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Parasitoids of whiteflies (Hymenoptera: Aphelinidae, Eulophidae, Platygastriidae; Hemiptera: Aleyrodidae) from the Macaronesian archipelagos of the Canary Islands, Madeira and the Azores

Abstract Data on the whitefly parasitoid species known from the Macaronesian archipelagos of the Canary Islands, Madeira and the Azores are presented, based largely on recently collected material. A total of 26 species are treated, including six new species, six new records for the Canary Islands, two new records for Madeira, and two new records for the Azores. All species are fully described and illustrated. New species described are: *Encarsia atlantica* Polaszek & Hernández; *Encarsia levadicola* Polaszek & Hernández; *Encarsia melanostoma* Polaszek & Hernández; *Encarsia noahii* Polaszek & Hernández; *Euderomphale gomer* LaSalle & Hernández; *Euderomphale insularis* LaSalle & Hernández. A fully illustrated identification key based on females is provided for recognition of whitefly parasitoids in these archipelagos. Data on the known distribution and hosts are provided, as well as references to biology and use in biological control.

Key words Aleyrodidae, Aphelinidae, Azores, biological control, Canary Islands, Eulophidae, identification, Macaronesia, Madeira, natural enemies, parasitoids, Platygastriidae

Introduction

Whiteflies are a group of sap-sucking insects belonging to the family Aleyrodidae (Hemiptera). The economic importance of whiteflies is undisputed and several species are among the most serious agricultural pests (CABI, 2001). Whiteflies cause direct damage to crops and ornamentals, but a few are very serious pests due to their ability to transmit a large number of plant viruses (Markham *et al.*, 1995), currently estimated at over 100 (I.D. Bedford, pers. comm.).

Until very recently, whiteflies were an almost unknown insect group in Macaronesia. In a relatively short period several species have become major pests in these archipelagos. A number of species belonging to the largely Neotropical subfamily Aleurodicinae have become pests in both the Canary Islands and Madeira, and threaten to spread further. In particular, the so-called ‘spiralling whitefly’ *Aleurodicus dispersus* Russell, and the more recently introduced *Lecanoideus flocosimus* Martin *et al.*, have caused serious economic problems in the Canaries (Martin *et al.*, 1997). *Paraleyrodes*, another

genus of Aleurodicinae, includes the two species *P. citricolus* Costa Lima and *P. bondari* Perrachi that are pests on citrus in Madeira, introduced presumably from the Neotropics (Martin, 1996). Several cosmopolitan whitefly pests are also present throughout the Canaries, Madeira and the Azores, including *Trialeurodes vaporariorum* (Westwood), *Bemisia tabaci* (Gennadius) and *Aleurothrixus floccosus* (Maskell) (Carnero *et al.*, 1990; Aguiar & Pita, 1995; Aguiar, 1998). Solutions are being sought to these new and continuing whitefly problems. Chemical control of whiteflies has rarely proved successful, due in particular to the development of pesticide resistance. For this reason, research efforts have been focused on biological control using natural enemies, as opposed to the use of insecticides.

As a first step towards evaluating the potential for biological control of whiteflies in the Macaronesian archipelagos, extensive exploration for whitefly parasitoids has been conducted over the last 5 years (Hernández-Suárez, 1999). Results obtained during these collections are presented in this paper, which provides a preliminary revision of the whitefly parasitoid species from the archipelagos of the Azores, Madeira and the Canary Islands.

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Background

Approximately 30 genera of Hymenoptera are known to be either facultative or obligate parasitoids of whiteflies (Polaszek, 1997a). They belong to six families: Aphelinidae, Eulophidae, Pteromalidae, Signiphoridae and Encyrtidae, within the superfamily Chalcidoidea, and Platygastriidae in the superfamily Platygastroidea (Polaszek 1997a; Polaszek, unpubl. data).

In the Canary Islands, 12 whitefly parasitoid species have been recorded previously, most of them belonging to the aphelinid genus *Encarsia* Förster. These species are: *Encarsia dichroa* (Mercet) (Viggiani & Mazzone, 1980a, as *E. pseudopartenopea* Viggiani & Mazzone), *Encarsia hispida* De Santis, *Encarsia lutea* (Masi) (Beitia et al., 1996), *Encarsia inaron* (Walker) (Carnero et al., 1989 as *E. partenopea* (Masi)), *Encarsia pergandiella* Howard (Beitia et al., 1996), *Encarsia sophia* (Girault) (Booth & Polaszek, 1996, as *E. transvena* (Timberlake)), *Encarsia tricolor* Förster (Rodríguez-Rodríguez, 1979) and *Eretmocerus mundus* Mercet (Cebrián et al., 1994). Together with them, *Encarsia formosa* Gahan (Rodríguez-Rodríguez, 1979), *Cales noacki* Howard (Rodríguez-Rodríguez, 1977a,b) and *Encarsia guadeloupae* Viggiani (Nijhof et al., 2000) have been deliberately introduced into the Canaries as potential biological control agents of whiteflies. The introduction of *Eretmocerus eremicus* Rose & Zolnerowich has been proposed.

In Madeira, 10 whitefly parasitoids have been recorded. Graham (1986) described *Euderomphale cortinae* Graham (Eulophidae) from swept material. It was later reared in Madeira by the authors (see below). Booth & Polaszek (1996) recorded the Neotropical *Encarsia hispida* DeSantis from Madeira for the first time. The remaining published records are as follows: *Amitus fuscipennis* MacGown & Nebeker, *C. noacki*, *E. formosa*, *E. inaron*, *E. lutea*, *E. pergandiella*, *E. tricolor* and *Eretmocerus mundus* (Aguiar, 1999).

