

A Review of Parasitoids (Hymenoptera: Chalcidoidea) of *Trialeurodes floridensis* (Hemiptera: Aleyrodidae) with Description of a New Species from Mexico

Authors: Myartseva, S. N., Ruíz-Cancino, E., and Coronado-Blanco, J. M.

Source: Florida Entomologist, 90(4) : 635-642

Published By: Florida Entomological Society

URL: [https://doi.org/10.1653/0015-4040\(2007\)90\[635:AROPHC\]2.0.CO;2](https://doi.org/10.1653/0015-4040(2007)90[635:AROPHC]2.0.CO;2)

BioOne Complete ([complete.BioOne.org](https://complete.bioone.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

A REVIEW OF PARASITIDS (HYMENOPTERA: CHALCIDOIDEA) OF *TRIALEURODES FLORIDENSIS* (HEMIPTERA: ALEYRODIDAE) WITH DESCRIPTION OF A NEW SPECIES FROM MEXICO

S. N. MYARTSEVA, E. RUÍZ-CANCINO AND J. M. CORONADO-BLANCO

División de Estudios de Postgrado e Investigación, UAM Agronomía y Ciencias,
Universidad Autónoma de Tamaulipas, 87149, Ciudad Victoria, Tamaulipas, México
E-mail: smyartse@uat.edu.mx; eruiz@uat.edu.mx; jmcoronado@uat.edu.mx

ABSTRACT

A new species, *Encarsia citricola* sp. n., reared from *Trialeurodes floridensis* (Quaintance) collected in the State of Guanajuato, Mexico, is described and illustrated. A review and a key to 9 parasitoid species attacking *T. floridensis* are provided. In addition, 4 species of chalcidoid wasps are recorded for the first time as parasitoids of *T. floridensis* in the New World.

Key Words: *Encarsia citricola* sp. n., Guanajuato, Aphelinidae, Encyrtidae, Signiphoridae.

RESUMEN

Se describe *Encarsia citricola* sp. n., especie emergida de *Trialeurodes floridensis* (Quaintance) recolectada en el Estado de Guanajuato, México. Se proporciona una revisión y clave de nueve especies de parasitoides que atacan esta mosquita blanca. Cuatro especies de avispa calcidoideas son nuevos registros como parasitoides de *T. floridensis* en el Nuevo Mundo.

Translation provided by the authors.

The family Aleyrodidae (Hemiptera) is comprised of approximately 1450 described species in the world. Whiteflies are detrimental pests attacking a wide variety of agricultural crops and ornamental plants, predominantly in the tropics and subtropics (Martin et al. 2000). About 50 whitefly species are commonly found infesting economic plants around the world, and 33 species in 20 genera are considered common and economically important in the Southeastern United States (Martin 1987; Hodges & Evans 2005). Nguyen et al. (1993) listed 73 species in 20 genera, including 7 species in the genus *Trialeurodes* (Cockerell) in their catalog of the Aleyrodidae species associated with citrus worldwide. Carapia et al. (2003) reported 13 species in the genus *Trialeurodes* from Mexico, of which 6 occur on citrus.

Trialeurodes floridensis (Quaintance 1900), the guava whitefly or the avocado whitefly, is a polyphagous insect feeding on many plant species from 20 families, and is widely distributed in the New World from United States of America (Florida, Texas, Arizona) to Venezuela (Mound & Halsey 1978). In Mexico, the current known distribution for *T. floridensis* is from the State of Nuevo León (Russell 1963).

Five species of chalcidoid wasps in the genus *Encarsia* Foerster (Aphelinidae) are known at present to attack *T. floridensis*: *Encarsia hispidula* De Santis, *E. meritoria* Gahan, *E. nigricephala* Dozier, *E. pergandiella* Howard and *E. telemachus* Evans (Evans & Serra 2002; Noyes 2006).

This paper presents the list of 9 species of parasitoids attacking *T. floridensis*: 7 species of *Encarsia*, including 1 new species of *Encarsia* (Aphelinidae), 1 species of *Metaphycus* (Encyrtidae), and 1 species of *Signiphora* (Signiphoridae). A key for identification of these parasitoid species, information on their distribution and alternative hosts, and new records of specimens collected in Mexico are provided.

MATERIALS AND METHODS

A large series of whitefly *Trialeurodes floridensis* pupae were collected on leaves of *Citrus sinensis* (L.) in San Miguel de Allende, Guanajuato, Mexico, during Nov 13-16, 2005. In the laboratory, leaves with colonies of whitefly pupae were maintained in plastic containers for parasitoid rearing. Female and male specimens from some of the emerged adult wasps were mounted in Canada balsam for morphological study and identification, following the slide-mounting method for Chalcidoidea described by Noyes (1982). A key for the identification of these species is provided, based on characters observed on specimens mounted on microscopic slides.

The whitefly species from which the parasitoids emerged were identified with keys to the puparium (=pupal cases) by Hamon (2002), Martin (1987), and Hodges & Evans (2005). Parasitoid species were identified with the 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), the key to Encyrtidae of Costa Rica (Noyes 2004), and the key to *Metaphycus* species parasitizing whiteflies (Myartseva 2006). Some specimens used in this study are deposited in the Entomological Museum of the University of Tamaulipas, UAM Agronomía y Ciencias, at Ciudad Victoria, Tamaulipas, Mexico. Morphological terminology used for the chalcidoid wasps follows that of Hayat (1998) and Schauff et al. (1996). Taxonomic information, hosts, geographic distribution, collected material, and references (only

information for Mexico) are provided for each parasitoid species.

