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Species of Genus *Encarsia* Förster (Hymenoptera: Aphelinidae) – Parasitoids of Whiteflies (Hemiptera: Aleyrodidae) Associated with *Psidium guajava* L. in Mexico, with Key and Description of New Species

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ABSTRACT - Data on the *Encarsia* species reared from whiteflies on *Psidium guajava* L.in Mexico are presented: four new species are described – *guajavae* sp. nov., *mexicana* sp. nov., *tapachula* sp. nov., and *terebrella* sp. nov.; *E. guadeloupae* Viggiani is new record for Mexico, its male is described and female redescribed based on mexican material; hosts and distribution of four known species are given. A key to all 9 species is provided.

KEY WORDS - Aphelinidae, *Encarsia*, *guajava*, whitefly, Mexico.

Introduction

Psidium guajava L. (fam. Myrtaceae) is a tropical tree or shrub, native to Central America from Mexico to northern South America. It has been introduced to most tropical and subtropical areas around the world for its edible fruits. In some countries the harvesting, processing and export of the fruit forms the basis of a sizeable industry (Morton, 1987). In Mexico, guajava is cultivated in many states as fruit and ornamental plant.

Sixteen species of insects have been recorded as pests of guajava in Mexico (MacGregor and Gitiérrez, 1983). According to new Catalogue of whiteflies of the world (Evans, 2007) 16 species of Aleyrodidae are associated with *Psidium guajava* in Mexico. Data on *Encarsia* species – parasitic on whiteflies associated with guajava of the world are poor. Four species are included in the Interactive Catalogue of world Chalcidoidea (Noyes, 2002), namely *Encarsia dispersa* Polaszek, *E. guadeloupae* Viggiani, *E. haitiensis* Dozier and *E. lutea* (Masi). Of these four, *E. guadeloupae* is reported from Mexico for the first time.

During the study of Aphelinidae of Mexico in 1998-2006, the author reared 9 species of genus *Encarsia* from several whiteflies on *Psidium guajava*. In this article are given description of four new species, description of earlier unknown male, *E. guadeloupae* and redescription of female, diagnosis, data on hosts and distribution of other four known species based on collected materials and key for identification of all 9 *Encarsia* species, parasitizing whiteflies on *Psidium guajava* in Mexico.

All materials were maintained in 75% alcohol. Most specimens have been preserved as slide-mounts in Canada balsam, following the method outlined by Noyes (1982). Morphological structures were drawn using a compound Carl-Zeiss microscope and RA-4 drawing apparatus at a magnification of 200X. All measurements of morphological structures were made at a magnification

of 400x. Morphological terminology used in this article following Hayat (1989).

Field key to pupal cases with figures of Hamon (2002) and keys from Martin (1987) and Hodges and Evans (2005) were utilized for identification of whitefly species. For determination of parasitoid species a pictorial guide to the species of *Encarsia* parasitic on whiteflies in North America (Schauff *et al.*, 1996), the guide to *Encarsia* parasitoids of *Bemisia tabaci* (Polaszek *et al.*, 1992), and also revisions with keys for identification of *Encarsia* species were used (Hayat, 1989, 1998; Schauff *et al.*, 1996; Huang and Polaszek, 1998; Hernández-Suárez *et al.*, 2003; Schmidt *et al.*, 2001; Viggiani, 1987 & 1993). Species were also compared with the original description of described species of the genus *Encarsia.*

Abbreviations for depositories of the material examined and institutions and collections: UAT – Entomological collection of Universidad Autónoma de Tamaulipas, Ciudad Victoria, México; UCR - Entomological Research Museum of University of California, Riverside, California, USA; FSCA - University of Florida, Gainesville, Florida, USA; IEUN – Istituto de Entomologia Agraria, Universitá degli Studi di Napoli, Portici, Italy; USNM – United States National Museum of Natural History, Washington DC, USA; FAU - Department of Plant Protection, Fujian Agricultural University, Fujian, China.

Key to species of *Encarsia* Förster parasitizing whiteflies on *Psidium guajava* in Mexico

1. Tarsi of middle leg 4-segmented (Figs. 24, 34) .. 2

- Tarsi of middle leg 5-segmented (Figs. 4, 9, 15, 20, 29) 3

2. Metasoma completely brownish-black ..... ***guadeloupae*** Viggiani

- Metasoma yellow with lateral brownish-black spot on each tergite ..... ***variegata*** Howard

3. Fore wing with an asetose area around stigmal vein 4

- Fore wing without an asetose area around stigmal vein 5

4. Midlobe of mesoscutum with two pairs of setae. Ovipositor about as long as middle tibia. Distance between anterior pair of scutellar long setae longer than distance between posterior pair of setae ..... ***americana*** (De Bach & Rose)

- Midlobe of mesoscutum with 3-4 pairs of setae. Ovipositor distinctly longer than middle tibia. Distance between anterior pair of scutellar long setae subequal to distance between posterior pair of setae (Fig. 2) ..... ***guajavae*** sp. nov.

5. Mesosoma entirely yellow. Midlobe of mesoscutum with 3-4 pairs of setae 6

- Mesosoma partially or completely darkened. 8

6. Metasoma entirely yellow. Ovipositor 1.6 times as long as middle tibia. Midlobe of mesoscutum with 4 pairs of setae ..... ***terebrella*** sp. nov.

- Metasoma with some tergites infuscate 7

7. Scutellar placoid sensilla widely placed. Base of metasoma infuscate. Midlobe of mesoscutum with 3 pairs of setae (Fig. 13) ..... ***tapachula*** sp. nov.

