

**ERETMOCERUS HALDEMAN (HYMENOPTERA: APHELINIDAE) –
PARASITOIDS OF WHITEFLIES *TRIALEURODES VAPORARIORUM*
AND *BEMISIA (TABACI COMPLEX)* IN MEXICO, WITH A KEY AND
DESCRIPTION OF A NEW SPECIES**

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RESUMEN Se describe una especie nueva, *Eretmocerus evansi* sp. nov., de los Estados de Tamaulipas y Querétaro de la República Mexicana. Se agregan las características del género *Eretmocerus* y la clave para la identificación de nueve especies de este género de México; se presenta la sinopsis de especies de *Eretmocerus*, los parasitoides de las moscas blancas *Trialeurodes vaporariorum* y *Bemisia (tabaci* complejo), con datos sobre sus diagnósticos, hospederos, distribución geográfica y los materiales examinados.

DESCRIPTORES Aleyrodidae, Aphelinidae, *Eretmocerus*, sinopsis, México.

ABSTRACT *Eretmocerus evansi* sp. nov., from the States of Tamaulipas and Querétaro, Mexico, is described. Characteristics of the genus *Eretmocerus*, a key to nine species of this genus from Mexico, and a synopsis of the species of *Eretmocerus* from Mexico, parasitoids of *Trialeurodes vaporariorum* and *Bemisia (tabaci* complex), with data on their diagnosis, hosts, geographical distribution, and examined material are included.

KEYWORDS Aleyrodidae, Aphelinidae, *Eretmocerus*, synopsis, Mexico.

INTRODUCTION

The genus *Eretmocerus* Haldeman, 1850 includes some species, which are very important in biological control and in integrated pest management of whiteflies (Homoptera: Aleyrodidae) – serious pests of agricultural crops. *Bemisia (tabaci* complex) are one of the major pests of many vegetable, fruits, technical and ornamental plants in USA, Mexico, the Caribbean, Central and South America, the Middle East, India and Africa (Rose & Zolnerowich 1997).

Species from the genus *Eretmocerus* were introduced into many countries for biological control of pests. Information on fauna and

biology of parasitoids of whiteflies *Bemisia tabaci* (Gennadius), also *Trialeurodes vaporariorum* (Westwood), serious pests of agricultural crops in Mexico, is insufficient.

In Mexico three *Eretmocerus* species were known as parasitoids of these whiteflies: *Eretmocerus emiratus* (Zolnerowich and Rose), *E. eremicus* (Rose and Zolnerowich) and *E. mundus* Mercet. These species were introduced for biological control of *Bemisia (tabaci* complex) (Cervantes & Cota 1992, Hennessey et al. 1995, Cota Gómez et al. 1998). Results and efficiency of these species in several States of Mexico were published in many articles and notes (Rodríguez-del-Bosque & Arredondo Bernal 2005).

Researchers are able to identify species of parasitoids of both *T. vaporariorum* and *Bemisia (tabaci)* complex, imported and originated locally. Therefore genus *Eretmocerus* becomes intensive taxonomic and biological studied during last ten years worldwide. Rose & Zolnerowich (1997, 1998) described many new species and published review of eight *Eretmocerus* species attacking *Bemisia (tabaci)* complex in the United States. Hayat (1998) revised *Eretmocerus* of India; from 15 species known to occur in India, 13 were described from different areas of India and two species are parasitoids of *B. tabaci*.

The genus *Eretmocerus* comprises over 60 described species and has a cosmopolitan distribution. Species of *Eretmocerus* develop as primary ecto-endoparasitoids of whiteflies and are important natural enemies for biological control of some pests. Publications of Rose & Zolnerowich (1997, 1998) included materials from Mexico, and they described some new species collected in Mexico. But special study of Mexican *Eretmocerus* till present was absent, including study of parasitoids of *T. vaporariorum* and *Bemisia (tabaci)* complex). According to our previous study of publications, there are currently nine described species of *Eretmocerus* known to occur in Mexico as parasitoids of different whiteflies (Myartseva & Ruíz Cancino 2000, Myartseva et al. 2004, Coronado Blanco et al. 2005, Ruíz Cancino et al. 2005). Most species were reared from whiteflies – agricultural pests. Little is known about *Eretmocerus* species found outside of agricultural areas, as parasitoids of whiteflies inhabited on ornamental and wild plants.

MATERIALS AND METHODS

The special study of the family Aphelinidae of Mexico, including genus *Eretmocerus*, was began in 1998. The principal method of collecting of parasitoids was rearing (Noyes 1982). Collected leaves

from different plants with whitefly pupas were brought to laboratory and kept in plastic and glass containers of different size depending on number of pupas. All material was controlled and delivered from other insects. Emerged parasitoids were collected with aspirator and transferred to 70% alcohol for preserving. Later part of specimens were dissected and mounted on slides in Canada balsam. All material was fully labelled. For identification of whiteflies was utilized author's experience from previous study of whiteflies and their parasitoids (Myartseva et al. 1998).

For identification of *Eretmocerus* species were used morphological criteria based principally on some parts of head and body with any modifications, and keys composed by Rose & Zolnerowich (1997) and Zolnerowich & Rose (1998). Basic morphological criteria for females are: configuration of antennal segments, relative proportions of antennal segments lengths (radicle, scape, pedicel, funicular segments, and club), setation of mesosoma (midlobe of mesoscutum, axillae, side lobes), length to width ratios of fore and hind wings, relative length of marginal fringe, relative lengths of stigmal and marginal veins, number of setae on base of fore wing, number of setae between marginal vein and linea calva, relative lengths of midtibial spur and midbasitarsus, relative lengths of ovipositor, club and midtibia and their ratios. Some species have very small morphological differences, and for their differentiation is needed biosystematic study or electrophoretic analysis.