Encarsia formosa has been recently introduced into the Azores archipelago for biological control of the greenhouse whitefly *T. vaporariorum*, and *C. noacki* is known to play an important role in the natural control of the citrus whitefly *A. floccosus* (Soares, pers. comm.). *Encarsia estrellae* Manzari & Polaszek was recently described from the Azores as part of the present survey of Macaronesian whiteflies and their parasitoids (Manzari et al., 2002).

Our recent surveys on all three archipelagos have recorded a number of both described and undescribed species, all of which are treated in detail below.

Material, methods and abbreviations

This study is largely based on new host-reared material collected in the aforementioned archipelagos by the authors. In addition, specimens in The Natural History Museum in London, UK (BMNH), as well as material deposited in the Museo Nacional de Ciencias Naturales in Madrid, Spain (MNCN), Universidad de La Laguna, Canary Islands (ULL)

and the University of Naples, Italy (IEUN), have been studied. All species of whitefly parasitoids previously recorded are included.

Holotypes of newly described species are deposited in BMNH. Paratypes and other material examined have been deposited at the Entomology department, Instituto Canario de Investigaciones Agrarias, Tenerife, Canary Islands, Spain (ICIA) and in the Insect Collection of the Laboratório Agrícola, Madeira (ICLAM). When not mentioned in the text, specimens examined are deposited in the ICIA insect collection.

Most specimens examined in this study have been preserved as slide-mounts in Canada Balsam, following the method outlined by Noyes (1982) with amendments (Polaszek, 1997a).

Terminology (Figs 1 to 4) used in the description of *Encarsia* species follows Hayat (1989) with a very few exceptions outlined by Huang & Polaszek (1998). The length of the marginal fringe refers to its longest seta (Fig. 1, H). The radicle and anellus are not counted in the number of antennal segments. Mesoscutum refers to the mid lobe and side lobes combined. Regarding *Eretmocerus* species, terminology used follows that of Rose & Zolnerowich (1997), and terminology used in descriptions of euplid species follows LaSalle & Schaufuß (1994).

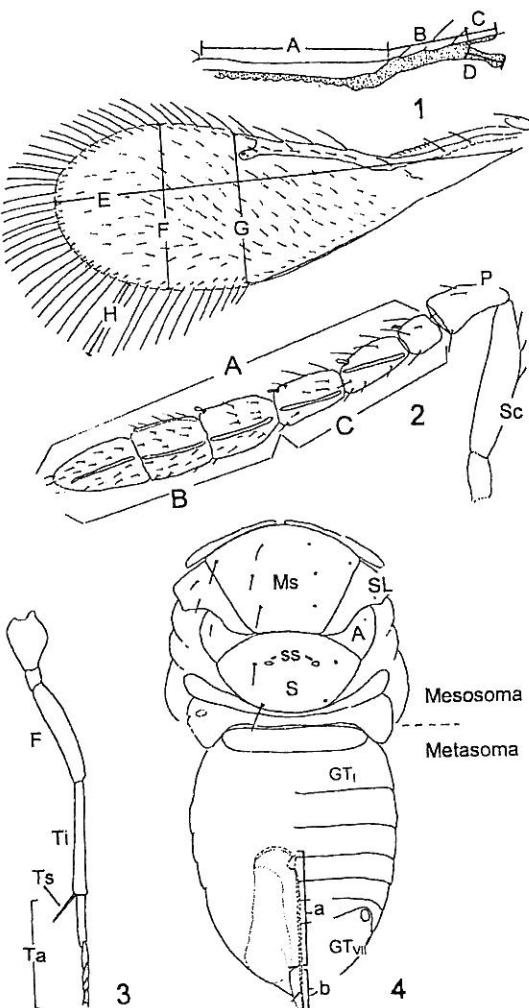
Descriptions have been kept as brief as possible. The body colour has been noted from live or card-mounted specimens. Habitus drawings for *Encarsia* species show the colour and cuticular sculpture on the right-hand side only, the setation on the left-hand side. The same scale has been followed when drawing the ovipositor and mid leg in each species.

The key provided is designed to be used for specimens mounted on microscope slides, examined with a good quality compound microscope. Males of most *Encarsia* species are extremely difficult to identify, thus the key provided has been designed to be used mainly for female specimens. For several species, isolated males (i.e. without their conspecific females) cannot be successfully identified to species with this key.

Material examined is listed in Appendix 1.

Abbreviations for institutions and collections

BMNH	The Natural History Museum, London, UK.
BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii, USA.
ICLAM	Laboratorio Agrícola da Madeira, Madeira Island, Portugal.
ICIA	Instituto Canario de Investigaciones Agrarias, Tenerife, Canary Islands, Spain.
IEUN	Istituto di Entomologia Agraria, Università degli Studi di Napoli, Portici, Italy.
MNCN	Museo Nacional de Ciencias Naturales, Madrid, Spain.
NMI	National Museum of Ireland, Dublin.
UNLP	Universidad Nacional de La Plata, Argentina.
USNM	United States National Museum of Natural History, Washington DC, USA.
ZDAMU	Zoology Department, Aligarh Muslim University, India.
ZSIC	Zoological Survey of India, Calcutta.



Figs 1-4 Morphological terminology: 1. Fore wing. A-D *Eretmocerus* sp. A. Length submarginal vein. B. Length marginal vein. C. Length postmarginal vein. D. Length stigmal vein. E-H *Encarsia* sp. E. Maximum length. F. Maximum width. G. Width at stigmal vein. H. Length of longest marginal fringe seta. 2. Female antenna (*Encarsia*). A. Length flagellum. B. Length clava. C. Length funicle. P. Pedicel. Sc. Scape. 3. Leg (*Encarsia*). F. Femur. Ti. Tibia. Ts. Tibial spur. Scape. 3. Leg (*Encarsia*). F. Femur. Ti. Tibia. Ts. Tibial spur. Scape. 4. Meso- and metasoma (*Encarsia* female) A, Ta, Tarsus. 4. Meso- and metasoma (*Encarsia* female) A, Axilla. Ms, Mesoscutum. SL, Side lobe. S, Scutellum. ss, scutellar sensilla. GT_I-GT_{VII}, Gastral tergites. a. Second valvifers. b. Third valvulae.

