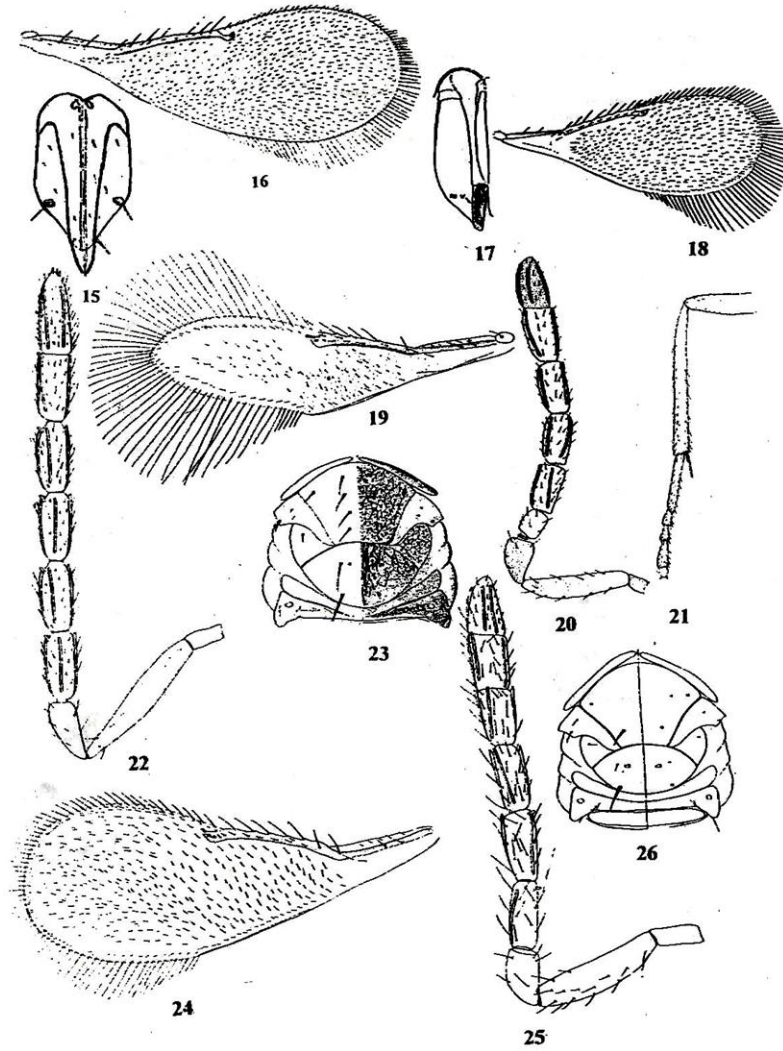
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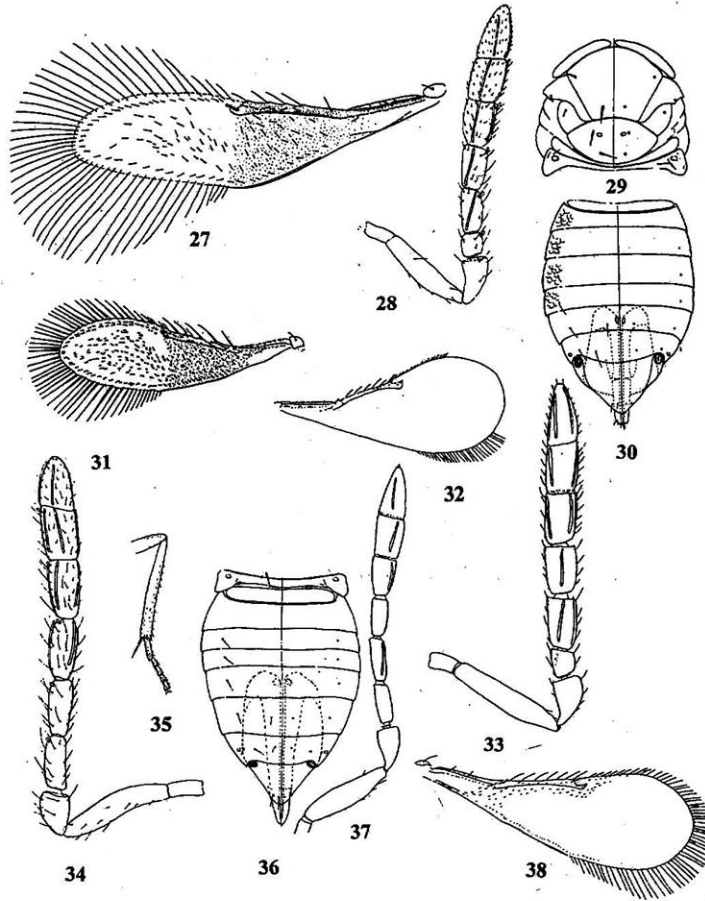
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Figs. 1-14. 1-5. *Encarsia* general morphology (from Polaszek *et al.* 1999): 1. mesosoma and gaster (female), 2. antenna (female), 3. fore wing, 4. stemmaticum, 5. mid leg. 6. mesosoma of *Encarsia acaudaleyrodis*, 7. fore wing of *E. acaudaleyrodis*, 8. mesosoma of *E. aurantii*, 9. fore wing of *E. aurantii*, 10. antenna of *E. aurantii*, 11. antenna of *E. azimi*, 12. fore wing of *E. berlessei*, 13. antenna of *E. berlessei*, 14. mesosoma of *E. berlessei*; (adapted from Polaszek *et al.* 1999).