This work is result of collecting, rearing, and taxonomical study of *Eretmocerus* parasitoids of whiteflies *T. vaporariorum* and *Bemisia (tabaci)* complex) of Mexico during period 1998-2006. In the article are presented the review of all nine Mexican *Eretmocerus* species, including introduced species, also key for identification of females, and description of a new species – parasitoids of *T. vaporariorum* and *Bemisia (tabaci)* complex).

The synopsis includes short diagnosis, distribution, host records, material studied and comments for each species.

Eretmocerus haldemani Howard, 1908 is not included into key and review, because, according to last Database of Chalcidoidea (Noyes 2005) this species is not presented in Mexico. In article of Hennessey et al. (1995) it was misidentification, possibly of *E. eremicus* (as *californicus* Howard). Later following to Hennessey et al. (1995) this species was cited in other articles, including our publications (Myartseva & Ruíz Cancino 2000: 22 and Myartseva et al. 2004: 756).

The type of a new species of *Eretmocerus* will be deposited in the University of California, Riverside, California, USA. Remain specimens are preserved in the Universidad Autónoma de Tamaulipas, Tamaulipas, Mexico. The following abbreviations are used for depositories of the type material: UAT – Museum of Insects of UAM Agronomía y Ciencias of the Universidad Autónoma de Tamaulipas, Ciudad Victoria, Tamaulipas; UCRC – Research Entomological Museum of the University of California, Riverside, California; USNM – U.S. National Museum of Natural History, Washington, D.C., USA.

Following Zolnerowich & Rose (1998), in article is used name for *Bemisia* species as *Bemisia (tabaci* complex), because of confusion regarding the use of names *B. tabaci* A-strain, *B. tabaci* B-strain and *B. argentifolii* Bellows and Perring.

RESULTS AND DISCUSSION

Diagnosis of genus *Eretmocerus* Haldeman

Eretmocerus Haldeman (1850): 111 (type species *E. corni* Haldeman, by monotypy).

Ricinusa Risbec (1951): 403 (type species *R. aleyrodiphaga* Risbec, by original designation); synonymized by Ferriere (1965): 170.

Diagnosis. Female with 5-segmented antenna: radicle/scape cylindrical, pedicel, two funicular segments short, to anelliform or triangular, club large, cylindrical or gradually widened distad and spatulate or fusiform, with sparse longitudinal sensilla. Mandible 3-dentate or with two teeth and short truncation. Antennal toruli closer to mouth margin. Eyes small. Ocelli usually arranged in obtuseangled triangle. Midlobe of mesoscutum dominantly with 4-6 long setae. Scutellum with two pairs of long setae. Propodeum usually on posterior margin medially with triangular projection, on anterior margin with a flat, scale-like seta with a bifid apex near each spiracle. Endophragma well-developed. Fore wing variable in dimensions and the length of marginal fringe. Marginal vein usually with 3-4 setae, submarginal vein with 2-3 setae. Disc sparsely setose, with linea calva closed posteriorly by a few setae and tubercles, basal cell with 1-3 setae. Hind wing narrow, the length of marginal fringe variable. Legs long and slender, tarsal formula 4-4-4. Midtibial spur usually about 0.5X the midbasitarsus. Metasoma of variable length, but usually longer than head and mesosoma combined. Ovipositor slightly exerted or not, but stylets may be strongly exerted, sometimes with curved apice.

Male with 3-segmented antenna: radicle, scape, pedicel and club. Club long and curved, bearing numerous sensilla. Phallobase of genitalia ventrally with two rod-like prolongations distad, digital sclerites well-developed, each with two denticles.

Length of body usually 0.4-0.8 mm. Color of body predominantly yellow, with minimum of brownish suffusions. Sculpture finely reticulate.

Hosts. Aleyrodidae.

Distribution. Almost cosmopolitan.

According to G. A. Evans (USDA/APHIS, Systematic Entomology Laboratory, Beltsville, MD, USA) opinion about division of species groups of *Eretmocerus* without taxonomic

status (unpublished data), new species *Eretmocerus evansi* sp. n. can be belong to *californicus* species group.

Key to species of the genus *Eretmocerus* – parasitoids of whiteflies *Trialeurodes vaporariorum* and *Bemisia (tabaci)* complex in Mexico (females)

1. Mesosoma brown orange, in contrasting with head and metasoma. Antenna see in Fig. 8.....*staufferi* Rose & Zolnerowich
 - Body yellow, mesosoma not contrasting with head and metasoma.....2
2. Midlobe of mesoscutum with 4 setae.....3
 - Midlobe of mesoscutum with 6 setae4
3. First funicular segment quadrate, second segment longer than wide, club 5.7-7.4 times as long as wide (Fig. 7) *mundus* Mercet
 - First funicular segment triangular, second segment subquadrate, club 5.3-6.6 times as long as wide (Fig. 3) *emiratus* Zolnerowich & Rose
4. Club 4.5-5.1 times as long as wide, ovipositor 1.5 times as long as club and 1.3 times as long as midtibia (Fig. 6)*joeballi* Rose & Zolnerowich
 - Club more than 5.4 times as long as wide.....5
5. Club more than 7.5 times as long as wide (Fig. 1), ovipositor 0.8-0.9 times as long as club and midtibia *antennator* Myartseva et Ruíz
 - Club 5.9-7.3 times as long as wide, ovipositor variable6
6. Club 5.9-7.0 times as long as wide, longer than ovipositor and as long as midtibia (Fig. 2) *corni* Haldeman
 - Club as long as ovipositor.....7
7. Club (Fig. 4, 9) as long as midtibia8
 - Club (Fig. 5) longer than midtibia, 7.0-7.3 times as long as wide, fore wing 2.9 times as long as wide its marginal fringe 0.4 times as long as maximum width of wing..... *evansi* sp. n.
8. Club 6.5-7.3 times as long as wide, fore wing 2.7 times as long as wide, its marginal fringe 0.35 times as long as maximum width of wing *eremicus* Rose & Zolnerowich
 - Club 6.2-7.1 times as long as wide, fore wing 2.6 times as long as wide, its marginal fringe 0.28 times as long as maximum width of wing *tejanus* Rose & Zolnerowich