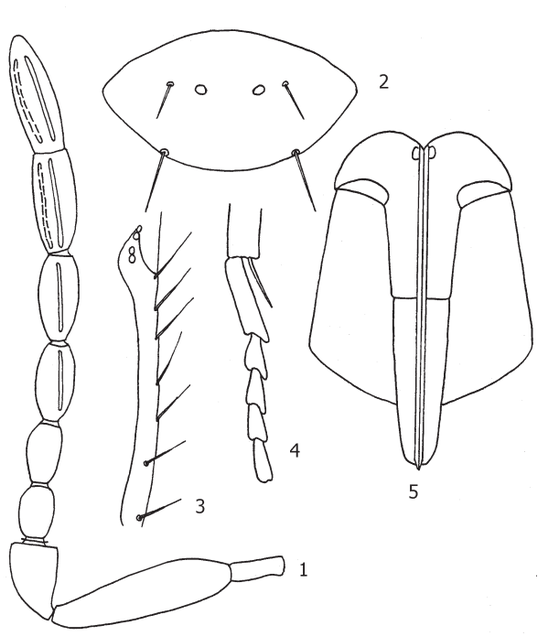
- Scutellar placoid sensilla closely placed. Base of metasoma yellow. Midlobe of mesoscutum with 4 pairs of setae ..... ***citrella*** (Howard)

8. First funicle segment transverse or very slightly longer than wide. Ovipositor 1.8-1.9 times as long as middle tibia. Midlobe of mesoscutum with 5 pairs of setae. Mesosoma yellow with pronotum, midlobe of mesoscutum anteriorly, side lobes, propodeum laterally darkened ..... ***perplexa*** Huang & Polaszek

- First funicle segment distinctly longer than wide. Ovipositor 1.5 times as long as middle tibia. Midlobe of mesoscutum with 4 pairs of setae. Mesosoma dark brown ..... ***mexicana*** sp. nov.

1. *Encarsia guajavae* Myartseva, sp. nov.
(Figs.1-5)

Female. Length 0.57-0.59 mm (holotype - 0.57 mm). Head yellow, face hitish-yellow, infuscate above mouth margin, frontovertex dark yellow, antennae yellow. Mesosoma yellow except pronotum, anterior margin of midlobe of mesoscutum infuscate. Fore wings very slightly infuscate, with small dark area under stigmal vein, posterior margin of stigmal vein brown. Legs whitish-yellow. Metasoma yellow, petiolus and anterior margin of first tergite slightly infuscate; third valvulae pale with apices brown.



Figs. 1-5. *Encarsia guajava*, sp. nov.: 1 – antenna, female; 2 – scutellum; 3 – marginal and stigmal veins of fore wing; 4 – midtibial spur and tarsus; 5 – ovipositor.

Head. Slightly wider than mesosoma and 1.5-1.6 times as wide as height; frontovertex 0.4-0.5 of head width. Ocelli in small obtuse triangle; distance between posterior ocelli subequal to that between posterior ocellus and eye margin. Antennae (Fig. 1) inserted at the level of lower margin of eyes. Radicle 3.0-3.2 times as long as wide, scape 3.9 times as long as wide, pedicel 1.7-1.9 times as long as wide, first-fourth funicular segments 1.4-1.9, 1.7-2.0, 1.9-2.0 and 2.1-2.2 times as long as wide, respectively; club 2-segmented, longer than two preceding segments combined. Flagellar segments third-fourth with one linear sensillum each, club segments with 2 sensilla each.

Mesosoma. Slightly longer than its width. Mesoscutum 1.5-1.7 times as long as scutellum, midlobe of mesoscutum with 6(4+2) or 8(4+2+2) thin setae, 2 setae on each side lobe; axilla seta located in middle of anterior half of axilla. Scutellar placoid sensilla widely placed, separated by a distance about 4-5 diameters of a sensillum (Fig. 2). Distance between anterior pair of setae subequal to distance between posterior pair of setae. Fore wing with an asetose area around stigmal vein and a bare narrow strip on posterior margin of wing distally, 3.0-3.3 times as long as wide, its marginal fringe 0.7 of maximal width of wing, base of disk with 2-3 setae. Marginal vein (Fig. 3) with 5 long setae along anterior margin and slightly longer than submarginal vein (46:42). Hind wing about 8 times as long as wide, its marginal fringe about 1.5 times as long as maximum width of wing. Tarsal formula 5-5-5. Midtibial spur (Fig. 4) 0.7 times as long as basitarsus, the latter slightly longer than the proximal two tarsal segments combined.

Metasoma. Longer than mesosoma, seventh tergite wider than its length. Ovipositor (Fig. 5) slightly exserted, with base originating at the level of third tergite, its length subequal to that of middle tibia (in one female slightly longer); third valvula 1.17 times as long as second valvifer (35:30), its apices obtuse rounded.

Male. Unknown.

Hosts. *Tetraleurodes mori* (Quaintance), *Tetraleurodes* sp.

Distribution. Mexico: Guerrero, Tamaulipas, Tampico.

Etymology. *Encarsia guajavae* is named after common name of *Psidium guajava* in Mexico.

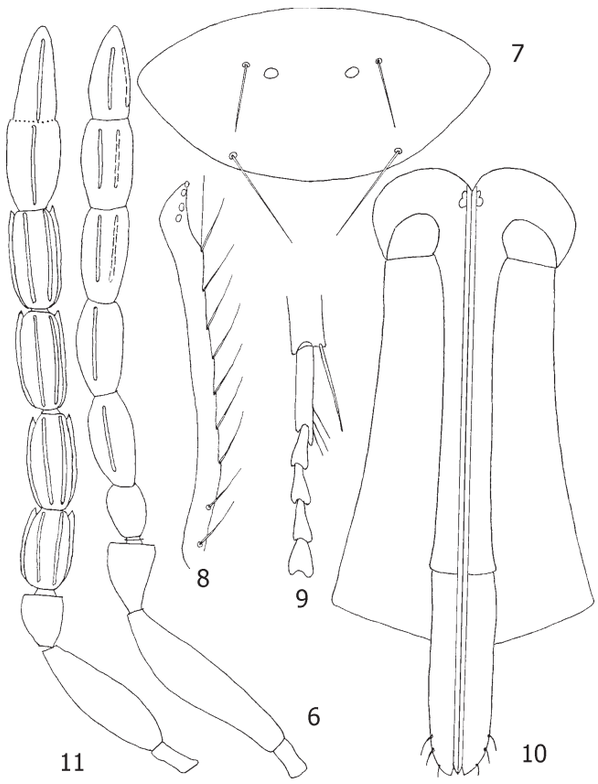
Material examined. *Holotype*. Female, MEXICO: Tamaulipas - Ciudad Victoria, ex *Tetraleurodes* sp. on *Psidium guajava*, coll. S. Myartseva, 7.i.1999 (UCR). *Paratypes*. same data as holotype except; 1 female, Guerrero, Acapulco, ex *Tetraleurodes* sp. (FSCA), 1 female, Tamaulipas - Tampico, ex. *Tetraleurodes mori* (Quaintance), coll. S. Myartseva, 12.vi.2000 (UCR); 1 female, coll. S. Myartseva, 27.iii.2001 (UAT).