Figs. 15-26 15. Ovipositor of *Encarsia bimaculata*, 16. fore wing of *E. bimaculata*, 17. Ovipositor of *E. cibensis*, 18. fore wing of *E. cibensis*, 19. fore wing of *E. citrina*, 20. antenna of *E. elegans*, 21. mid leg of *E. formosa*, 22. antenna of *E. inaron*, 23. mesosoma of *E. inaron*, 24. fore wing of *E. lahorensis*, 25. antenna of *E. lahorensis*, 26. mesosoma of *E. lahorensis*. (adapted from Polaszek *et al.* 1999 and Hayat, 1989).



Figs. 27-38. 27. fore wing of *Encarsia lounsburyi*, 28. antenna of *E. lutea*, 29. mesosoma of *E. mineoi*, 30. gaster of *E. mineoi*, 31. fore wing of *E. pergandiella* (adapted from Hayat, 1989), 32. fore wing of *E. perniciosi*, 33. antenna of *E. perniciosi*, 34. antenna of *E. protransvena*, 35. mid leg of *E. protransvena*, 36. gaster of *E. protransvena*, 37. antenna of *E. sophia*, 38. fore wing of *E. sophia*.

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من المعروف أن الأنواع الخاصة بجنس *Encarsia* من الأنواع الهامة في مكافحة البيولوجية للذباب الأبيض والحشرات القشرية المسلحة ، وأن هذا العمل مراجعة علي هذا الجنس في ايران وتناول هذا العمل وصف كامل لثمانية أنواع من هذا الجنس الي جانب عرض لعوائله وكذلك مفتاح تصنيفي لكل هذه الأنواع المذكورة في هذا البحث.



١٥. ١٦. ١٧. ١٨. ١٩. ٢٠. ٢١. ٢٢. ٢٣. ٢٤. ٢٥. ٢٦. ٢٧. ٢٨. ٢٩. ٣٠. ٣١. ٣٢. ٣٣. ٣٤. ٣٥. ٣٦. ٣٧. ٣٨. ٣٩. ٤٠. ٤١. ٤٢. ٤٣. ٤٤. ٤٥. ٤٦. ٤٧. ٤٨. ٤٩. ٥٠. ٥١. ٥٢. ٥٣. ٥٤. ٥٥. ٥٦. ٥٧. ٥٨. ٥٩. ٦٠. ٦١. ٦٢. ٦٣. ٦٤. ٦٥. ٦٦. ٦٧. ٦٨. ٦٩. ٧٠. ٧١. ٧٢. ٧٣. ٧٤. ٧٥. ٧٦. ٧٧. ٧٨. ٧٩. ٨٠. ٨١. ٨٢. ٨٣. ٨٤. ٨٥. ٨٦. ٨٧. ٨٨. ٨٩. ٩٠. ٩١. ٩٢. ٩٣. ٩٤. ٩٥. ٩٦. ٩٧. ٩٨. ٩٩. ١٠٠.