Review of species

1. *Eretmocerus antennator* Myartseva et Ruíz, 2006 (Fig. 1)

Eretmocerus antennator Myartseva et Ruíz, 2006: Fig. 1.

Described from Mexico, holotype female in UCRC.

Hosts. *T. vaporariorum*, *Tetraleurodes* sp.

Distribution. Mexico (Coahuila, Tamaulipas).

Diagnosis. Female of *E. antennator* can be distinguished by unusual elongate club (Fig. 1), which 7.5-9.0 times as long as wide, scape 4.4-5.7 times as long as wide, midlobe of mesoscutum with 6 setae, the ovipositor about 0.8-0.9 times as long as club and midtibia.

It is very similar to *E. haldemani* and *E. staufferi*, which also have the extremely elongate club, but in *E. haldemani* – club is only 7.5-8.3 times as long as wide and pedicel 0.5 X the length of scape, type material was reared from *Aleuroplatus coronata* (Quaintance) on oak (Howard 1908); *E. staufferi* has club 8.2-9.1 times as long as wide, but it is one species that has mesosoma brown orange. *Eretmocerus antennator* is similar also to *E. exilis* Rose, *E. tejanus* Rose and Zolnerowich and *E. delhiensis* Mani. Female of *E. exilis* has club about 6.9 times as long as wide, pedicel about 2.1 as long as wide, scape about 4.5 times as long as wide, and was reared from *Aleurothrixus floccosus* (Maskell). *Eretmocerus tejanus* has the club