Abbreviations used for morphology

F₁-F₄: Funicular segments 1 to 4.

GT_I-GT_{VII}: Gastral tergites 1 to 7.

All illustrated characters are for females unless otherwise stated.

Key to the whitefly parasitoid species present in the Macaronesian archipelagos

1. Fore wing without venation (Fig. 122) *Amitus fuscipennis*
- Fore wing with venation (e.g. Figs 83, 88) 2

2. Tarsi of fore and hind legs 5-segmented. Mid tarsi 4- or 5-segmented *Encarsia* spp., 3
- Tarsi of fore, mid and hind legs 4-segmented 19
3. Mid tarsi 4-segmented 4
- Mid tarsi 5-segmented 6
4. Female with mesosoma dark brown, metasoma pale or dark 5
- Female with mesosoma and metasoma yellow *Encarsia hispida*
5. Female with scutellum dark brown; metasoma pale yellow, with 1-2 setae on each side of GT_{II} and GT_{III} *Encarsia formosa*
- Female with scutellum pale yellow; metasoma dark brown, with more than 2 setae on each side of GT_{II} and GT_{III} *Encarsia guadeloupea*
6. Fore wing with an evident asetose area around stigmal vein (e.g. Fig. 5) 7
- Fore wing without an asetose area around the stigmal vein (e.g. Fig. 9) 8
7. Fore wing (Fig. 75) narrowly rounded at its distal end, faintly infuscated proximally. Maximum marginal fringe length more than half of wing disc width *Encarsia pergandiella*
- Fore wing (Fig. 5) broadly rounded at its distal end, without infuscation. Maximum marginal fringe length less than or equal to half of wing disc width *Encarsia acaudaleyrodis*
8. Scutellar sensilla very closely placed, separated by a distance of approximately the maximum width of one sensillum or less (e.g. Figs 71, 81) 9
- Scutellar sensilla widely placed, separated by a distance of more than the maximum width of one sensillum 10
9. Mid tibial spur short, less than half the length of the corresponding basitarsus (Fig. 72). Female and male with body largely dark brown *Encarsia noahi* sp. nov.
- Mid tibial spur long, more than half the length of the corresponding basitarsus (Fig. 82). Female with body entirely yellow, male largely pale brown *Encarsia sophia*
10. Third valvula of ovipositor dark, in striking contrast to second valvifer. Male with F₁-F₃ strongly developed into a sensorial complex (Figs 22, 61) 11
- Third valvula of ovipositor pale. Male without F₁-F₃ developed into a sensorial complex 12
11. Third valvula of ovipositor less than one third total ovipositor length *Encarsia lutea*
- Third valvula of ovipositor more than one third total ovipositor length *Encarsia davidi*
12. Female with mesosoma and head dark brown to black and metasoma mostly pale yellow 13
- Female with different colour pattern, body unicolorous, either yellow or brown 15
13. Female clava 3-segmented. Male antenna with F₅-F₆ fused *Encarsia dichroa*
- Female clava 2-segmented. Male with F₅-F₆ either separated or partly fused 14
14. Cells of mid lobe of mesoscutum and scutellum with internal sculpture (Fig. 11). Stemmaticum pale. Male with F₅-F₆ partly fused *Encarsia azimi*

- Cells of mid lobe of mesoscutum and scutellum without internal sculpture. Stemmaticum dark. Male with F₅–F₆ separate *Encarsia inaron*
15. Female clava 3-segmented. Mid tibia more than 3× the length of the corresponding basitarsus 16
- Female clava 2-segmented. Mid tibia less than 3× the length of the corresponding basitarsus
..... *Encarsia estrellae*
16. Female body mostly brown. Male, when present, with mesoscutum mostly dark brown 17
- Female body mostly yellow. Male with mesoscutum mostly pale 18
17. Female scutellum dark brown
..... *Encarsia atlantica* sp. nov.
- Female scutellum pale yellow *Encarsia tricolor*
18. Third valvula of ovipositor less than 1.4× maximum length of mid tibial spur
..... *Encarsia levadicola* sp. nov.
- Third valvula of ovipositor more than 1.7× maximum length of mid tibial spur
..... *Encarsia melanostoma* sp. nov.
19. Antennal clava of both sexes elongate, composed of a single segment (e.g. Figs 89, 90, 92, 93, 95, 96, 98, 100, 101). Mesosoma yellow 20
- Antennal clava short, composed of several segments (e.g. Figs 103, 104). Mesosoma dark brown-black *Euderomphale* spp. 24
20. Female antenna 6-segmented, the funicle with 3 segments, F₃ longer than wide (Fig. 100). Male antenna 4-segmented, the flagellum 2-segmented with long setae (Fig. 101). Fore wing disc setae arranged in a few parallel rows as in Fig. 99 *Cales noacki*
- Female antenna 5-segmented, the funicle with 2 small segments, each quadrate to transverse (Figs 90, 92). Male antenna 3-segmented with one flagellar segment, the setae short (e.g. Fig. 89). Fore wing disc setae not arranged in parallel rows *Eretmocerus* spp. 21
21. Mid lobe of mesoscutum with 6 setae
..... *Eretmocerus eremicus*
- Mid lobe of mesoscutum with 4 setae 22
22. Stigmal vein of fore wing less than half the length of marginal vein. Female antenna with first and second funicule segments subequal in size, clava more than 5× as long as wide (Fig. 92) *Eretmocerus mundus*
- Stigmal vein of fore wing more than half the length of marginal vein. First funicule segment clearly shorter than second. Female clava less than 5× as long as wide 23
23. Marginal fringe of fore wing less than 0.15× the maximum width of wing disc (Fig. 94)
..... *Eretmocerus* sp. nr. *rajasthanicus*
- Marginal fringe of fore wing more than 0.15× the maximum width of wing disc (Fig. 97)
..... *Eretmocerus roseni*
24. Fore wing hyaline (Fig. 115), some slight infuscation may be present basally, but never reaching stigmal vein. F₂ in both sexes quadrate or slightly longer than wide (Figs 116, 117). Male antenna with scape very strongly broadened, 1.4× as long as wide (Fig. 117)
..... *Euderomphale insularis* sp. nov.
- Fore wing with infuscation below marginal vein, reaching to stigmal vein (Figs 102, 108). F₂ in both sexes transverse (Figs 103, 104, 109, 110). Male antenna with scape at most moderately broadened, clearly more than 1.4× as long as wide (Figs 104, 110) 25
25. Fore wing with postmarginal vein absent (Fig. 108). F₁ in both sexes transverse, closer in size to anellus (Figs 109, 110) *Euderomphale gomer* sp. nov.
- Fore wing with postmarginal vein present (though often faint; Fig. 102). F₁ in both sexes longer, almost quadrate (Figs 103, 104) *Euderomphale cortinæ*