Discussion. *E. guajavae* sp. nov. is similar to *E. gerlingi* Viggiani (1989) described from Kenya, but differs as follows: in *E. guajavae* – first funicular segment 1.4-1.9 times as long as wide, distance between anterior pair of scutellar setae subequal to that between posterior pair of setae, marginal fringe of fore wing 0.7 of maximum width of wing, third valvula 1.17 times as long as second valvifer (35:30); in *E. gerlingi* - first funicular segment 2.17 times as long as wide, distance between anterior pair of scutellar setae less than that between posterior pair of setae, marginal fringe of fore wing 0.59 of maximum width of wing, third valvula 0.48 times as long as second valvifer (10:21).

2. *Encarsia mexicana* Myartseva, sp. nov.
(Figs. 6-11)

Female. Length 0.65-0.77 mm (holotype - 0.77 mm). Head pale yellow, frontovertex dark yellow, occiput above slightly infuscate, antennae yellow. Mesosoma except side lobes of mesoscutum dark brown, with dark setation. Wings hyaline. Legs pale yellow, hind coxae infuscate. Metasoma dark brown with first, second and seventh tergites yellow and third valvula dark brown.

Head. About the same width as mesosoma, its width 1.3 times as long as height; frontovertex about 0.6 of head width. Ocelli in slightly obtuse triangle; distance between posterior ocellus and eye margin about 2 diameters of an ocellus. Antennae (Fig. 6) inserted at the level of lower margin of eyes. Radicle twice as long as wide, scape 4.4 times as long as wide, pedicel 1.4 times as long as wide, first-third funicular segments 1.2, 2.1 and1.9 times as long as wide, respectively, club 3-segmented, slightly shorter than three first funicular segments and pedicel combined. Flagellar segments second-third each with one linear sensillum, club segments with two sensilla each.



Figs. 6-11. *Encarsia mexicana*, sp. nov.: 6 – antenna, female; 7 – scutellum; 8 – marginal and stigmal veins of fore wing; 9 – midtibial spur and tarsus; 10 – ovipositor; 11 – antenna, male.

Mesosoma. Slightly wider than length, with thin reticulate sculpture. Midlobe of mesoscutum 1.4 times as long as scutellum, with 8 setae (4+2+2), 3 setae on each side lobe and one seta on each axilla. Scutellar placoid sensilla widely spaced, separated by a distance of 4-5 diameters of a sensillum. Distance between anterior pair of scutellar setae 0.9 times as long as distance between posterior pair of setae (Fig. 7). Fore wing uniformly setose, about 2.4 times as long as wide, its marginal fringe 0.2 of maximum width of wing, base of disk with 3 setae. Marginal (Fig. 8) vein with 7 long setae along anterior margin and shorter than submarginal vein (63:69); stigmal vein with broad uncus, close to margin of wing. Hind wing 6.3 times as long as wide, its marginal fringe 1.2 times as long as maximum width of wing. Tarsal formula 5-5-5. Midtibial spur (Fig. 9) subequal to basitarsus.

Metasoma. Longer than mesosoma and slightly narrower. Seventh tergite wider than its length. Third-seventh tergites with 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor (Fig. 10) exserted, with base originating at base of metasoma, 1.5 times as long as middle tibia; third valvula 0.5 times as long as second valvifer.

Male. Length 0.55 mm. Head and mesosoma similar to that of female, hind femora and tibiae basally slightly infuscate. Metasoma dark brown except middle part of first tergite and seventh tergite brownish yellow.

Antennal radicle twice as long as wide, scape 3.2 times as long as wide, pedicel 1.3 times as long as wide, first-fourth funicular segments 1.5, 2.0, 1.9 and 2.0 times as long as wide, respectively. Club 2-segmented, segments fused (Fig. 11). Funicular segments with four and club segments with one linear sensilla each.

Host. Aleyrodidae – species undetermined.

Distribution. Mexico : Tamaulipas.

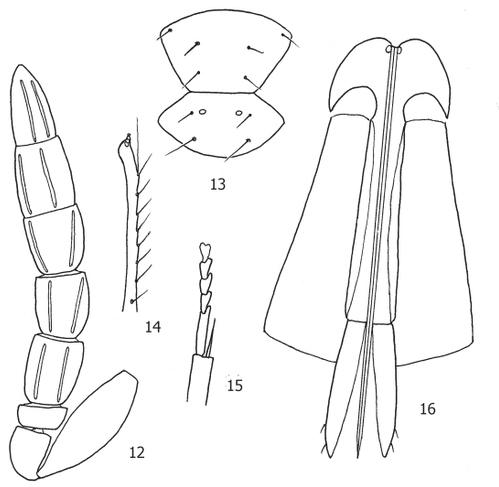
Etymology. *Encarsia mexicana* is named after its collecting in Mexico.

Material examined. *Holotype*. Female, MEXICO: Tamaulipas - Jaumave, ex. Aleyrodidae on *Persea americana* Mill., coll. S. Myartseva, 4.x.1998 (UCR). *Paratypes*. 1 male, same data as holotype, (UCR); 2 females, Ciudad Victoria, ex Aleyrodidae on *Psidium guajava* L., coll. S. Myartseva, 7.x.1998 (FSCA); 8 females, 25 km SSW Cd Victoria, Madroño, ex Aleyrodidae, coll. S. Myartseva, 4.xi.2001 (UCR, FSCA, UAT).

Discussion. *E. mexicana* sp. nov. is similar to *E. townsendi* Howard (1907) described from Mexico, but differs as follows: in *E. mexicana* female - face yellow, scutellum dark brown, metasoma yellow with sixth-seventh tergites dark brown, first funicular segment longer than wide, distance between anterior pair of scutellar setae 0.9 times as long as that between posterior pair of setae; in *E. townsendi* female - face brown, scutellum lemon yellow, metasoma dark brown with sixth-seventh tergites pale brown, first funicular segment wider than length; distance between anterior pair of scutellar setae 0.9 times as long as that between posterior pair of setae as long as that between posterior pair of setae.