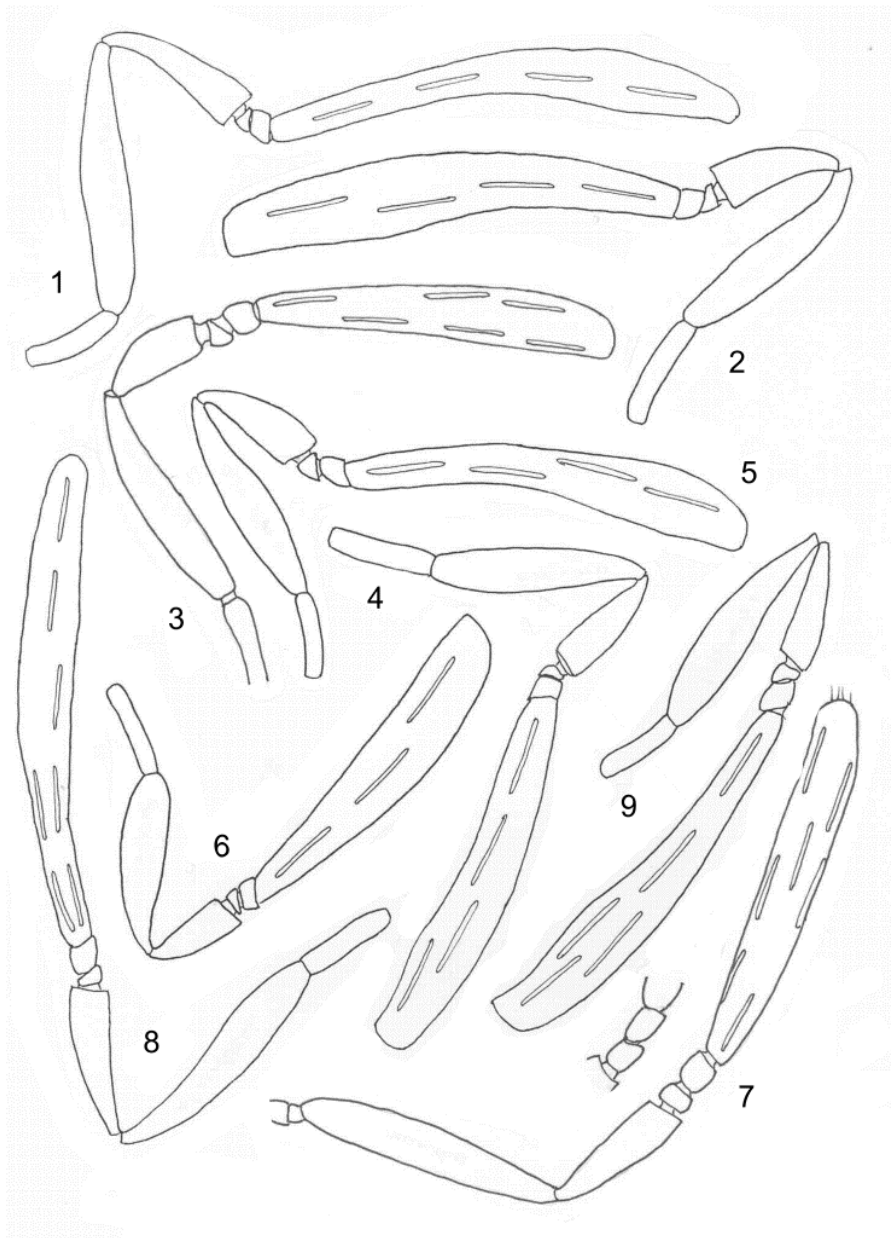


Fig. 1-9. *Eretmocerus* antennae, female: 1, *antennator*; 2, *corni* (from Rose & Zolnerowich, 1997); 3, *emiratus* (from Zolnerowich & Rose, 1998); 4, *eremicus* (from Rose & Zolnerowich, 1997); 5, *evansi* sp. n.; 6, *joeballi*; 7, *mundus* (from Hayat, 1998); 8, *staufferi*; 9, *tejanus*.

6.2-7.1 times as long as wide and 2.8 times as long as pedicel, reared from *Bemisia* (*tabaci* complex). Female *E. delhiensis* has pedicel usually at least 2.5 times as long as wide, but less than three times, club not less than six

times as long as wide, but usually less than seven times, ovipositor subequal in length to club and midtibia, reared from whiteflies on sugar cane in India.

Material examined. Mexico– Tamaulipas, Cd. Victoria, ex *T. vaporariorum* on grass, 1 f, 3.II.2006; ex *Tetraleurodes* sp. on tree, 1 f, 18.X.1998; Jaumave, ex *T. vaporariorum* on *Malva* sp., 2 f, 31.III.2001, 2 f, 31.IX.2001. Coahuila, Saltillo, ex *Tetraleurodes* sp. on *Morus* sp., 8 f, 9.VII.2000 (S. Myartseva).

2. *Eretmocerus corni* Haldeman (Fig. 2)

Eretmocerus corni Haldeman (1850): 110, Figs. 6-7.

Described from USA, neotype female in USNM.

Hosts. *Aleurocanthus* sp., *Aleurothrix porteri* Quaintance and Baker, *Aleurotuberculatus takahashii* David and Subramaniam, *B. tabaci*, *Dialeurolonga fici* David and Subramaniam, *Pealius hibisci* (Kotinsky), *P. quercus* (Signoret), *Siphoninus phillyreae* (Haliday), *Trialeurodes packardi* (Morrill), *T. vaporariorum*, *Tetraleurodes corni* (Haldeman) (Noyes 2005).

Distribution. Argentina, Chile, China, Egypt, Greece, Hawaii, Italy, Pakistan, Paraguay, U.K., USA; Mexico¹ – Tamaulipas.

Diagnosis. Club (Fig. 2) elongate, with apex truncate, 5.9-7.0 times as long as wide, scape 4.9 times as long as wide, pedicel 2.4-3.1 times as long as wide and 0.25-0.29, rarely 0.30 times as long as the club, first funicular segment triangular, second segment subquadrate; midlobe of mesoscutum with six setae; fore wing 2.7 times as long as maximum width of disc, marginal fringe 0.3 X the width of wing; between marginal fringe and linea calva 10-11, occasionally 10-15 setae; ovipositor 0.8 X the length of club, equal in length to midtibia.

Material examined. Mexico– Tamaulipas, Jaumave, ex *T. vaporariorum* on *Ruta* sp., 1 f, 31.III.2001; Cd. Victoria, ex *T. vaporariorum* on grass, 1 f, 3.II.2006, ex *B. tabaci* on

Euphorbia sp., 1 f, 20.VII.1998 (S. Myartseva).

Comments. *Eretmocerus corni* was released in Egypt for biocontrol of *S. phillyreae* (Abd-Rabou 1998). In Argentina it is used against *T. vaporariorum* (López & Botto 2005).

In Mexico three females of *Eretmocerus* were reared from *T. vaporariorum* and *B. tabaci*. The author carefully measured and compared morphological features of Mexican specimens with description of *E. corni* in Rose & Zolnerowich (1997) and not found differences of females reared in Mexico from this description. Thus, *E. corni* is new record for Mexico.

3. *Eretmocerus emiratus* Zolnerowich and Rose (Fig. 3)

Eretmocerus emiratus Zolnerowich & Rose (1998): 312-314.

Described from United Arab Emirates, holotype female in USNM.

Hosts. *Bemisia argentifolii*, *B. tabaci*.

Distribution. Egypt, Ethiopia, United Arab Emirates, USA (Arizona, California, Texas); Mexico (Baja California Norte, introduced).

Diagnosis. Midlobe of mesoscutum with four setae; the club (Fig. 3) 5.3-6.6 times as long as wide, scape 4.0-6.5 times as long as wide, pedicel 2.0-2.62 times as long as wide, first funicular segment extremely short, second segment subquadrate; fore wing 2.9-3.4 times as long as maximum width, marginal fringe 0.25-0.35 X the width of disc, between marginal vein and linea calva 6-9 setae; ovipositor 0.88-1.18 times as long as club and 1.0-1.2 times as long as midtibia.

Comments. *Eretmocerus emiratus* was imported and released in the United States for biocontrol of *Bemisia (tabaci)* complex (Zolnerowich & Rose 1998). In 1998 it was introduced to Mexico, Valle de Mexicali,

¹ See in text comments to this species (*E. corni*).

against whitefly *B. argentifolii* (Cota Gómez et al. 1998).