RESULTS AND DISCUSSION

Eight parasitoid species of *T. floridensis* were collected in different Mexican States, including 6 species of the genus *Encarsia*, 1 species of *Metaphycus*, and 1 species of *Signiphora*. Moreover, *Encarsia telemachus* Evans is recorded as a parasitoid of *T. floridensis* in Haiti. A new species, *Encarsia citricola*, is described and illustrated and a review and key to 9 parasitoid species attacking *T. floridensis* are given.

KEY FOR IDENTIFICATION OF PARASITIDS ATTACKING *TRIALEURODES FLORIDENSIS* (FEMALES)

- 1. Antennal flagellum 4-segmented with three transverse funicular segments and one, greatly elongate club segment *Signiphora aleyrodis* Ashmead
—Antennal flagellum 6 or 9-segmented, club 2-3-segmented, not greatly elongate. 2
- 2. Antennal flagellum 9-segmented, with 6-segmented funicle and 3-segmented club; marginal vein of fore wing very short, much shorter than stigmal vein. *Metaphycus troas* Noyes
—Antennal flagellum 6-segmented with 3-4-segmented funicle; marginal vein of fore wing long, much longer than stigmal vein. 3
- 3. Tarsus of middle leg 4-segmented 4
—Tarsus of middle leg 5-segmented 7
- 4. Fore wing with an asetose area around the stigmal vein; metasoma completely yellow, midlobe of mesoscutum bearing with two pairs of setae and with its anterior third to half and head dark brown; first funicular segment twice as long as wide *Encarsia nigricephala* Dozier
—Fore wing without an asetose area around the stigmal vein 5
- 5. Metasoma yellow with dark brown lateral margins; first funicular segment about 0.5 times as long as second segment; midlobe of mesoscutum with 4-6 pairs of setae *Encarsia variegata* Howard
—Metasoma completely yellow; head, mesoscutum, axillae and base of metasoma sometimes infusate. 6
- 6. Second funicular segment intermediate in length between first and third segments and usually without linear sensilla; sixth segment with pointed apex and elongate, 1.2-1.3 times as long as fifth segment. Male with fifth and sixth flagellar segments separated *Encarsia hispida* De Santis
—Second funicular segment as long as, or slightly shorter than third segment and usually with one linear sensillum; sixth segment about as long as fifth. Male with fifth and sixth flagellar segments fused *Encarsia meritoria* Gahan
- 7. Fore wing with an asetose area around the stigmal vein 8
—Fore wing without an asetose area around stigmal vein and infusate below marginal vein; metasoma completely dark brown; apical segment of club infusate *Encarsia citricola* sp. n.
- 8. Body completely yellow. Fore wing hyaline. *Encarsia telemachus* Evans
—Body with pronotum, triangular spot on midlobe of mesoscutum and larger area on metasoma slightly infuscated. Fore wing slightly infuscated beneath venation *Encarsia pergandiella* Howard

SYNOPSIS OF PARASITIDS ATTACKING
TRIALEURODES FLORIDENSIS

Family Aphelinidae

- 1. Description of *Encarsia citricola* Myartseva **sp. nov.**
Female. Body length: 0.80 mm (without ovipositor).

Coloration. Head yellow; face, cheeks (genae) and occiput below foramen brownish; interocellar triangle and two triangular spots on frontovertex behind ocelli infuscated. Antennae yellowish-white; scape, pedicel and apical segment of club slightly infuscated. Pronotum, axillae, tegulae, mesopleuron and propodeum brown; midlobe of mesoscutum brownish-yellow, darker along the

middle; scutellum, metanotum and side lobes of mesoscutum (except apices) light yellow. Fore wings infuscated below marginal vein, with dark and strong setae on disc, apical half of disc with short, thin and light setation; marginal vein slightly infuscated. Legs whitish; middle coxae, hind coxae and hind femora brownish. Metasoma brown, ovipositor sheaths yellowish-white.

Morphology. Head about as wide as thorax and slightly wider than height. Frontovertex 0.5 times as wide as head width and slightly wider than long (9:8). Ocelli forming slightly obtuse triangle; distance between hind ocelli about 0.5 times as long as distance from hind ocellus to eye and about as long as distance to occiput margin. Eyes finely and rarely setose, about 1.4 times as long as cheeks. Malar sulcus present. Mandible with three teeth (Fig. 1). Antennae (Fig. 2) inserted immediately at the level of lower margin of eyes. Distance between toruli about 0.5 times as long as distance to eye and twice as long as distance to mouth margin. Scape about 4 times as long as wide; pedicel 1.5 times as long as wide; first funicular segment shorter than other flagellar segments and 1.7 times as long as wide, other funicular segments subequal in length and about 1.8 times as long as wide; club 2-segmented, slightly wider than funicle and about as long as 2 preceding funicular segments combined. First funicular segment without sensillum, other flagellar segments with one linear sensillum each, apical segment with 2 sensilla. Mesosoma with reticulate sculpture, distinctly visible on midlobe of mesoscutum and axillae. Midlobe of mesoscutum (Fig. 3) with 4 pairs of setae, side lobes each with 3 setae, each axilla with 1 seta; midlobe about twice as wide as long; scutellum shorter and slightly less than twice as wide as long. Scutellar placoid sensilla closely placed, separated by distance about one diameter of sensillum. Distance between posterior scutellar setae about 1.3 times as long as that between anterior setae. Fore wing (Fig. 4) 2.6 times as long as wide, its marginal fringe about 0.25 times as long as the wing's maximum width; disc with bare base, on apical middle with more short and thin setation than below marginal vein. Submarginal vein with 2 setae, and 1 long seta on apex; marginal vein with 7 setae along anterior margin and subequal in length to submarginal vein. Hind wing about 7 times as long as wide, its marginal fringe longer than maximum width of wing (4:3). Tarsal formula 5-5-5. Midtibial spur (Fig. 5) shorter than basitarsus (4:5); basitarsus subequal in length to two next tarsal segments combined. Tergites 1-7 with 2-2-2-2-4-4 setae, respectively. Ovipositor (Fig. 6) exerted, its base inserted at the level of third tergite. Ovipositor 1.5 times as long as middle tibia. Third valvula 0.5 times as long as second valvifer and 0.3 times as long as ovipositor.