Whitefly parasitoids in the Macaronesian archipelagos APHELINIDAE

Genus *Encarsia* Förster

Encarsia Förster, 1878:65. Type species *Encarsia tricolor* Förster, by monotypy.

Aspidiotiphagus Howard, 1894a:229. Synonymized by Viggiani & Mazzone, 1979:44.

Prospalta Howard, 1894b:6. Preoccupied by *Prospalta* Walker, 1857 (in Lepidoptera) designated by ICZN Opinion 845.

Prospaltella Ashmead, 1904:126. Replacement name for *Prospalta* Howard. Synonymized by Viggiani & Mazzone, 1979:44.

Mimatonus Cockerell, 1911:464. As synonym of *Prospaltella* by Girault, 1917:114.

Doloresia Mercet, 1912:294. Synonymized by Mercet, 1930a:191.

Prospaltoides Brèthes, 1914:12. As synonym of *Aspidiotiphagus* by Brèthes, 1916:429.

Aleurodophilus DeBach & Rose, 1981:659. Synonymized by Hayat, 1983:85.

Diagnosis

Diagnostic characters of *Encarsia* species have been provided by several authors, including Hayat (1989; 1998), Huang & Polaszek (1998) and Polaszek *et al.* (1999). The most important characters are summarized here.

Colour. Varies from entirely pale yellow to completely dark brown, the males generally darker than the females. Body colour can be used with some degree of confidence as a key character in certain species groups, but is best avoided in others. For example, it is known to vary intraspecifically in the *inaron-* and *lutea-*groups. Fore wings vary from completely hyaline to infuscate below the marginal vein.

Morphology. Head dorsum transverse, twice or more as wide as long, and with a postocellar bar behind each lateral ocellus. Mandibles usually with three teeth, or two teeth and a truncation; labial palps 1-segmented. Antenna 8-segmented excluding radicle and anellus, often 7-segmented in males; scape cylindrical or slightly flattened; funicle 2- to 4-segmented, clava 2- to 4-segmented, or not apparent.

Pronotum medially membranous. Mid lobe of mesoscutum with 0–20 setae, usually arranged in bilateral symmetry;

axillae separated mesally by a distance greater than the maximum length of an axilla, and each with a single seta. Scutellum distinctly wider than long, with 4 setae and a pair of placoid sensilla ('ss', Fig. 4); scutellum with reticulate sculpture, becoming longitudinally elongate/reticulate medially. Metanotum a narrow transverse strip; propodeum narrow in the middle, not much longer than metanotum, and expanded on sides with a spiracle and a pair of setae on each side.

Fore wings with shape and length of marginal fringe variable. Submarginal vein shorter than marginal vein, with 2 setae, rarely with 1 or more than 2. Basal area usually with fewer than 10 setae, occasionally more, and costal cell with a row of minute setae. A strong seta present at the junction of the submarginal vein and parastigma or on the parastigma. A variable number of setae on anterior margin of marginal vein. Postmarginal vein absent. Disc densely or sparsely setose. Hind wings narrow. Legs with tarsal formula 5-5-5 or 5-4-5.

Petiole transverse, remainder of metasoma consisting of seven tergites (GT_I-GT_{VII}); apex of GT_{VII} always membranous and pale; GT_I usually without setae, GT_{II-IV} with 1-5 setae on each side, GT_{V-VI} usually with 2+2 setae (occasionally more) each and GT_{VII} usually with 4 setae (occasionally 6). Ovipositor with relative lengths of the second valvifer and third valvula variable and useful as key characters; ovipositor/mid tibia ratio often useful for species recognition. Male genitalia usually with phallobase several times longer than wide, without digit; aedeagus generally longer than phallobase.

Remarks

The genus *Encarsia* contains species considered as the most effective group of whitefly (Aleyrodidae) and armoured scale insect (Diaspididae) parasitoids. Females usually develop as primary parasitoids, but males are very often hyperparasitoids of females (or males) of their own or other species (Viggiani 1984; Williams & Polaszek, 1996). Males of certain species have been recorded as hyperparasitoids of Psyllidae (Polaszek *et al.*, 1992) and males of *E. porteri* are obligate parasitoids of lepidopteran eggs (Polaszek, 1991; Polaszek *et al.*, 1995; Hunter *et al.*, 1996).