3. *Encarsia tapachula* Myartseva, sp. nov.
(Figs. 12-16)

Female. Length 0.70 mm. Head light yellow, ocelli reddish, occiput slightly infuscate, antennae light yellow. Mesosoma yellow; pronotum anteriorly and anterior margin of midlobe of mesoscutum narrowly brownish-black, apical half of axillae, tegulae fully, propodeum laterally, mesopleuron and petiole slightly infuscate. Wings hyaline, venation very slightly infuscate. Legs whitish-yellow. Metasoma yellow; basal tergite fully, fourth tergite posteriorly, fifth tergite fully, sixth tergite anteriorly slightly infuscate, apex of seventh tergite pale; apical margin of second valvifers and third valvulae (except base) brownish black.



Figs. 12-16. *Encarsia tapachula*, sp. nov.: 12 – antenna, female; 13 – midlobe of mesocutum and scutellum; 14 – marginal and stigmal veins of fore wing; 15 – midtibial spur and tarsus; 16 – ovipositor.

Head. Slightly wider than mesosoma and about 1.3 times as wide as heigh. Frontovertex about half as wide as head width. Ocelli forming small acuteangular triangle. Eyes finely setose, about 1.8 times as long as cheeks. Cheeks with malar sulcus not reaching mouth margin. Mandible 3-dentate. Antennae (Fig. 12) inserted immediately under the level of lower margin of eyes. Scape three times as long as wide. Pedicel about twice as long as first funicular segments and about 1.3 times as long as wide. First funicular segment transverse, about 1.7 times as wide as long; second segment the longest, 1.4 times as long as wide; third segment 1.2 times as long as wide. Club 3-segmented, about as wide as funicle and about as long as funicle and pedicel combined. First funicular segment without sensillum, other funicular segments each with two sensilla.

Mesosoma. Midlobe of mesoscutum (Fig. 13) with 3 pairs of long setae; side lobes each with three setae, axillae each with one seta. Scutellum slightly shorter than midlobe and about 1.7 times as wide as long. Scutellar placoid sensilla widely placed, separated by distance about 8-9 diameters of an sensillum. Distance between anterior pair of scutellar setae about as long as distance between posterior pair of setae. Fore wing without an asetose area around stigmal vein, about 3.3 times as long as wide, its marginal fringe about 0.2-0.3 times as long as maximum width of wing; disc uniformly setose, base with two setae under apical part of submarginal vein. Marginal vein with 7 long setae along anterior margin and subequal to submarginal vein; stigmal vein close to wing margin (Fig. 14). Hind wing about 6.5 times as long as wide, its marginal fringe slightly longer than maximum width of wing. Tarsal formula 5-5-5. Midtibial spur (Fig.15) about 0.7 times as long as basitarsus; basitarsus subequal in length to next three tarsal segments combined.

Metasoma. Gaster longer than mesosoma; seventh tergite wider than long. Metasomal tergites second-seventh with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor (Fig.16) strongly protruded, its base inserted at the level of second tergite and its length twice as long as middle tibia. Extended part of ovipositor about 1/5 of gaster length. Third valvula about 0.5 times as long as second valvifer.

Male. Unknown.

Host. Aleyrodidae – species undetermined.

Distribution. Mexico : Chiapas.

Etymology. *Encarsia tapachula* is named after its collecting place.

Material examined. *Holotype.* Female, MEXICO: Chiapas, Tapachula, ex Aleyrodidae on *Psidium guajava*, coll. S. Myartseva, 5.x.2006 (UCR).

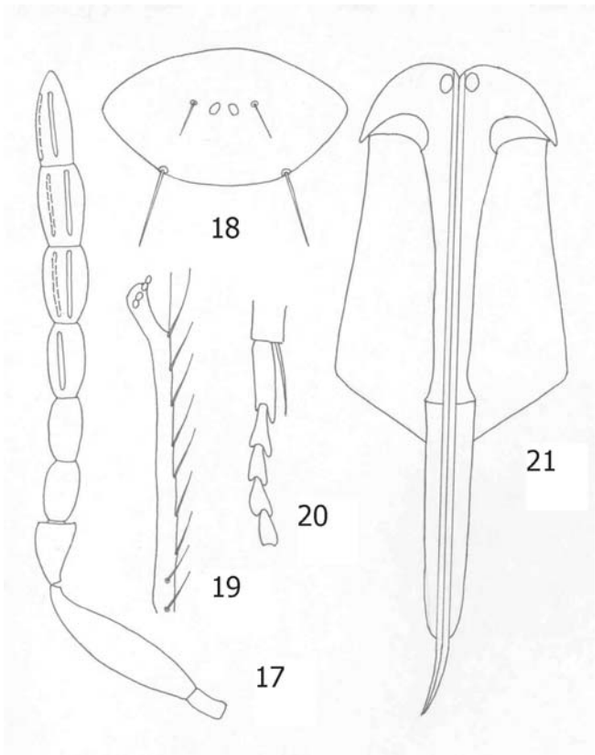
Discussion. *Encarsia tapachula* sp. nov. close to *E. udaipuriensis* (Shafee) described from India (Hayat, 1998), *E. davidi* Viggiani and Mazzone (1980) distributed in Egypt, Israel, South Africa and Macaronesia (Hernández-Suárez *et al.*, 2003) and *E. hamata* Huang and Polaszek described from China (1998). New species can be distinguished from these species by long exserted ovipositor and following other characteristics: in *E. tapachula* – antennal club subequal in length to funicle and pedicel combined, midlobe of mesoscutum with three pairs of long setae, fore wing 3.3 times as long as wide, ovipositor twice as long as middle tibia, third valvula 0.5 times as long as second valvifer and 0.3 times as long as ovipositor. In *E. udaipuriensis* – antennal club distinctly shorter than funicle and pedicel combined, midlobe of mesoscutum with 4 pairs of setae, fore wing about 2.7 times as long as wide, ovipositor not exserted and slightly shorter than middle tibia, third valvula longer than 0.5 of second valvifer. In *E. davidi* – midlobe of mesoscutum with 4-5 pairs of setae, fore wing 2.3 times as long as wide, ovipositor not exserted and 1.2 times as long as middle tibia, third valvula 0.35-0.40 times as long as ovipositor. In *E. hamata* – midlobe of mesoscutum with 4 pairs of setae, ovipositor not exserted, sheaths with apices of third valvula appearing hook-shaped and third valvula shorter than half the length of second valvifer.