Male. Body length: 0.70-0.80 mm.

Coloration. In coloration similar to female, but frontovertex without infuscate triangular spots, antennae without infuscated segments, fore wings hyaline.

Morphology. Head about 1.2 times wider than height and 1.8 times wider than frontovertex. Eyes 1.6 times as long as cheeks. Antennal scape 3.3 times as long as wide (Fig. 7). First funicular segment 2.5 times as long as wide, funicle segments 2nd to 4th about 2.2 times as long as wide; club suffused, 3.7 times as long as wide and about as long as 2 preceding funicular segments combined. All flagellar segments each with 2 sensilla. Fore wing 2.5 times as long as wide, its marginal fringe about 0.3 times as long as wing width. Hind wing about 6.2 times as long as wide. Genitalia about 0.6 times as long as middle tibia.

Comments. The female of the new species is similar to the female of *Encarsia quercicola* (Howard), described from *Aleuroplatus* [= *Aleyrodes*] *Aleyrodes gelatinosus* Cockerell on *Quercus* sp. in California, USA. According to the original description by Howard (1908) and the redescription by Viggiani (1986), *E. citricola* can be distinguished by the following characters: in *E. quercicola*—midlobe of mesoscutum with 4+2 setae; middle coxae pale; club subequal in length to third and fourth preceding segments combined; ovipositor with base arising on the level of T1; third valvula about one-fourth of the total ovipositor length; scape about 5 times as long as wide; hind portion of mesoscutum lemon yellow. In *E. citricola*—midlobe of mesoscutum with 4+2+2 setae; middle coxae dark brown; club longer than third and fourth preceding segments combined; ovipositor with base arising at the level of T3; third valvula 0.3 times as long as ovipositor; scape about 4 times as long as wide; midlobe of mesoscutum brown-yellowish, along middle part fuscous.

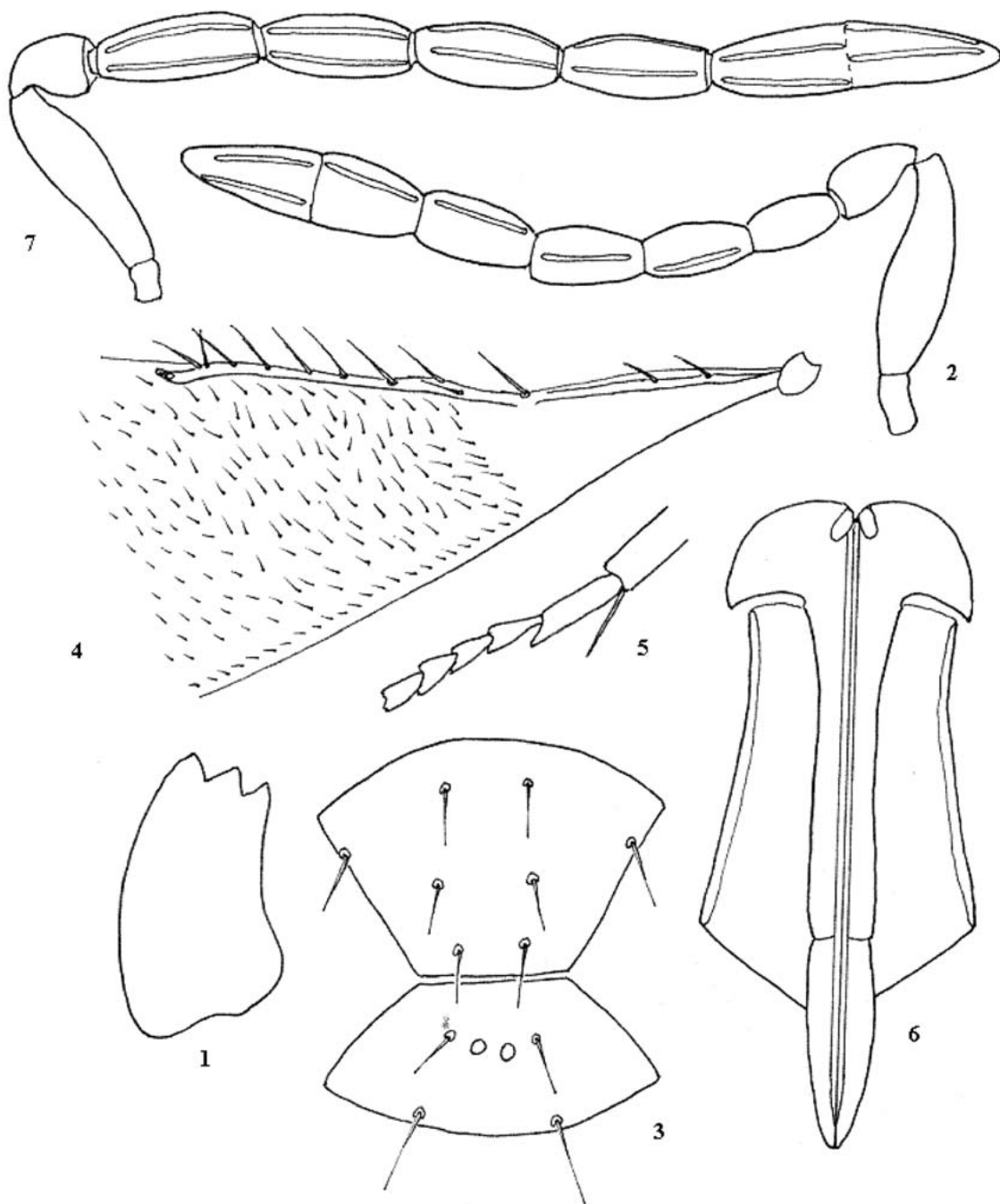
Hayat (1998) divided the genus *Encarsia* species into more than 20 species groups. *E. citricola* sp. n. can be included in the *strenua* group.