Currently, *Encarsia* contains 280 species, and 29 species groups have been recognized. Major recent contributions to *Encarsia* taxonomy have been made by: Viggiani & Mazzzone (1979), Viggiani (1985a,b, 1986, 1987a,b, 1989a,b), Hayat (1989, 1998), Yasnosh (1989), Huang & Polaszek (1998), Polaszek *et al.* (1999) and Schmidt *et al.* (2001). In particular, *Encarsia* species parasitic on whiteflies have been treated by Huldén (1986), Rivnay & Gerling (1987), Polaszek *et al.* (1992), Krishnan & David (1996), Schauff *et al.* (1996), Trjapitzin *et al.* (1996), Heraty & Polaszek (2000) and Schmidt *et al.* (2001).

Encarsia acaudaleyrodis Hayat (Figs 5-8)

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

Encarsia acaudaleyrodis Hayat; Polaszek *et al.*, 1999:135.

Diagnosis

Female

Colour. Head pale, with clypeus very distinctly darker. Antennae light brown, with pedicel and clava darker. Mesosoma largely yellow, with pronotum, anterior margin of mid lobe of mesoscutum, half of axillae and propodeum brown. Metasoma largely pale, with petiole and GT_I darker. Fore wings hyaline. Legs pale.

Morphology. Antennal formula 1-1-4-2. Scape 1.7× as long as pedicel. F₁ slightly longer than wide, 0.6× as long as pedicel. F₂ intermediate in size between F₁ and F₃; F₃ and F₄ subequal in length. Clava 0.7× as long as funicle. Flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:0, F₃:1-2, F₄:2, F₅:3, F₆:2-3 (Fig. 8).

Mid lobe of mesoscutum with 2+2 setae. Distance between placoid sensilla on scutellum 5× the maximum width of one sensillum; distance between anterior pair of scutellar setae a little greater than that between posterior pair (Fig. 6). Fore wing 3.5× as long as wide, with the wing apex rounded (Fig. 5); marginal fringe 0.4-0.6× disc width. A distinct asetose area present below the stigmal vein, 2 setae on submarginal vein, 5-7 setae on anterior margin of marginal vein, 2-3 setae in basal area, 5 setae in costal cell. Tarsal formula 5-5-5. Mid basitarsus 0.4× as long as corresponding tibia; mid tibial spur 0.3× as long as corresponding basitarsus (Fig. 7).

GT_{I-VII} with 0+0, 1+1, 1+1, 1+1, 2+2, 1+1 and 4 setae, respectively. Ovipositor 1.0-1.25× as long as mid tibia; third valvula 0.35× ovipositor length, with 3-4 pairs of short apical setae and one pair of medial setae.

Male

In general much darker than the female. Head and mesosoma largely yellow with pronotum, mid lobe of mesoscutum, axillae and propodeum brown. Metasoma dark brown. Morphology similar to that of female except for genitalia characters and the following: Antennae with F₅ and F₆ partially fused.

Species-group placement: *E. parvella*-group. However, *E. acaudaleyrodis* is very closely related to, and possibly conspecific with, *E. mineoi* Viggiani. Recent molecular studies (Babcock *et al.*, 2001) have placed *E. mineoi* (and by inference *E. acaudaleyrodis*) distant from the *parvella*-group.

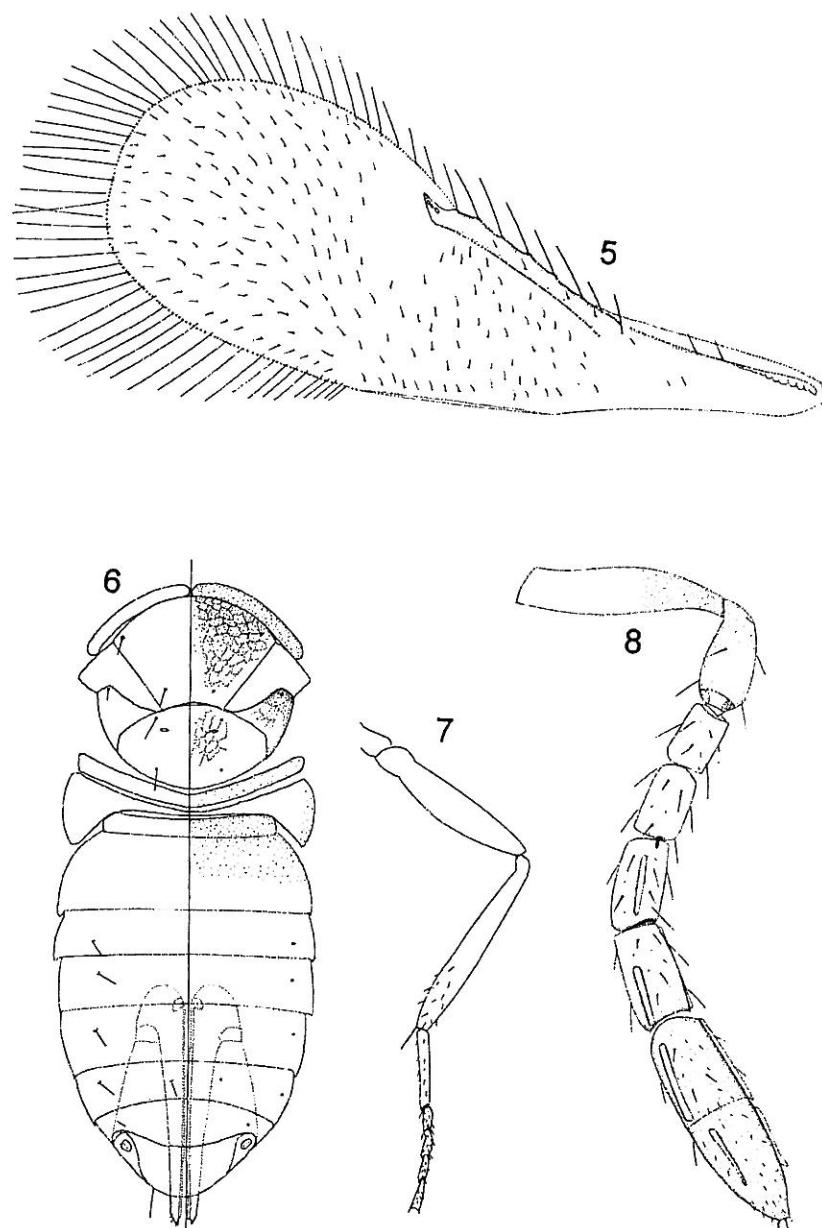
Hosts in Macaronesia: *Acaudaleyrodes rachipora* (Singh) (= *A. citri*), *Bemisia tabaci*-complex.