Remarks. According to Hayat´s classification (1989), *Encarsia tapachula* sp. nov. belong to the *lutea* species group in the genus *Encarsia*. This group includes 8 species, among them 5 species have Oriental distribution (Noyes, 2002). In the New World, only cosmopolitan species *Encarsia lutea* (Masi), is known to occur. Thus, *E. tapachula* is second species registered in the New World as representative of *lutea* species group, and first species described from Neotropics belonging to *lutea* species group in genus *Encarsia*. In Mexico *Encarsia lutea* species- group is represented for the first time.

4. *Encarsia terebrella* Myartseva, sp. nov.
(Figs. 17-21)

Female. Length 0.53-0.54 mm (holotype 0.53 mm) [without ovipositor]. Head yellow, face pale, antennae light yellow. Mesosoma yellow. Wings hyaline. Legs pale. Metasoma yellow, third valvula pale.

Head. Not wider than mesosoma, width 1.5x height; frontovertex 0.5 of head width. Frontovertex and



Figs. 17-21. *Encarsia terebrella*, sp. nov.: 17 – antenna, female; 18 – scutellum; 19 – marginal and stigmal veins of fore wing; 20 – midtibial spur and tarsus; 21 – ovipositor.

stemmaticum with reticulate sculpture. Ocelli in rectangled triangle; distance between posterior ocelli slightly shorter than between posterior ocellus and eye. Antennae (Fig. 17) inserted at the level of lower margin of eyes. Radicle 1.8 times as long as wide, scape 4.1 times as long as wide, pedicel 1.7 times as long as wide, funicle segments 1.9, 1.9 and 2.3 times as long as wide, respectively; club 3-segmented, subequal in length to first-third flagellar segments and pedicel combined. Third funicle segment with one linear sensillum and club segments with two sensilla each.

Mesosoma. Midlobe of mesoscutum 1.3 times as long as scutellum, with 8 (4+2+2) setae, 3 setae on each side lobe and one seta on each axilla. Scutellar placoid sensilla closely spaced, separated by a distance less than the diameter of a sensillum. Distance between anterior pair of scutellar setae 0.4 times as long as distance between posterior pair of setae (Fig. 18). Fore wing uniformly setose, 2.6 times as long as wide, its marginal fringe 0.3 of maximum width of wing, base of disk with 4 setae. Marginal vein (Fig. 19) with 6-7 long setae along anterior margin and slightly longer than submarginal vein (59:50). Tarsal formula 5-5-5. Midtibial spur (Fig. 20) subequal in length to basitarsus, the latter subequal in length to proximal two tarsal segments combined.

Metasoma. Longer than mesosoma. Sixth tergite with 4 setae; seventh tergite wider than its length. Ovipositor (Fig. 21) strongly exserted, with base originating at base of metasoma and 1.7 times as long as middle tibia; third valvula 0.59 times as long as second valvifer (46:77).

Male. Unknown.

Host. Aleyrodidae – species undetermined.

Distribution. Mexico : Tamaulipas.

Etymology. *Encarsia terebrella* is named after its extremely long ovipositor.

Material examined. *Holotype*. Female, MEXICO: Tamaulipas, Gómez Farías, Reserve “El Cielo”, ex. Aleyrodidae on *Psidium guajava*, coll. S. Myartseva, 22.viii.1998 (UCR). *Paratype*. 1 female, same data as holotype (FSCA).

Discussion. *E. terebrella* sp. nov. is similar to *E. neocala* Heraty and Polaszek (2000) and *E. strenua* (Silvestri, 1927). It can be distinguished by following: in *E. terebrella* - axillae pale brown, antennal first-second funicular segments with sensilla, club only slightly longer than pedicel and first-third funicular segments combined, first funicular segment 1.9 times as long as wide, fore wing 2.3-2.4 times as long as wide, its base with 4 setae, sixth tergite with 6 setae, ovipositor with base originating at level of third tergite and slightly exserted, seventh tergite wider than its length, third valvula pale; in *E. neocala* – axillae yellow, antennal first-second funicular segments without sensilla, club subequal to pedicel and first-third funicular segments combined, fore wing 2.6 times as long as wide, sixth tergite with 4 setae, ovipositor with base originating at base of metasoma and strongly exserted; in *E. strenua* - base of fore wing with 9-14 setae, club shorter than first-third funicular segments combined, first funicular segment 2.6 times as long as wide, seventh tergite longer than broad, third valvula dorsally infuscate.

5. *Encarsia americana* (De Bach & Rose)

Aleurodiphilus americanus De Bach and Rose, 1981:660. *Holotype*. female, Mexico: Colima, Santiago (Manzanillo), ex *Aleurothrixus floccosus* (Maskell) on *Citrus* sp., 21.I.1975, P. De Bach and M. Rose, UCR. Male described.

Encarsia americana (De Bach and Rose); Hayat, 1983:70, change of combination.

Diagnosis. Tarsal formula 5-5-5. Fore wing hyaline, with large asetose area under stigmal vein; marginal vein with 5-6 setae along anterior margin; marginal fringe 0.5x wing width; 2 basal group setae. Antennal club 2-segmented. Midlobe of mesoscutum with 2 pairs of setae. Scutellar placoid sensilla widely spaced. Midtibial spur subequal to basitarsus; apical pretarsus of all legs with pair of very developed tarsal claws. Ovipositor 1.2x as long as middle tibia; third valvula about as long as second valvifer. Female body entirely yellow.

Hosts. Aleyrodidae - *Aleurothrixus floccosus* (Maskell).

Distribution. Brazil; El Salvador; Honduras; Puerto Rico; USA (California); Mexico : Baja California Sur, Colima, Guerrero, Morelos, Oaxaca, San Luis Potosí, Sinaloa, Tamaulipas, Veracruz.8

Material examined. 3 females, MEXICO: Tamaulipas – Ciudad Victoria, ex. *Aleurothrixus floccosus* on *Psidium guajava*, coll. S. Myartseva, 27.x.1999.

6. *Encarsia citrella* (Howard)

Prospaltella citrella Howard, 1908: 282. Lectotype female [designated by Evans and Polaszek, 1997: 566], USA: Florida, Orlando, A. W. Morrill, ex. *Aleyrodes* [=*Aleuroplatus*] *coronatus*, USNM.