Material. Holotype female: Mexico, Guanajuato, San Miguel de Allende, ex *Trialeurodes floridensis* on *Citrus sinensis*, 16-XI-2005 (S. Myartseva). Paratypes: same data as holotype, 2 females and 2 males. All specimens mounted on slides in Canada balsam. Holotype and 1 paratype male will be deposited in UCR (University of California, Riverside, USA), other paratypes in the Entomological Museum of University of Tamaulipas, Cd. Victoria, Mexico.

2. *Encarsia hispida* De Santis 1948

Synonym: *Encarsia brasiliensis* (Hempel 1904); synonymy according to Polaszek et al. 2004.

References: De Santis (1979); Hernández-Suárez et al. (2003); Myartseva & Ruíz Cancino (2000); Myartseva et al. (2000, 2006); Noyes (2002, 2006); Polaszek et al. (1992, 2004); Schmidt et al. (2001).



Figs. 1-7. *Encarsia citricola* Myartseva, **sp. n.**: 1—mandible, 2—antenna, female, 3—midlobe of mesoscutum and scutellum, 4—basal half of fore wing, 5—ovipositor, 6—antenna, male.

Hosts: *Aleuroglandulus malangae* [=subtilis Bondar], *Aleurothrixus floccosus*, *A. porteri*, *Aleurotrachelus espunae* [=rhamnicola (Goux)], *A. rhamnicola*, *A. socialis*, *A. trachoides*, *Aleurotuba jelinekii*, *Aleyrodes horridus* [=*Aleurothrixus floc-*

cosus (Maskell)], *A. proletella*, *A. singularis*, *A. spiraeoides*, *Bemisia tabaci*, *B. tuberculata*, *Crenidorsum aroidephagus*, *Dialeurodes* sp., *Lecanoides floccissimus*, *Lipaleyrodes* sp., *Metaleurodinus minimus*, *Parabemisia myricae*, *Siphoninus*

phillyreae, *Tetraleurodes acaciae*, *Trialeurodes abutiloneus*, *T. floridensis*, *T. ricini*, *T. vaporariorum*, *T. variabilis*.

In Mexico this species was reared from *Bemisia tabaci*-complex, *Tetraleurodes* sp., and *Trialeurodes variabilis*.

World distribution: Nearctic (USA, Mexico), Neotropical (widespread), Palaearctic (Europe), Afrotropical (South Africa), Oriental, Australasian (Australia).

Mexican Distribution: Guerrero, Sinaloa, Tabasco, Tamaulipas, Yucatan.

Material: Mexico, Tamaulipas, Ciudad Victoria, ex *Bemisia tabaci*-complex on *Euphorbia* sp., 2 females, 29-VII-1998, 1 female, 20-VII-1998, 1 female, 19-X-1998, sweeping, 1 female, 11-XI-1998; Gómez Farías, El Nacimiento, ex *Tetraleurodes* sp. on *Bauhinia divaricata*, 1 female, 3-II-1999 (S. Myartseva).

Comments. *Encarsia hispida* was considered as a junior synonym of *E. meritoria* Gahan 1927 (Viggiani 1989; Schauff et al. 1996). According to Polaszek et al. (1992), they are distinct species, and molecular evidence (Babcock et al. 2001) supports this view.

3. *Encarsia meritoria* Gahan 1927

References: Gordh (1979); Heraty & Woolley (1999); Myartseva & Ruíz Cancino (2000); Noyes (2002, 2006); Myartseva et al. (2000); Polaszek et al. (1992, 2004); Schauff et al. (1996); Schmidt et al. (2001).

Host: *Trialeurodes floridensis*; all records of hosts may refer to *Encarsia hispida* (Polaszek et al. 2004).

World Distribution: Nearctic (USA, Mexico).

Mexican distribution: Chiapas.

Material: Mexico, Chiapas, Reserva El Triunfo, sendero Palo Gordo 97/049. Trampa agua, N 15°39'22", W 92°48'31", one female, 20-22-VII-1997 (A. González Hdz., J.B. Woolley and L. Montoya), CIB B 97-057; El Encajonado, sendero El Túnel, red de golpeo, one female, 28-VII-1997 (A. González Hdz.), CIB 97-070.

Comments. Although *Encarsia meritoria* clearly is very closely related to *E. hispida*, there appear to be good reasons for maintaining the 2 species as distinct pending DNA sequencing of populations of true *E. meritoria*, preferably from the type locality (Polaszek et al. 2004).

4. *Encarsia nigricephala* Dozier 1937

References: Alarcón (1993); De Santis (1979); Evans (1993); Evans & Polaszek (1997); Evans & Serra (2002); Heraty & Woolley (1999); Myartseva & Ruíz Cancino (2000); Myartseva et al. (2006); Noyes (2002, 2006); Polaszek et al. (1992); Schauff et al. (1996); Schmidt et al. (2001); Schuster et al. (1998).

Hosts: *Aleurodicus dispersus*, *Aleurotrachelus atratus*, *A. trachoides*, *Bemisia tabaci*, *B. argentifolii* [= *tabaci*], *B. euphorbiae* (probably *B. poinsettiae* Hempel), *Crenidorsum* sp., *Dialeurodes kirkaldyi*, *Tetraleurodes acaciae*, *Trialeurodes abutiloneus*, *T. floridensis*, *T. vaporariorum*.