Other recorded hosts: *Tetraleurodes leguminicola* Bink-Moenen (Polaszek *et al.*, 1999).

Distribution: CANARY ISLANDS (new records): Lanzarote, Fuerteventura, Gran Canaria, La Palma.

Distribution outside Macaronesia: Palaearctic: Egypt. Oriental: India (Polaszek *et al.*, 1999).

Remarks: As mentioned by Polaszek *et al.* (1999), *E. acaudaleyrodis* is very close to *Encarsia mineoi* Viggiani, and differences between both species are very slight. Specimens collected in the Macaronesian archipelagos have been identified as *E. acaudaleyrodis* based on their antennal configuration (in particular the presence of a short funicle), the body colour (presence of dark axillae) and the ovipositor length, which is longer than 1.2× mid tibia.



Figs 5–8 *Encarsia acaudaleyrodes* Hayat: 5. Wing. 6. Meso- and metasoma. 7. Mid leg. 8. Female antenna.

***Encarsia atlantica* Polaszek & Hernández sp. nov.
(Figs 9–12)**

HOLOTYPE ♀: CANARY ISLANDS: Tenerife, Baranco de Badajoz, 1.v.98 (E. Hernández) ex *Aleyrodes* sp. on *Bencomia caudata* (BMNH).

Description

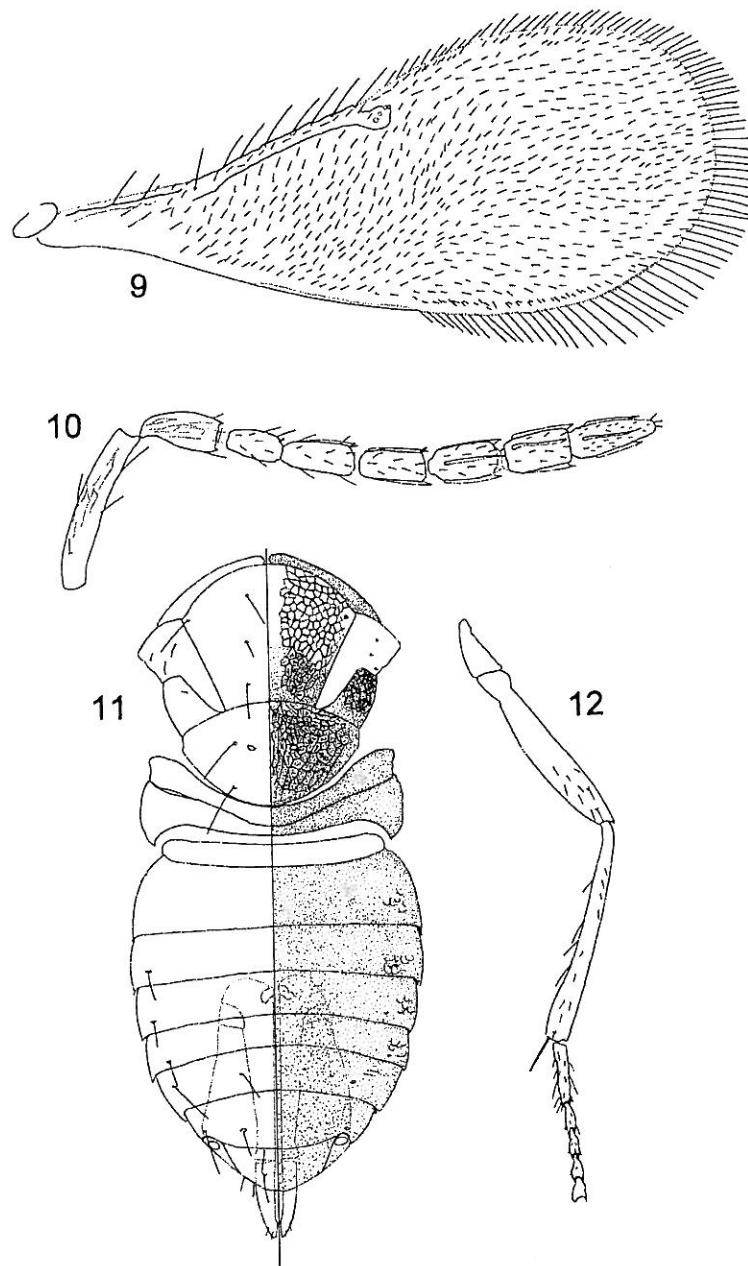
Female

Colour. Head dark brown, with clypeus and malar sulcus black. Stemmaticum yellow. Mesosoma yellow with pronotum, posterior margin of mid lobe of mesoscutum, axillae and scutellum dark brown. Propodeum and metasoma dark

brown. Legs yellow, with brown infuscation on femora. Wings with dark infuscation below marginal vein.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-3-3. Scape 2× as long as pedicel; F₁ 1.9× as long as wide, shorter than pedicel and F₂; F₂, F₃, F₄ and F₅ equal in length. Flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:0–1, F₃:3, F₄:3, F₅:3, F₆:3 (Fig. 10).