Encarsia citrella (Howard); Viggiani & Mazzone, 1979, change of combination.

Encarsia citrella (Howard); Evans and Polaszek, 1997: 566, redescription, male illustrated.

Diagnosis. Tarsal formula 5-5-5. Fore wing slightly infuscate under marginal vein and uniformly setose; marginal vein with 6-7 setae along anterior margin; marginal fringe 0.4x wing width; 4 basal group setae. Antennal club 3-segmented. Midlobe of mesoscutum with 2 pairs of setae. Scutellar placoid sensilla closely spaced. Midtibial spur subequal to basitarsus. Ovipositor 1.6x as long as middle tibia; third valvula 0.5x as long as second valvifer. Female body yellow, except third-fifth gastral tergites dark brown centrally and third valvulae brownish apically.

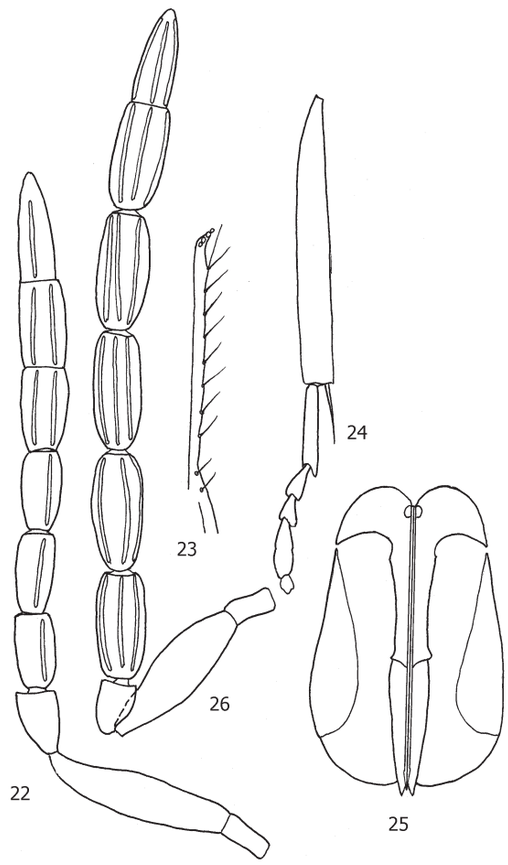
Hosts. Aleyrodidae - *Aleurothrixus floccosus* (Maskell), *Bemisia tabaci* (Gennadius), *Tetraleurodes* sp. The following hosts have been recorded: *Aleuroplatus coronata* (Quaintance), *A. liquidambaris* (cited as *A. elemerae* Mound and Halsey, 1978) *Bemisia tabaci (=argentifolii* Bellows and Perring), *Tetraleurodes ursorum* (Cockerell).

Distribution. USA (Florida, Arizona, California); Honduras; Chile; Mexico : Tamaulipas.

Material examined. 3 females, 2 males, MEXICO: Tamaulipas - Ciudad Victoria, ex. *Aleurothrixus floccosus* on *Psidium guajava*, coll. S. Myartseva, 2.x.1998.

7. *Encarsia guadeloupae* Viggiani
(Figs. 22-26)

Encarsia guadeloupae Viggiani, 1987: 35-37. Holotype female, Guadeloupe – Wonche, 12.VI.1985 (J. Etiénne),



Figs. 22-26. *Encarsia guadeloupae* Viggiani: 22 – antenna, male; 23 – marginal and stigmal veins of fore wing; 24 – midtibial spur and tarsus; 25 – ovipositor; 26 – antenna, female.

ex. *Aleyrodes* sp. on *Persea americana*, IEUN.

Encarsia guadeloupae Viggiani; Viggiani, 1993: 123-125 (redescription); Schmidt *et al.*, 2001: 377, 379.

Male. Length 0.60-0.67 mm. Head dark brown, occiput above foramen yellow, antennae yellowish, scape with brownish dorsal margin. Mesosoma yellowish-brown, with more dark middle part of midlobe of mesoscutum and axillae; scutellum and side lobes except for apices dark yellow in one specimen and yellowish-brownish in other specimen. Wings hyaline. Legs whitish-yellow, hind coxae, apical 1/3 of hind femora dorsally and apices of middle and hind tibiae brownish. Petiole whitish-yellow anteriorly. Metasoma dark brown.

Head. as wide as mesosoma and 1.1-1.2 times as

wide as height; frontovertex about 0.6 of head width. Ocelli forming slightly obtuseangled triangle; distance between hind ocelli about 1.5 times as long as distance from hind ocellus to eye margin. Eyes thin setose, about 1.7 times as long as cheeks. Mandible 3-dentate. Antennae (Fig. 22) inserted immediately on the level of lower margin of eyes. Distance between toruli about 0.7 times as long as distance from torulus to eye margin. Radicle about twice as long as wide. Scape 3.4 times as long as wide. Pedicel about 1.4 times as long as wide. All flagellar segments slightly more than twice as long as wide, first segment shorter than other segments. Club slightly shorter than two preceding segments combined. Flagellar segments with 3 linear sensilla each. Midlobe of mesoscutum about 1.2 times as wide as long, with 10-12 setae (2+2+2+4 or 2+2+4+4) arranged more or less symmetrically. Side lobes with 3 setae each, axillae with one seta each near inner margin anteriorly. Scutellum about 0.7 times shorter than mesoscutum and about 1.7 times as wide as long. Scutellar placoid sensilla widely placed, separated by distance 3-4 diameters of an sensillum. Distance between anterior pair of long setae equal to distance between posterior pair of setae. Fore wing without an asetose area around stigmal vein and 2.2 times as long as wide, its marginal fringe about 0.2 of maximum width of wing, base with 3-4 setae under apical part of submarginal vein. Marginal vein (Fig. 23) with 6 long setae along anterior margin and subequal in length to submarginal vein. Hind wing 9 times as long as wide, its marginal fringe 1.3 times longer than maximum width of wing. Tarsal formula 5-4-5. Midtibial spur (Fig. 24) about 0.8 times as long as basitarsus; hindtibial spur about 0.7 times as long as basitarsus. Metasomal tergites second-seventh with 1+1, 1+1, 1+1, 3+3, 3+2 and 4 setae, respectively. Genitalia about 0.8 times as long as middle tibia.

Redescription.