In Mexico this species was reared from the *Bemisia tabaci*-complex, *Tetraleurodes acaciae* and *Trialeurodes vaporariorum*.

World distribution: Nearctic (USA, Mexico), Neotropical (widespread), Oriental (Reunion), Pacific Islands (Micronesia).

Mexican distribution: Sinaloa, Tabasco, Tamaulipas.

Material: Mexico, Tamaulipas, Ciudad Victoria, ex *Trialeurodes vaporariorum*, 2 females, 2 males, 25.I-4.II.2006 (S. Myartseva).

Comments. New State record for Tamaulipas, Mexico.

5. *Encarsia pergandiella* Howard 1907

Synonyms: *Encarsia versicolor* Girault, 1908; *Encarsia bemisiae* De Santis, 1981; *Encarsia tabacivora* Viggiani, 1985.

References: Alarcón (1993); Arredondo et al. (1994); Hennessey et al. (1995); De Santis (1981) (as *bemisiae*); De Santis & Fidalgo (1994); Evans (1993); Evans & Serra (2002); Gordh (1979); Heraty & Woolley (1999); Mound & Halsey (1978); Noyes (2002, 2006); Myartseva & Ruíz Cancino (2000); Myartseva et al. (2000, 2006); Polaszek et al. (1992); Schauff et al. (1996); Schmidt et al. (2001).

Hosts: *Aleurocanthus woglumi*, *Aleurodicus dispersus*, *Aleuroglandulus malangae* [= *subtilis*], *Aleuroplatus coronata*, *A. elemerae*, *Aleurothrixus floccosus*, *Aleurotrachelus rhamnicola*, *A. socialis*, *A. trachoides*, *Aleyrodes azaleae* [= *Pealius azaleae*], *A. elevatus*, *A. loniceriae*, *A. prolella*, *A. spiraeoides*, *Asterochiton sonchi* [= *Trialeurodes vaporariorum*], *Bemisia afer*, *B. argentifolii* [= *tabaci*], *B. tabaci*, *Dialeurodes citri*, *D. kirkaldyi*, *Pealius azaleae*, *Trialeurodes abutiloneus*, *T. floridensis*, *T. packardi*, *T. vaporariorum*, *T. variabilis*.

In Mexico this species was reared from the *Bemisia tabaci*-complex, *Trialeurodes vaporariorum*, *Tetraleurodes* sp. and *T. mori*.

World distribution: Nearctic (USA, Mexico), Neotropical (Central and South America), Palaearctic (Europe), Australasian (Australia).

Mexican distribution: Colima, Mexico D.F., Quintana Roo, Sinaloa, Sonora, Tamaulipas. Material. Mexico, Tamaulipas, Ciudad Victoria, ex *Bemisia tabaci*-complex on *Puansetia* sp., 2 females, 9.IX.1998; ex *Trialeurodes vaporariorum*, 6 females, 25.I-6.II.2006; Jaumave, ex *Trialeurodes vaporariorum* on *Malva* sp., 10 females, 4 males; Tampico, ex *Tetraleurodes mori*, 1 male, 27.III.2001 (S. Myartseva).

Comments. *Encarsia pergandiella* is a Nearctic species. It was introduced into Israel and Europe

to control *Bemisia tabaci* (Evans & Castillo 1998; Hernández-Suárez et al. 2003). Information about introduction of *E. pergandiella* into Mexico against *Aleurocanthus woglumi* Ashby (Alvarado-Mejía & González-Hernández, 1990, with reference to Dominguez & Carrillo, 1976) is erroneous.

6. *Encarsia telemachus* Evans 2002

E. telemachus was reared from *Trialeurodes floridensis* in Haiti on *Bauhinia divaricata* (Evans & Serra 2002).

7. *Encarsia variegata* Howard 1908

References: Evans (1993); Evans & Serra (2002); Heraty & Woolley (1999); Myartseva & Ruíz Cancino (2000); Myartseva et al. (2006); Myartseva & Varela Fuentes (in press); Noyes (2002, 2006); Schauff et al. (1996); Viggiani (1996).

Hosts: *Aleurodicus perseae* [= *Paraleyrodes perseae*], *Aleurothrixus floccosus*, *Paraleyrodes naranjiae*, *P. perseae*, *Trialeurodes floridensis*.

In Mexico this species was reared from *Trialeurodes floridensis*.

World distribution: Nearctic (USA, Mexico), Neotropical (Colombia, Haiti, Honduras, Puerto Rico).

Mexican distribution: Chapas, Guanajuato, Nuevo León, San Luis Potosí, Tamaulipas. Material: Mexico, Nuevo León, 20 km S Monterrey, 2 females, 7.VI.2005 (S. Myartseva & E. Ruíz Cancino); San Luis Potosí, Tamuín, 1 female, 30.I.2005 (S. Varela Fuentes); Tamaulipas, Guémez, 18 females, 4 males, 10.V.2005 (S. Myartseva). All specimens were reared from *Paraleyrodes* spp. on *Citrus* spp. Guanajuato, San Miguel de Allende, ex *Trialeurodes floridensis* on *Citrus sinensis*, 2 females, 2 males, 16.XI.2005; Chiapas, Tapachula, ex Aleyrodidae on *Psidium guajava*, 2 females, 8-9.X.2006 (S. Myartseva).