Mid lobe of mesoscutum with 4–5 pairs of large setae, from anterior to posterior margin: 2+2, 0–1+0–1, 1+1, 1+1; each axilla with one short seta. Mid lobe of mesoscutum, axillae and scutellum with polygonal/reticulate sculpture, each cell with sculpture centrally. Distance between scutellar sensilla



Figs 9–12 *Encarsia atlantica* Polaszek & Hernández sp. n.: 9. Wing. 10. Female antenna 11. Meso- and metasoma. 12. Mid leg.

5.6× the width of one sensillum; distance between anterior pair of scutellar setae slightly longer than that between posterior pair (Fig. 11). Fore wing (Fig. 9) 2.5× as long as width; marginal fringe short. No setose area distally from the stigmal vein, discal setae uniformly distributed; 7–8 setae in basal area, 2 setae on submarginal vein, 7 long setae on the anterior margin of marginal vein. Tarsal formula 5-5-5. Middle leg tibial spur 0.6× length of corresponding basitarsus; middle leg basitarsus 0.3× as long as corresponding tibia (Fig. 12).

Gastral dorsum with rugose lateral margins on GT_{I–IV}; GT_{V–VII} with 0+0, 1+1, 1+1, 1+1, 3+3, 2+2 and 4 setae, respectively. Ovipositor slightly longer (1.2×) than mid tibia; third valvula 0.4× as long as second valvifer; ovipositor

with one pair of medial setae and 4–5 pairs of short apical setae.

Male

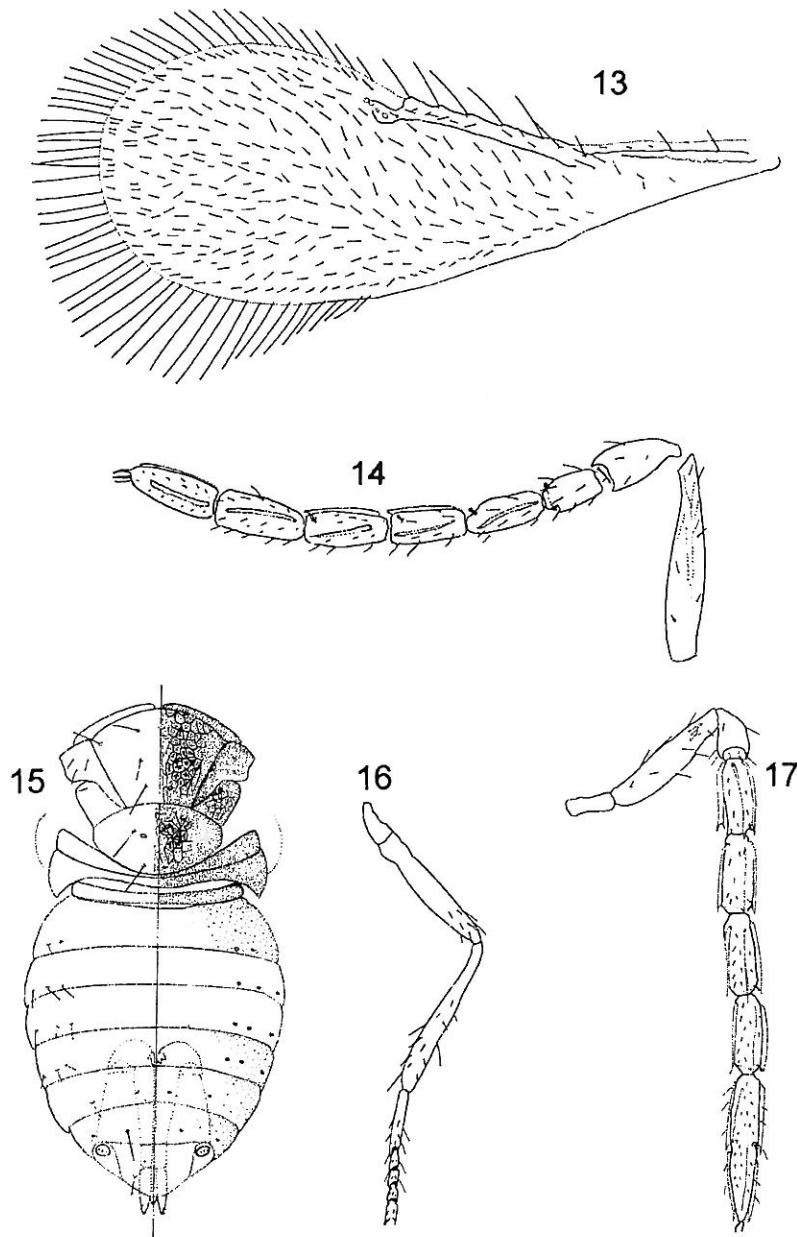
Unknown.

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

Hosts in Macaronesia: Undescribed *Aleyrodes* sp. on *Bencomia caudata* (specimens examined by the first author and Dr J. Martin, The Natural History Museum, London).

Distribution: CANARY ISLANDS: Tenerife.

Remarks: *E. atlantica* is most closely related to *E. melanostoma* and *E. levadicola*, all apparently endemic species here described from the Canary Islands and Madeira,



Figs 13–17 *Encarsia azimi* Hayat: 13. Wing. 14. Female antenna. 15. Meso- and metasoma. 16. Mid leg. 17. Male antenna.

respectively. *Encarsia atlantica* differs in having the scutellum dark brown, cells of mesoscutum centrally sculptured, longer third valvulae, and dark infuscation below the marginal vein. The other two species have the scutellum pale, central sculpture absent from the mesoscutal cells, shorter third valvulae and hyaline wings. *Encarsia atlantica* is here placed in the *Encarsia inaron* species group, which has been characterized as follows: 2-segmented clava, mid tibial spur less than half the length of corresponding basitarsus, ovipositor shorter than mid tibia and basitarsus combined. *Encarsia atlantica* has a 3-segmented clava and the mid tibial spur is slightly longer than half the length of the corresponding basitarsus. However, recent studies have shown that the latter character is not consistent within the *E. inaron* group and *E. dichroa*, with

a 3-segmented clava, was also found to be a member of this group (Manzari *et al.*, 2002). A revision of the *Encarsia inaron* group, including *E. atlantica*, is currently in preparation (S. Manzari & A. Polaszek).