*Female***.** Length: 0.60-0.75 mm. Head and mesosoma colouration as in male, antennal radicle, scape and two apical segments of flagellum infuscate, scutellum and side lobes yellow. Fore wings with light infuscate under marginal vein. Hind coxae and femora black. Petiolus yellowish. Seventh metasomal tergite and third valvulae yellowish, tips of stylets black.

Head. slightly wider than mesosoma and 1.3 times as wide as height, frontovertex about 0.5 of head width. Ocelli forming slightly acuteangled triangle, distance between hind ocelli about 0.7 times as long as distance from ocellus to eye margin. Eyes finely setose, about 2.3 times as long as cheeks. Mandible 3-dentate. Antennae (Fig. 25) inserted immediately on the level of lower margin of eyes. Distance between toruli about as long as distance from an ocellus to eye margin. Radicle twice as long as wide. Scape 4.7-4.8 times as long as wide. Pedicel 1.5 times as long as wide. First, second and third funicular segments 1.9, 2.1 and 1.8 times as long as wide, respectively. Club 3-segmented, very slightly wider than funicle and slightly shorter than funicle. Funicular segments with one linear sensillum each, segments of club with two sensilla each.

Mesosoma. Midlobe of mesoscutum about 1.4 times as wide as long and with 16-20 setae, often rather irregularly arranged. Side lobes with 3 setae each, axillae with one seta each close to inner margin. Scutellum about 0.7 times as long as midlobe of mesoscutum and twice as wide as long. Scutellar placoid sensilla widely placed, separated by distance about 3 diameters of an sensillum. Distance between anterior pair of long setae equal to distance between posterior pair of setae. Fore wing without an asetose area around stigmal vein, 2.6 times as long as wide, its marginal fringe about 0.2 of maximal width of wing, base with 4 setae under apical part of submarginal vein. Marginal vein with 6-7 long setae along anterior margin (in one female 8 long setae) and subequal in length to submarginal vein. Hind wing 8.4 times as long as wide, its marginal fringe about 1.2 times as long as maximum width of wing. Tarsal formula 5-4-5. Midtibial spur 0.8 times as long as basitarsus, hindtibial spur about 0.5 times as long as basitarsus.

Metasoma. Metasomal tergites second-seventh with varying number of setae: 2+3, 3+3, 3+3, 3+3, 3+3 and 4 or 2+2, 3+2, 2+2, 2+2, 3+3 and 4 setae, respectively. Ovipositor (Fig. 26) not exserted, its base on the level of third tergite, its length 1.2 times as long as middle tibia, third valvula about 0.7 times as long as second valvifer and about 0.4 times as long as ovipositor.

Discussion. *Encarsia guadeloupae* female is one in the *luteola* species-group with dark brown to black body with yellow scutellum, numerous, often irregularly arranged mesoscutal setae and 4-6 setae on some gastral tergites. The female of this species was described and redescribed by Viggiani (1987 & 1993). Male is described in this article. Colouration and structure of female are variable. Specimens from Pacific Islands and

Papua New Guinea have head and body color mostly brown, including scutellum (Schmidt *et al.*, 2001). Specimens from Canary Islands have first-fifth flagellar segments with 2-3 pit-like sensilla, club 2-segmented, ovipositor 0.95 times as long as middle tibia (Hernández-Suárez *et al.*, 2003). Mexican specimens are most similar to redescription of female given by Viggiani (1993).

Hosts. *Aleurodicus dugesii* Cockerell, *A. dispersus* Russell, *Bemisia tabaci* (Gennadius), *Lecanoideus floccissimus* Martin *et al.*, *Trialeurodes vaporariorum* (Westwood).

Remarks. New record for Mexico. Male is described.

Distribution. Canary Islands; Guadeloupe; French Polynesia; Hawaii; India; Micronesia; Nauru, Papua New Guinea; Philippines; Thailand; Benin; USA (Florida) (Hernández-Suárez *et al.*, 2003); Mexico : Chiapas.

Material examined. 3 females, 1 male, MEXICO: Chiapas – Tapachula, ex Aleyrodidae on *Psidium guajava*, coll. S. Myartseva, 5.x. 2006, 2 females, 1 male, data same as above except coll. S. Myartseva, 9.x.2006.

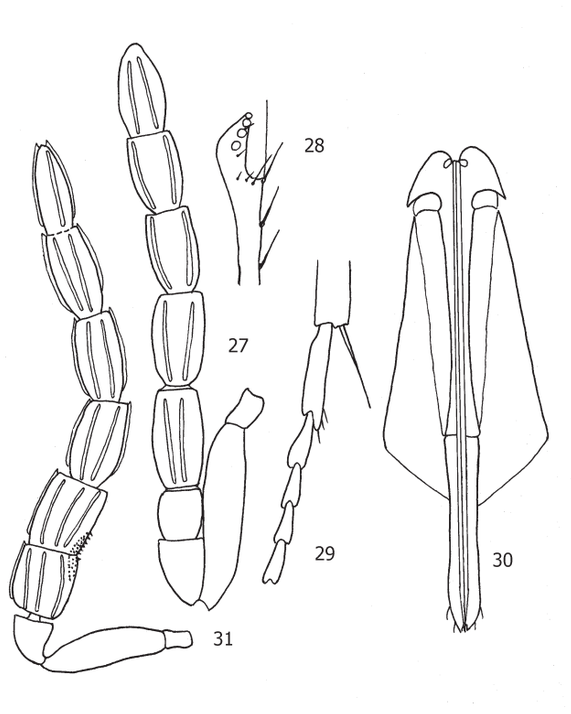
8. *Encarsia perplexa* Huang and Polaszek
(Figs. 27-31)

Encarsia perplexa Huang and Polaszek, 1998: 1934. Holotype female, China: Fujian, Fuzhou, Jinshan, 23.VIII.1995, L. Ye, ex *Aleurotuberculatus kuwani* [=*Aleuroclava kuwani* (Takahashi)] on red bayberry, FAU.

Encarsia opulenta (Silvestri), Viggiani and Mazzone, 1979: 45; Hayat, 1989: 31; Viggiani and Ren, 1993: 226; Schauff *et al.*, 1996: 23, misidentifications.

Prospaltella opulenta Silvestri; Grissell, 1979: 1; De Santis, 1979: 335, misidentifications.