4. *Eretmocerus eremicus* Rose and Zolnerowich (Fig. 4)

Eretmocerus eremicus Rose & Zolnerowich (1997): 10-14, Fig. 10-12, 30.

Described from USA (Arizona), holotype female in USNM.

Hosts. *Bemisia (tabaci)* complex), *T. abutiloneus* (Haldeman), *T. vaporariorum*.

Distribution. USA (Arizona, California, Massachusetts), UAE, Egypt, Spain, Italy, Morocco, Belgium, Canary Islands; Mexico (Tamaulipas², Baja California).

References. Alarcón (1993): 19-22, Arredondo-Bernal et al. (1994): 56-57, Hennessey et al. (1995): 68-69, Cota Gómez et al. (1998): 182, Myartseva & Ruíz Cancino (2000): 22, Myartseva et al. (2004): 756. In Mexican publications *E. eremicus* is recorded as *E. californicus*. Alarcón (1993) noted as host of *E. eremicus* also *Tetraleurodes acaciae* (Quaintance).

Diagnosis. Club (Fig. 4) 6.5-7.3 times as long as wide, pedicel 3-4 times as long as wide, scape 5.1 times as long as wide, first funicular segment triangular, second segment 1.1 times as long as wide; midlobe of mesoscutum with six setae; fore wing 2.7 times as long as maximum width of wing, marginal fringe 0.35 X the width of disc, between marginal vein and linea calva 6-12 setae; ovipositor equal in length to club and to midtibia.

Material examined. Mexico—Tamaulipas, Cd. Victoria, ex *B. tabaci* on *Euphorbia* sp., 1 f, 20.VII.1998, 1 f, 14.VIII.1998, 1 f, 7.XI.1998, 1 f, 28.X.1999; ex *T. vaporariorum* on grass, 2 f, 29.I.2006, 1 f, 1.III.2006; Jaumave, ex *T. vaporariorum* on *Malva* sp., 1 f, 31.III.2001 (S. Myartseva).

Comments. *Eretmocerus eremicus* was introduced into many countries for control of whiteflies *Bemisia (tabaci)* complex) on greenhouse and field crops (Hoddle & van Driesche 1999, Calvo et al. 2002). In Mexico introduced *E. eremicus* parasitized 58% of whiteflies on obelisco in Valle de Mexicali (Arredondo-Bernal & Rosas 1995).

5. *Eretmocerus evansi* Myartseva, sp. n. (Fig. 5)

Diagnosis. Females of *E. evansi* sp. n. can be distinguished by club, which 7.0-7.3 times as long as wide and 1.7-1.8 times as long as scape, midlobe of mesoscutum with six setae, ovipositor equal in length to club and 1.1 times as long as midtibia.

Eretmocerus evansi sp. n. extremely close to *E. eremicus* and *E. tejanus*, but differs from both species in following: In *E. eremicus* – scape 5.1 times as long as wide, pedicel 3-4 times as long as wide and 0.30-0.39 X the length of club, club 6.5-7.3 times as long as wide, between marginal vein and linea calva 6-12 setae, stigmal vein 1.5 times shorter than marginal vein, hind wing 6.9 times as long as wide, ovipositor in length equal to midtibia. In *E. tejanus* – scape 5.0 times as long as wide, pedicel 3.0-3.7 times as long as wide and 0.29-0.36 X the length of club, club 6.2-7.1 times as long as wide, hind wing 7.3 times as long as wide, ovipositor equal in length to midtibia. In *E. evansi* – scape 5.0-5.5 times as long as wide, pedicel 2.9-3.2 times as long as wide and 0.30-0.33 X the length of club, club usually seven times as long as wide, at most 7.3 X, between marginal vein and linea calva 11-12 setae, stigmal vein slightly shorter than marginal vein, hind wing 8.3 times as long as wide, ovipositor equal to club and longer than midtibia.

Eretmocerus evansi sp.n. is similar also to *E. exilis* and *E. corni*, but differs from both species by following: In *E. exilis* – second funicular segment subquadrate, apex of club

² New record for Tamaulipas.

sloped, club two times as long as scape, fore wing 2.5 times as long as maximum width of wing, its base with three setae, marginal fringe of hind wing shorter than maximum wing width, midtibia 2.5 times longer than basitarsus, reared from *A. floccosus*. In *E. evansi* – second funicular segment quadrate, apex of club truncate, club 1.7-1.8 times as long as scape and equal to ovipositor length, fore wing 2.9 times as long as maximum width of wing, its base with one seta, marginal fringe of hind wing longer than maximum wing width, midtibia 2.7 times longer than basitarsus, reared from *B. tabaci* and *T. vaporariorum*. In *E. corni* – scape 4.9 times as long as wide and 0.4 X the length of club, pedicel 2.4-3.1 times as long as wide and 0.25-0.29 X the length of club, rarely 0.30 X, second funicular segment subquadrate, club 2.5 times longer than scape, ovipositor equal to midtibia, reared from *Trialeurodes packardi*, which is not registered in Mexico. In *E. evansi* – scape 5.0-5.5 times as long as wide and 0.55-0.60 X the length of club, pedicel 2.9-3.2 times as long as wide and usually 0.30-0.33 X the length of club, second funicular segment quadrate, club 1.7-1.8 times longer than scape, ovipositor 1.1 times as long as midtibia, reared from *B. tabaci* and *T. vaporariorum*. *Eretmocerus evansi* sp. n. has club equal to ovipositor and longer than midtibia, like to *E. californicus*, but last species has tapered shape of club, which 5.2-6.6 times as long as wide.