Comments. The Universal Chalcidoidea Database (Noyes 2006) does not record *Encarsia variegata* as occurring in Mexico. Schauff et al. (1996) indicated that this species is presented in Mexico, but did not mention any specific localities. We reared *E. variegata* from *Paraleyrodes* spp. collected in 3 states of Mexico—Nuevo León, San Luis Potosí and Tamaulipas (Myartseva & Varela Fuentes in press) and from the states of Guanajuato and Chiapas. *Trialeurodes floridensis* represents a new host for *Encarsia variegata*.

Family Encyrtidae

8. *Metaphycus troas* Noyes 2004

References: Myartseva (2006).

Host: *Trialeurodes floridensis*.

World distribution: Nearctic (Mexico), Neotropical (Costa Rica).

Mexican distribution: Guanajuato.

Material: Mexico, Guanajuato, San Miguel de Allende, ex *Trialeurodes floridensis* on *Citrus sinensis*, 5 females, 5 males, 16.XI.2005 (S. Myartseva).

Comments. Currently, there are 5 described species of the genus *Metaphycus* that are known to parasitize whiteflies, all of which are from the Neotropical region (Noyes 2004; Myartseva 2006; Noyes & Lozada 2005). Of these, 3 species are known from Mexico. *Trialeurodes floridensis* represents a new host record for the genus *Metaphycus*.

Family Signiphoridae

9. *Signiphora aleyrodis* Ashmead, 1900

References: De Santis (1979); Myartseva et al. (2005); Noyes (2002, 2006); Ruíz et al. (2005).

Hosts: A hyperparasitoid through *Aleuropatus coronata*, *Aleurothrixus floccosus*, *Aleyrodes spiraeoides*, *Bemisia tabaci*-complex, *Dialeurodes citri*, *Tetraleurodes* sp., *Trialeurodes floridensis*, *T. vaporariorum*. Also known from several species of armored scales (Diaspididae).

In Mexico, was reared from *Aleurothrixus floccosus*, *Bemisia tabaci*-complex, *Tetraleurodes* spp., *Trialeurodes floridensis* and *Trialeurodes vaporariorum*.

World distribution: Nearctic (USA, Mexico), Neotropical (widespread).

Mexican distribution: Guanajuato, Guerrero, San Luis Potosí, Tamaulipas.

Material: Mexico, Tamaulipas, Ciudad Victoria, ex *Tetraleurodes* sp. on *Bauhinia divaricata*, 1 female, 7.VII.1998, ex *Bemisia tabaci*-complex on *Rosa* sp., 1 female, 3.IX.1998, ex *Aleurothrixus floccosus* on *Citrus sinensis*, 1 female, 9.V.1999, 1 female, 4.IV.2000, ex *Tetraleurodes* sp. on *Leucaena pulverulenta*, 2 females, 17.I.2000, 2 females, 6.V.2000; Miquihuana, ex *Tetraleurodes* sp. on *Sophora secundiflora*, 1 female, 1 male, 3.X.1998, 3 females, 1.IV.2001, ex *Tetraleurodes* sp. on *Mahonia trifoliata*, 1 female, 13.V.2000; Jaumave, ex *Trialeurodes vaporariorum* on *Ruta* sp., 1 female, 31.III.2001. San Luis Potosí, ex *Tetraleurodes* sp. on *Psidium guajava*, 1 female, 12.XI.1999, 1 female, 28.X.1999. Guerrero, Acapulco, ex Aleyrodidae on *Pithecellobium* sp., 1 female, 12.VI.2000. Guanajuato, San Miguel de Allende, ex *Trialeurodes floridensis* on *Citrus sinensis*, 1 female, 16.XI.2005 (S. Myartseva).

Comments. *Trialeurodes floridensis* represents a new host record for *Signiphora aleyrodis*.

ACKNOWLEDGMENTS

The authors thank Dr. G. Evans (APHIS/PPQ/NIS, c/o Systematic Entomology Laboratory, ARS, USDA, BARC-West, Beltsville, Maryland, USA) for the loan of important publications on Aphelinidae; Dr. J. Noyes (Department of Entomology, The Natural History Mu-

seum, London, UK) for loan of his excellent books about Encyrtidae of Costa Rica; and Departamento de Estudios de Postgrado e Investigación, UAM Agronomía y Ciencias, Universidad Autónoma de Tamaulipas, Ciudad Victoria, México, for financial support of this work. We thank 2 anonymous reviewers for helpful suggestions and corrections.