Diagnosis. Tarsal formula 5-5-5. Fore wing hyaline, faintly infuscate below marginal vein and uniformly setose; marginal vein with 7-8 setae along anterior margin; marginal fringe 0.2x wing width; 2-3 basal group setae. Antennal club 3-segmented; first flagellar segment about as long as wide. Midlobe of mesoscutum with variable number of setae, from 8 to 14. Scutellar



Figs. 27-31. *Encarsia perplexa* Huang and Polaszek: 27 – antenna, female; 28–marginal and stigmal veins of fore wing; 29 – midtibial spur and tarsus; 30 – ovipositor; 31 – antenna, male.

placoid sensilla widely spaced. Midtibial spur slightly shorter than basitarsus. Ovipositor 1.8x as long as middle tibia; third valvula 0.6x as long as second valvifer. Head and mesosoma yellow, except anterior half of occiput, crossband above toruli, pronotum, anterior part of midlobe, propodeum laterally brown; gaster with two basal tergites yellow.

Hosts. Aleyrodidae - *Aleuroplatus pectiniferus* Quaintance and Baker), *Aleurocanthus woglumi* Ashby, *Aleuroclava kuwani* (Takahashi), *Aleurothrixus floccosus* (Maskell), *Tetraleurodes acaciae* (Quaintance).

Distribution. Barbados; China; India; Taiwan; USA; Mexico : Colima, Jalisco, Morelos, Nuevo León, San Luis Potosí, Sinaloa, Tamaulipas, Veracruz, Yucatan.

Material examined. 2 females, Mexico: Tamaulipas, Gómez Farías, Alta Cimas, ex *Aleurothrixus floccosus* on *Psidium guajava*, coll. S. Myartseva, 13.xi.1998.

Discussion. According to Huang and Polaszek (1998), specimens of *Encarsia* species introduced in 1949-1950 into Mexico, South and Central America and the USA against the citrus blackfly *Aleurocanthus woglumi* as *E. opulenta* (Silvestri, 1927), are *E. perplexa* Huang and Polaszek; *E. opulenta* is distributed only in China and Vietnam. Smith *et al.* (1964) stated that satisfactory control of citrus blackfly in Mexico was achieved by the combination of *E. clypealis* (Silvestri) and *Amitus hesperidum* Silvestri, two introduced species. The parasite release program continued for many years (Jiménez-Jiménez, 1961; Jiménez and Rodríguez-Carrillo, 1968; Alfieri and Nicholls, 1999). Our collections confirm that the release of *E. perplexa* in Mexico was successful; at present it is a very common parasite of the citrus blackfly in Mexico. In 1998-2006 years we reared more than 2000 specimens of *E. perplexa* and prepared diagnosis with color varieties of this species based on Mexican materials (Myartseva and Luna Salas, 2005). The author reared two females from *Aleurothrixus floccosus* on *Psidium guajava* in Tamaulipas, Gómez Farías, Alta Cimas, 13.xi.1998.

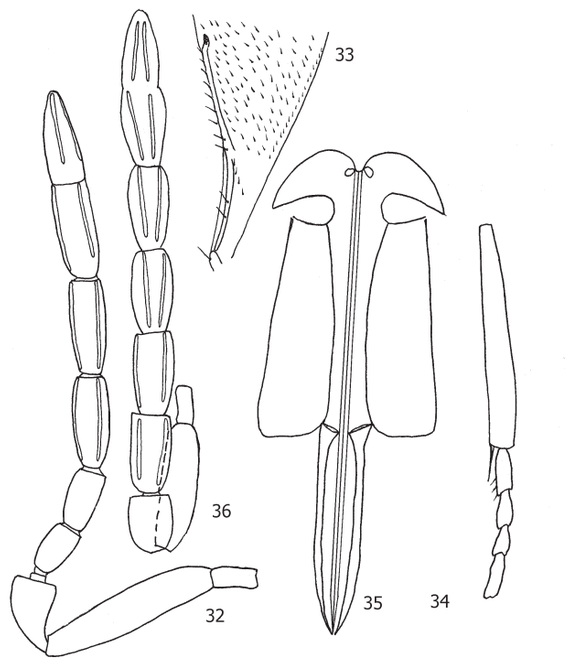
9. *Encarsia variegata* Howard
(Figs. 32-36)

Encarsia variegata Howard, 1908: 64. Holotype female, USA: Florida, Orlando, 25.VI.1907 A.W. Morrill, ex *Paraleyrodes (=Aleurodicus) perseae* on *Citrus* sp., type 11707, USNM. Male known but not described and illustrated.

Trichoporus variegata (Howard); Dozier, 1933, change of combination.

Encarsia variegata Howard; Viggiani and Mazzone, 1979: 45; Viggiani, 1986: 75.

Diagnosis. Tarsal formula 5-4-5. Fore wing hyaline and uniformly setose; marginal vein with 6-7 setae along anterior margin; marginal fringe 0.2x wing width; 4 basal group setae. Antennal club 3-segmented. Midlobe of mesoscutum with 8 pairs of setae. Scutellar placoid sensilla widely spaced. Midtibial spur slightly shorter than basitarsus. Ovipositor 1.7x as long as middle tibia; third valvula 0.7x as long as second valvifer. Head and mesoscutum brown, face yellow, scutellum silvery white; gaster yellow with lateral brown spot on each tergite.



Figs. 32-36. *Encarsia variegata* Howard: 32 – antenna, female; 33–marginal and stigmal veins of fore wing; 34 – midtibial spur and tarsus; 35 – ovipositor; 36 – antenna, male.

Hosts. Aleyrodidae. *Aleurocanthus spiniferus* (Quaintance), *Aleurodicus perseae*, *Aleurothrixus floccosus* (Maskell), *Paraleyrodes minei* Iaccarino, *P. naranjae* (Quaintance), *P. perseae* (Quaintance), *Trialeurodes floridensis* (Quaintance).

Distribution. Bahamas; Cuba; Haití; Honduras; Puerto Rico; USA; Venezuela; Mexico : Chiapas, Guanajuato, Nuevo León, San Luis Potosí, Tamaulipas (Myartseva and Varela-Fuentes, 2007, in press).

Material examined. 2 females, MEXICO: Chiapas - Tapachula, ex Aleyrodidae on *Psidium guajava*, coll. S. Myartseva, 8-9.x.2006.

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