Description. Length of specimens mounted in balsam of Canada - 0.67-0.83 mm.

Coloration. Head and body yellow, legs pale yellow, frontovertex orange, eyes brown, anterior margin of mesoscutum brownish, wings hyaline, submarginal vein infuscate.

Structure. Head 1.2 times as wide as height. Frontovertex width 0.4-0.5 X the head width. Hind ocelli arranged in about two diameters of an ocellus to eye margin. Eyes subequal to or slightly shorter than cheeks. Mandible 3-dentate. Antennae (Fig. 5) inserted

under the level of lower margin of eyes. Radicle 0.8-0.7 X the length of pedicel. Scape 5.0-5.5 times as long as wide and 0.55-0.60 X the length of club. Pedicel 2.9-3.2 times as long as wide and usually 0.30-0.33 times as long as club. First funicular segment triangular, second segment quadrate. Club with the apex truncate, 1.7-1.8 times longer than scape, 7.0-7.3 times as long as wide and as long as the ovipositor. Midlobe of mesoscutum with 6 setae, axilla with one seta, side lob with two setae. Propodeum with short process medially. Fore wing about 2.9 times as long as maximum wing width, its marginal fringe about 0.4 X the maximum width of wing, base with one seta. Stigmal vein slightly shorter than marginal vein. Between marginal vein and linea calva 11-12 setae. Hind wing 8.3 times as long as wide, its marginal fringe 1.2 times as long as maximum width of wing. Midtibial spur 0.4 X the length of basitarsus. Ovipositor exerted, as long as the club and 1.1 times as long as midtibia.

Male. Unknown.

Material examined. Holotype female – Mexico, Tamaulipas, Cd. Victoria, ex *T. vaporariorum* on grass, 29.I.2006 (S. Myartseva). Paratypes – one female, same data as holotype; Jaumave, ex *T. vaporariorum* on *Ruta* sp., 2 f, 31.III.2001, ex *B. tabaci* on *Euphorbia* sp., 1 f, 20.VII.1998 (S. Myartseva). Querétaro, Concá, Arroyo Seco, prop. A. Martínez, ex *B. tabaci* on *Lycopersicum esculentum* Miller – jitomate, 2 f, 13.XII.2003 (J.B. Castillo Vega).

6. *Eretmocerus joeballi* Rose and Zolnerowich (Fig. 6)

Eretmocerus joeballi Rose & Zolnerowich (1997): 17-18, Fig. 18-19.

Described from USA (California), holotype female in USNM.

Hosts. *Bemisia* (*tabaci* complex), *Tetraurodes* sp.

Distribution. USA (California); Mexico (Coahuila, Tamaulipas).

References. Myartseva et al. (2004): 756; Ruíz Cancino et al. (2005): 934.

Diagnosis. Club (Fig. 6) with apex slightly deflexed, 4.5-5.1 times as long as wide, scape 4.5 times as long as wide, pedicel 2.0-2.3 times as long as wide, equal in length to radicle, first funicular segment triangular, second segment 1.4 times as wide as long; midlobe of mesoscutum with six setae; fore wing 2.4 times as long as maximum width of wing, marginal fringe 0.3 X the width of wing, between marginal vein and linea calva 7-13 setae; ovipositor 1.5 times as long as club and 1.3 times as long as midtibia.

Material examined. Mexico—Tamaulipas, Cd. Victoria, ex *B. tabaci* on *Euphorbia* sp., 1 f, 20.VII.1998, 2 f, 29.VII.1998, 4 f, 19.X.1998. Coahuila, Saltillo, ex *Tetraleurodes* sp. on *Morus* sp., 1 f, 9.VII.2000 (S. Myartseva).

7. *Eretmocerus mundus* Mercet (Fig. 7)

Eretmocerus mundus Mercet (1931): 395.

Described from Spain, lectotype female in IEEM, Spain; designated by Zolnerowich & Rose (1998).

Hosts. *Acaudaleyrodes citri* (Priesner and Hosny), *Aleuroplatus cadabae* (Priesner and Hosny), *Aleyrodes* sp., *A. proletella* (L.), *Asterobemisia avellanae* (Signoret), *A. carpini* (Koch), *Bemisia afer* (Priesner and Hosny), *B. argentifolii*, *B. ovata* (Gouch), *B. tabaci*, *Dialeurodes kirkaldyi* (Kotinsky), *Neomaskellia bergii* (Signoret), *S. phillyreae*, *T. ricini* (Misra), *T. vaporariorum* (Noyes 2005), *Tetraleurodes* sp.

Distribution. Cosmopolitan; Mexico (Baja California Norte, introduced).

References. Hennessey et al. (1995): 70, Cota Gómez et al. (1998): 182, Myartseva & Ruíz Cancino (2000): 22, Myartseva et al. (2004): 756.

Diagnosis. Midlobe of mesoscutum with four setae; the club (Fig. 7) tapered towards apex, 6.0-7.0 times as long as wide, pedicel about 0.5 times as long as scape, first funicular segment quadrate, second segment usually at least slightly longer than wide; forewing about three times as long as wide, its marginal fringe 0.3 X the wing width; between marginal vein and linea calva 6-10 setae; midtibial spur nearly 0.33 X the length of basitarsus; ovipositor slightly longer than both club and midtibia.

Comments. *Eretmocerus mundus* was introduced successfully into many countries for control *Bemisia (tabaci)* complex and other whitefly species (Zolnerowich & Rose 1998). In 1992 *E. mundus* was introduced from Spain to Valle de Mexicali, Baja California against *B. argentifolii*; here it parasitized 44.5% of pest (Cervantes & Cota 1992).