REFERENCES CITED

- ALARCÓN, M. S. 1993. Control biológico de mosquita blanca en Sinaloa, pp. 19-22 *In* L. A. Rodríguez del Bosque (ed.), II Taller Sobre Control Biológico de Mosquita Blanca, Centro Nacional de Referencia de Control Biológico, DGSV-SARH, México.
- ALVARADO-MEJÍA, G. AND A. GONZÁLEZ-HERNÁNDEZ. 1990. Taxonomía de las especies de *Aphytis* Howard (Hymenoptera: Aphelinidae) y otros géneros en el área citrícola de Nuevo León. *Biotam* 2(3): 42-51.
- ARREDONDO-BERNAL, H. C., C. DÍAZ-HERNÁNDEZ, AND G. GUTIÉRREZ-CORONA. 1994. Afelinidos parasitoides de mosquita blanca en el occidente y noroeste de México. *Memoria XVII Congreso Nacional de Control Biológico*, Oaxaca, México. pp. 56-57.
- BABCOCK, C. S., J. M. HERATY, P. J. DE BARRO, F. DRIVER, AND S. SCHMIDT. 2001. Preliminary phylogeny of *Encarsia* Förster (Hymenoptera: Aphelinidae) based on morphology and 28S rDNA. *Molecular Phylogenetics and Evolution* 18: 306-323.
- CARAPIA-RUIZ, V. E., H. GONZÁLEZ-HERNÁNDEZ, J. ROMERO-NÁPOLES, L. D. ORTEGA-ARENAS, AND S. D. KOCH. 2003. Descripción de los nuevas especies de *Trialetrodes* (Cockerell) (Homoptera: Aleyrodidae) y clave para las especies de México. *Acta Zoológica Mexicana* (n.s.): 93-101.
- DE SANTIS, L. 1979. Catálogo de los Himenópteros Calcidoideos de América al Sur de los Estados Unidos. La Plata, Argentina. 488 pp.
- DE SANTIS, L. 1981. Sobre dos especies de *Encarsia* (Hymenoptera, Aphelinidae) del Brasil parasitoides de *Bemisia tabaci* (Homoptera, Aleyrodidae). *Revista Brasileira Entomológica* 25: 37-39.
- DE SANTIS, L., AND P. FIDALGO. 1994. Catálogo de Himenópteros Calcidoideos. Serie de la Academia Nacional de Agronomía y Veterinaria (Buenos Aires) 13: 1-154.
- DOMÍNGUEZ, Y., AND R. J. L. CARRILLO S. 1976. Lista de Insectos en la Colección Entomológica del Instituto Nacional de Investigadores Agrícolas. Segundo Suplemento. Folleto INIA, SAG. Folleto Misceláneo 29: 1-245.
- EVANS, G. A. 1993. Systematic Studies of New World *Encarsia* Species and a Survey of the Parasitoids of *Bemisia tabaci* in Florida, the Caribbean and Latin America. Ph.D. Dissertation, University of Florida, Gainesville, USA. pp. 1-283.
- EVANS, G. A., AND J. A. CASTILLO. 1998. Parasites of *Aleurotrachelus socialis* (Homoptera: Aleyrodidae) from Colombia including descriptions of two new species (Hymenoptera: Aphelinidae; Platygasteridae). *Florida Entomol.* 81: 171-178.
- EVANS, G. A., AND A. POLASZEK. 1997. Additions to the *Encarsia* parasitoids (Hymenoptera: Aphelinidae) of the *Bemisia tabaci* complex (Hemiptera: Aleyrodidae). *Bull. Entomol. Res.* 87: 563-571.
- EVANS, G. A., AND C. A. SERRA. 2002. Parasitoids associated with whiteflies (Homoptera: Aleyrodidae) in Hispaniola and descriptions of two new species of *Encarsia* Förster (Hymenoptera: Aphelinidae). *J. Hymenoptera Res.* 11: 197-212.
- GORDH, G. 1979. Chalcidoidea, pp. 743-1044 *In* K. V. Krombein, P. D. Hurd, Jr., D. R. Smith, and B. D. Burks (eds.). *Catalog of Hymenoptera in America North of Mexico*. Vol. 1. Smithsonian Institution Press, Washington, D.C., USA. 1198 pp.
- HAMON, A. B. 2002. Whitefly of Citrus in Florida (Homoptera: Aleyrodidae) (<http://www.doacs.state.fl.us/pi/enpp/ento/aleyrodi.htm>).
- HAYAT, M. 1998. Aphelinidae of India (Hymenoptera: Chalcidoidea): A Taxonomic Revision. *Memoirs on Entomology. International Assoc. Publisher, Gainesville, Florida, USA.* 13: 1-416.
- HENNESSEY, R. D., M. C. ARREDONDO-BERNAL, AND L. A. RODRÍGUEZ DEL BOSQUE. 1995. Distribución geográfica y huéspedes alternos de parasitoides afelinidos de *Bemisia tabaci* (Hymenoptera: Aleyrodidae). *Vedalia* 2: 61-75.
- HERATY, J. M., AND J. B. WOOLLEY. 1999. Printed Catalog of the World Species of *Encarsia*. The Computer Database. pp. 1-71.
- HERNÁNDEZ-SUÁREZ, E., A. CARNERO, A. AGUILAR, G. PRINSLOO, J. LA SALLE, AND A. POLASZEK. 2003. Parasitoids of whiteflies (Hymenoptera: Aphelinidae, Eulophidae, Platygasteridae; Hemiptera: Aleyrodidae) from the Macaronesian archipelagos of the Canary Islands, Madeira and the Azores. *Systematics and Biodiversity* 1: 55-108.
- HODGES, G. S., AND G. A. EVANS. 2005. An identification guide to the whiteflies (Hemiptera: Aleyrodidae) of the Southeastern United States. *Florida Entomol.* 88: 518-534.
- HOWARD, L. O. 1908. A key to the species of *Prospaltella*, with table of hosts, and descriptions of four new species. *Ann. Entomol. Soc. America* 1: 282-284.
- MARTIN, J. H. 1987. An identification guide to common whitefly pest species of the world (Homoptera, Aleyrodidae). *Trop. Pest Management* 33: 298-322.
- MARTIN, J. H., D. MIFSUD, AND C. RAPISARDA. 2000. The whiteflies (Hemiptera: Aleyrodidae) of Europe and the Mediterranean Basin. *Bull. Entomol. Res.* 90: 407-448.
- MOUND, L. A., AND S. H. HALSEY. 1978. Whitefly of the World. A Systematic Catalogue of the Aleyrodidae (Homoptera) with Host Plant and Natural Enemy Data. British Museum (Natural History) and John Wiley and Sons, Chichester-New York-Brisbane-Toronto. 340 pp.
- MYARTSEVA, S. N. 2006. Species of the genus *Metaphycus* Mercet (Hymenoptera: Encyrtidae) parasitizing whiteflies (Homoptera: Aleyrodidae). *Zoosystematica Rossica* 2005 14(2): 266.
- MYARTSEVA, S. N. AND E. RUIZ-CANCINO. 2000. Annotated checklist of the Aphelinidae (Hymenoptera: Chalcidoidea) of Mexico. *Folia Entomológica Mexicana* 109: 7-33.
- MYARTSEVA, S. N., E. RUIZ-CANCINO, AND J. M. CORONADO-BLANCO. 2000. The *Encarsia* species—parasitoids of whiteflies (Homoptera: Aleyrodidae) in Mexico (Abstract 1600). Abstracts, XXI Internacional Congreso de Entomología, Brazil, August 20-26, 2000, 1: 403.
- MYARTSEVA, S. N., E. RUIZ-CANCINO, S. E. VARELA FUENTES, AND J. M. CORONADO-BLANCO. 2006. Especies del género *Encarsia* (Hymenoptera: Aphelinidae) obtenidas de mosquitas blancas (Homoptera:

- Aleyrodidae) en México en cítricos y otras plantas. *Entomología Mexicana* 5: 1120-1124.
- MYARTSEVA, S. N., E. RUÍZ-CANCINO, J. M. CORONADO-BLANCO, AND S. E. VARELA FUENTES. 2005. Signiphoridae (Hymenoptera: Chalcidoidea) hiperparasíticos y sus hospederos en México. *Entomología Mexicana* 4: 937-940.
- MYARTSEVA, S. N., AND S. E. VARELA FUENTES. In press. *Encarsia variegata* Howard (Hymenoptera: Aphelinidae)—a parasitoid of whiteflies *Paraleyrodes* spp. (Homoptera: Aleyrodidae) in three citrus-producing states of Mexico. *Vedalia*.
- NGUYEN, R., R. I. SAILER, AND A. B. HAMON. 1993. Catalog of Aleyrodidae on Citrus and their natural enemies. (Homoptera-Aleyrodidae). Florida Department of Agriculture and Consumer Services, Occasional papers of the Florida State Collection of Arthropods, Vol. 8, Contribution No. 730, Bureau of Entomology, Gainesville, Florida, USA. 57 pp.
- NOYES, J. S. 1982. Collecting and preserving chalcid wasps (Hymenoptera: Chalcidoidea). *J. Natural Hist.* 16:315-334.
- NOYES, J. S. 2002. Interactive Catalogue of World Chalcidoidea 2001. Compact disc. Taxapad, Vancouver, Canada.
- NOYES, J. S. 2004. Encyrtidae of Costa Rica (Hymenoptera: Chalcidoidea), 2. Memoirs of American Entomological Institute 73. 459 pp.
- NOYES, J. S. 2006. Universal Chalcidoidea Database (Computer version, last updated June 2006).
- NOYES, J. S., AND P. W. LOZADA. 2005. *Metaphycus zdeneki* sp. nov. (Hymenoptera: Encyrtidae) from Peru, a parasitoid of *Bakerius* sp. (Hemiptera: Aleyrodidae). *Acta Societas Zoologicae Bohemicae* 69: 209-214.
- POLASZEK, A., G. A. EVANS, AND F. D. BENNETT. 1992. *Encarsia* parasitoids of *Bemisia tabaci* (Hymenoptera: Aphelinidae, Homoptera: Aleyrodidae): a preliminary guide to identification. *Bull. Entomol. Res.* 82: 375-392.
- POLASZEK, A., S. MANZARI, AND D. L. J. QUICKE. 2004. Morphological and molecular taxonomic analysis of the *Encarsia meritoria* species-complex (Hymenoptera, Aphelinidae), parasitoids of whiteflies (Hemiptera, Aleyrodidae) of economic importance. *Zoologica Scripta* 33: 403-421.
- RUÍZ-CANCINO, E., J. M. CORONADO-BLANCO, AND S. N. MYARTSEVA. 2005. Plagas de cítricos y sus enemigos naturales en el estado de Tamaulipas, México. *Entomología Mexicana* 4: 931-936.
- RUSSELL, L. M. 1963. Hosts and distribution of five species of *Trialeurodes* (Homoptera: Aleyrodidae). *Ann. Entomol. Soc. America* 56: 149-153.
- SCHAUFF, M. E., G. A. EVANS, AND J. M. HERATY. 1996. A pictorial guide to the species of *Encarsia* (Hymenoptera: Aphelinidae) parasitic of whiteflies (Homoptera: Aleyrodidae) in North America. *Proc. Entomol. Soc. Washington* 98: 1-35.
- SCHMIDT, S., I. D. NAUMANN, AND P. J. DE BARRO. 2001. *Encarsia* species (Hymenoptera: Aphelinidae) of Australia and the Pacific Islands attacking *Bemisia tabaci* and *Trialeurodes vaporariorum* (Hemiptera: Aleyrodidae)—a pictorial key and descriptions of four new species. *Bull. Entomol. Res.* 91: 369-387.
- SCHUSTER, D. J., G. A. EVANS, F. D. BENNETT, P. A. STANSLY, R. K. JANSSON, G. L. LEIBEE, AND S. E. WEBB. 1998. A survey of parasitoids of *Bemisia* spp. whiteflies in Florida, the Caribbean, and Central and South America. *Intl. J. Pest Management* 44: 255-260.
- VIGGIANI, G. 1986. Notes on some species of *Coccophagus* Westwood, *Coccophagoides* Girault, *Encarsia* Foerster and *Encarsiella* Hayat (Hymenoptera: Aphelinidae), mainly from the Nearctic and Neotropical regions. *Bolletino del Laboratorio di Entomologia Agraria Filippo Silvestri di Portici* 43: 29-78.
- VIGGIANI, G. 1989. Notes on some Nearctic and Neotropical *Encarsia* Förster (Hymenoptera: Aphelinidae). *Bolletino del Laboratorio di Entomologia Agraria Filippo Silvestri di Portici* 46: 207-213.