8. *Eretmocerus staufferi* Rose and Zolnerowich (Fig. 8)

Eretmocerus staufferi Rose & Zolnerowich (1997): 20-22, Fig. 23-25, 32.

Described from Texas, USA, holotype female in USNM.

Hosts. *Bemisia (tabaci)* complex, *T. abutiloneus*, *T. vaporariorum*.

Distribution. USA (Arizona, California, Texas); Mexico (Tamaulipas).

References. Myartseva et al. (2004): 756.

Diagnosis. Mesosoma distinctly brown-orange, in contrasting to yellow head and metasoma; club (Fig. 8) extremely elongate, 8.2-9.1 times as long as wide, scape 5.7 times as long as wide, pedicel 3.3 times as long as wide; first funicular segment triangular, second segment 0.9 times as long as wide; midlobe of mesoscutum with six setae; fore wing 2.7 times as long as wide, marginal fringe 0.3 X the width of disc; between marginal vein and linea calva 8-12 setae; ovipositor 0.8 X the length of club and 0.9 X the length of midtibia.

Material examined. Mexico– Tamaulipas, Cd. Victoria, ex *B. tabaci* on *Euphorbia* sp., 3 f, 19.X.1998; ex *T. vaporariorum*, 1 f, 25.I.2006, 3 f, 20.II.2006 (S. Myartseva).

Comments. *Trialeurodes vaporariorum* is new host record for *E. staufferi*.

9. *Eretmocer* *tejanus* Rose and Zolnerowich (Fig. 9)

Eretmocer *tejanus* Rose & Zolnerowich (1997): 22-26, Fig. 26-28, 33.

Described from Texas, USA, holotype female in USNM.

Hosts. *Bemisia* (*tabaci* complex).

Distribution. USA (Texas), Martinique; Mexico (Tamaulipas).

References. Myartseva et al. (2004): 756.

Diagnosis. Club (Fig. 9) 6.2-7.1 times as long as wide, scape five times as long as wide, pedicel 3.0-3.7 times as long as wide, first funicular segment triangular, second segment subquadrate; midlobe of mesoscutum with six setae; fore wing 2.6 times as long as maximum width of wing, marginal fringe 0.28 X the width of disc; between marginal vein and linea calva 9-14 setae; ovipositor equal in length to club and midtibia.

Material examined. Mexico– Tamaulipas, Jaumave, ex *T. vaporariorum* on *Malva* sp., 4 f, 31.III.2001, 2 f, 31.IX.2001; Cd. Victoria, ex *T. vaporariorum* on grass, 1 f, 29.I.2006, 1 f, 19.II.2006 (S. Myartseva).

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LITERATURE CITED

- Abd-Rabou, S. 1998.** The efficacy of indigenous parasitoids in the biological control of *Siphoninus phillyreae* (Homoptera: Aleyrodidae) on pomegranate in Egypt. *Pan-Pacific Entomologist*, 74: 169-173.
- Alarcón, M.S. 1993.** Control biológico de mosquita blanca en Sinaloa, p. 19-22. *In*: L.A. Rodríguez del Bosque (ed.), Memoria del II Taller sobre control biológico de mosquita blanca. Centro Nacional de Referencia de Control Biológico, DGSV-SARH, México.
- Arredondo-Bernal, H.C. 1993.** Identificación de entomófagos de mosquita blanca, p. 17-31. *In*: Memoria del Taller sobre control biológico de mosquita blanca en hortalizas. Septiembre 27-28, 1993. Tapachula, Chiapas, México.
- Arredondo-Bernal, H.C., C. Días-Hernández & G. Gutiérrez-Corona. 1994.** Afelínidos parasitoides de mosquita blanca en el occidente y noroeste de México, p. 56-57. *In*: Memoria del XVII Congreso Nacional de Control Biológico. Oaxaca, Oaxaca, México.
- Arredondo-Bernal, H.C. & M.A. Mellén Rosas. 1995.** Los parasitoides en el control biológico de mosquita blanca (Homoptera: Aleyrodidae) en México, p. 3-14. *In*: Memoria del Simposio sobre Control Biológico de mosquita blanca. Centro Nacional de Control Biológico – DGSV,

- SMCB. Noviembre 9, 1995. Tapachula, Chiapas, México.
- Calvo, J., P. León, A. Jiménez, P. Stansly & A. Urbaneja. 2002.** Control Biológico de *Bemisia tabaci* (Hom.: Aleyrodidae) en cultivo de pimiento en el Campo de Cartagena mediante sueltas de *Eretmocerus mundus* y *E. eremicus* (Hym.: Aphelinidae). Terralia 30: 60-68.
- Cervantes, M. & C. Cota. 1992.** Evaluación de parasitoides específicos del género *Eretmocerus mundus* (España) e *Encarsia formosa* (E.E.U.U. y Egipto). Mexicali, B.C. Informe a Centro Nacional de Referencia de Control Biológico. 4 p.
- Coronado-Blanco, J.M., E. Ruíz Cancino & S.N. Myartseva. 2005.** Chalcidoidea (Hymenoptera) de Tamaulipas, México (excepto Encyrtidae), p. 156-160. *In*: L. Barrientos Lozano, A. Correa Sandoval, J.V. Horta Vega & J. García Jiménez (eds.), Biodiversidad Tamaulipeca, vol. 1. Instituto Tecnológico de Cd. Victoria, Tamaulipas, México.
- Cota Gómez, C., W. Roltsch & G. Simmons. 1998.** Introducción de parasitoides exóticos de la especie *Eretmocerus emiratus* (Hymenoptera: Aphelinidae) contra mosquita blanca *Bemisia argentifolii* Bellows y Perring (Homoptera: Aleyrodidae) en cultivo de algodónero y refugios en el Valle de Mexicali, B.C., p. 182-185. *In*: Memoria, XXI Congreso Nacional de Control Biológico. Noviembre 5-6, 1998. Río Bravo, Tamaulipas, México.
- Ferriere, C. 1965.** Hymenoptera Aphelinidae d'Europe et du Bassin Méditerranéen. Masson et Cie Editeurs, Paris. 205 p.
- Haldeman, S.S. 1850.** On four new species of Hemiptera of the genera *Ploiaria*, *Chermes* and *Aleurodes*, and two new Hymenoptera, parasitic in the last named genus. American Journal of Scientific Arts 9: 108-111.
- Hayat, M. 1998.** Aphelinidae of India (Hymenoptera: Chalcidoidea): a taxonomic revision. Memoirs on Entomology, Internacional, 13, 416 p.
- Hennessey, R.D., H.C. Arredondo-Bernal & L.A. Rodríguez-Del-Bosque. 1995.** Distribución geográfica y huéspedes alternos de parasitoides afelinidos de *Bemisia tabaci* (Homoptera: Aleyrodidae). Vedalia 2: 61-75.
- Hoddle, M.S. & R. van Driesche. 1999.** Evaluation of *Eretmocerus eremicus* and *Encarsia formosa* (Hymenoptera: Aphelinidae) Beltsville strain in comercial greenhouses for biological control of *Bemisia argentifolii* (Homoptera: Aleyrodidae) on colored poinsettia plants. Florida Entomologist 82: 556-569.
- Howard, L.O. 1908.** On two new species of parasites of Aleyrodidae. Proceedings of the Entomological Society of Washington, 10: 63-65.
- López S.N. & E. Botto. 2005.** Effect of cold storage on some biological parameters of *Eretmocerus corni* and *Encarsia formosa* (Hymenoptera: Aphelinidae). Biological Control 33: 123-130.
- Martell, C.G. 1973.** Primera lista de insectos entomófagos de interés agrícola en México. Fitófilo 26: 1-47.
- Mercet, R.G. 1931.** Notas sobre Aphelinidos (Hym. Chalc.), 4a nota. Eos, Revista Española de Entomología, Madrid, 7: 395.
- Myartseva, S.N., J.V. Smirnova & R. Kh. Mukhiev. 1998.** Whiteflies (Homoptera, Aleyrodoidea) and their natural enemies in Turkmenistan. Ashgabat, Institute of Zoology of Academy of Sciences of Turkmenistan, 173 p.
- Myartseva, S.N. & E. Ruíz Cancino. 2000.** Annotated checklist of the Aphelinidae (Hymenoptera: Chalcidoidea) of México. Folia Entomológica Mexicana 109: 7-33.
- Myartseva, S.N. & E. Ruíz Cancino. 2006.** Species of *Eretmocerus* Haldeman (Hymenoptera: Aphelinidae) – parasitoids

- of whiteflies *Tetraleurodes* spp. (Homoptera: Aleyrodidae) from Mexico, with description of new species. *Folia Entomológica Mexicana* (in press).
- Myartseva, S.N., E. Ruíz Cancino & J.M. Coronado Blanco. 2004.** 40. Aphelinidae (Hymenoptera), p.753-757. *In*: J. Llorente Bousquets, J.J. Morrone, O.Y. Ordóñez & I. V. Fernández (eds.), *Biodiversidad, taxonomía y biogeografía de artrópodos de México: Hacia una síntesis de su conocimiento*. Universidad Nacional Autónoma de México. México.
- Noyes, J.S. 1982.** Collecting and preserving chalcid wasps (Hymenoptera: Chalcidoidea). *Journal of Natural History* 16: 315-334.
- Noyes, J.S. 2005.** Universal Chalcidoidea Database. World Web electronic publication <<http://internt.nhm.ac.uk/jds/ml/perth/chalcidoids/>> Updated 6.X.2005.
- Risbec, J. 1951.** Les chalcidoïdes d'A.O.F. *Mem. Inst.Franc.Afrique Noire* 13: 7-409.
- Rodríguez-del-Bosque, L.A. & H.C. Arredondo-Bernal. 2005.** Bibliografía sobre control biológico en México hasta 2005 <<http://www.controlbiologico.org.mx>> Updated 27.V.2008.
- Rose, M. & G. Zolnerowich. 1997.** *Eretmocerus* Haldeman (Hymenoptera: Aphelinidae) in the United States, with descriptions of new species attacking *Bemisia* (*tabaci* complex) (Homoptera: Aleyrodidae). *Proceedings of the Entomological Society of Washington* 99: 1-27.
- Ruíz Cancino, E., J.M. Coronado Blanco & S.N. Myartseva. 2005.** Plagas de cítricos y sus enemigos naturales en el estado de Tamaulipas, México. *Entomología Mexicana* 4: 931-936.
- Zolnerowich, G. & M. Rose. 1998.** *Eretmocerus* Haldeman (Hymenoptera: Aphelinidae) imported and released in United States for control of *Bemisia* (*tabaci* complex) (Homoptera: Aleyrodidae). *Proceedings of the Entomological Society of Washington* 100: 310-323.

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