Encarsia azimi Hayat (Figs 13–17)

Trichaporus indicus Azim & Shafee, 1980:335. HOLOTYPE ♀: INDIA, Tamil Nadu, Ootacamund, 24.vi.1968 (S.A. Shafee) ex Aleyrodidae on *Nerium* (ZDAMU, examined).

Encarsia azimi Hayat, 1986:160. Replacement name for *Trichaporus indicus* Azim & Shafee. Preoccupied by *Prospaltella indica* Shafee, 1973:255.

Encarsia adrianae Lopez-Avila, 1987:425. Synonymized by Hayat, 1998:202.

Encarsia adrianae Lopez-Avila; Polaszek *et al.*, 1992:381; Booth & Polaszek, 1996:72.

Encarsia azimi Hayat; Hayat, 1989:62–64; Hayat, 1998:202–203; Huang & Polaszek, 1998:1845–1847; Schmidt *et al.*, 2001:376.

Diagnosis

Female

Colour. Head, mesosoma and petiole brown to dark brown. Head with stemmaticum yellow. Metasoma pale (yellow/white) except GT₁ narrowly across base and sides dark brown. Third valvulae pale. Antennae yellow, with pedicel and clava slightly darkened. Fore wings hyaline with slight infuscation below marginal vein. Legs yellow with fore and hind coxae brown basally.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-4-2. Pedicel 0.37× as long as scape, longer than F₁ and equal in length to F₂; F₁ 1.67× as long as wide, shorter than F₂; F₂, F₃, F₄ and F₅ all approximately equal in length, F₆ longer (Fig. 14). Flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:1–2, F₃:2–3, F₄:2–3, F₅:3, F₆:3; flagellar segments with 2–3 pit sensilla distally, F₆ with the sensillum pre-apical.

Mid lobe of mesoscutum with four pairs of setae, from anterior to posterior margin: 2+2, 1+1, 1+1. Each axilla with one short seta. Placoid sensilla on scutellum rather widely separated, 9× the maximum width of one sensillum; distance between anterior pair of scutellar setae 1.5× that between posterior pair. Mid lobe of mesoscutum, scutellum and axillae with distinct reticulate sculpture, also with slight sculpture within cells. Fore wing (Fig. 13) 2.6× as long as wide; marginal fringe 0.30× disc width. Fore wing disc uniformly setose, 2 setae on submarginal vein, 5–6 setae on anterior margin of marginal vein, 2 parastigmal setae, 1–3 setae on basal area, 8–10 setae on costal area. Tarsal formula 5-5-5. Mid basitarsus 0.39× as long as corresponding tibia. Mid tibial spur 0.31–0.38× as long as corresponding basitarsus (Fig. 15).

Metasoma with GT_{I–VII} (unusually) with 2+2, 3+3, 3+3, 3+3, 2+2, 2+2 and 4 setae respectively (see 'Remarks' below). Ovipositor shorter than middle tibia and basitarsus combined. Third valvula 0.3–0.48× as long as second valvifer.

Male

Not recorded previously from Macaronesia. Described by Lopez-Avila (1987) as: mostly brown, with darker axillae and side lobes of mesoscutum paler. Fore wings hyaline. Morphology as for female except genitalia and the following characters: Antennae (Fig. 17) 7-segmented with F₅ and F₆ fused.

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

Hosts in Macaronesia: *B. tabaci* complex, *T. vaporariorum*.

Other recorded Aleyrodidae hosts: *Aleurolobus rhododendri* Takahashi, *Dialeurodes fici* Quaintance & Baker, *Dialeurodes piperis* Takahashi, *Lipaleurodes* sp., *Odontaleurodes rhododendri* (Takahashi), *Parabemisia myricae* (Kuwana), *Rachipora fici* (Takahashi) (recorded as *Dialeurodes citri*).

Distribution: CANARY ISLANDS (new records): Lanzarote, El Hierro.

Distribution outside Macaronesia: Palaearctic: Italy, Japan, Pakistan, Spain. Oriental: China, India, Australia.

Remarks: Placed previously in the *coryli* species group by Lopez-Avila (1987), *E. azimi* belongs to a section of the *inaron* species group that contains *Encarsia accentra* Schmidt & Naumann, *E. adusta* Schmidt & Naumann, *E. aethiopica* Viggiani, *E. coryli* Viggiani, *E. margaritiventris* (Mercet), and *E. reticulata* Rivnay. These species are characterized by having a dark mesosoma contrasting with a pale metasoma, tarsal formula 5-5-5, antennal formula 1-1-4-2, and male with F₅ and F₆ at least partially fused. The setation of the metasoma is unusual in *E. azimi* (though unfortunately is indistinct in the holotype) with setae present on GT₁. This character, or suite of characters, merits further study in this subgroup.

E. azimi is a biparental species with hyperparasitic males developing on conspecific females and other *Encarsia* species such as *E. formosa* (Lopez-Avila, 1987). Life history and detailed morphological studies on adults and developmental stages of *E. azimi* (as *E. adrianae*) were given by Lopez-Avila (1988).

Encarsia davidi Viggiani & Mazzone (Figs 18–22)

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

Encarsia davidi Viggiani & Mazzone, 1980b:55. HOLOTYPE ♀: ISRAEL, Nazareth, 10.iv.1975 ex *Acaudaleyrodes citri* on *Ceratonia siliqua* (IEUN, examined).

Encarsia davidi Viggiani & Mazzone; Rivnay & Gerling, 1987:464; Polaszek *et al.*, 1999:143.

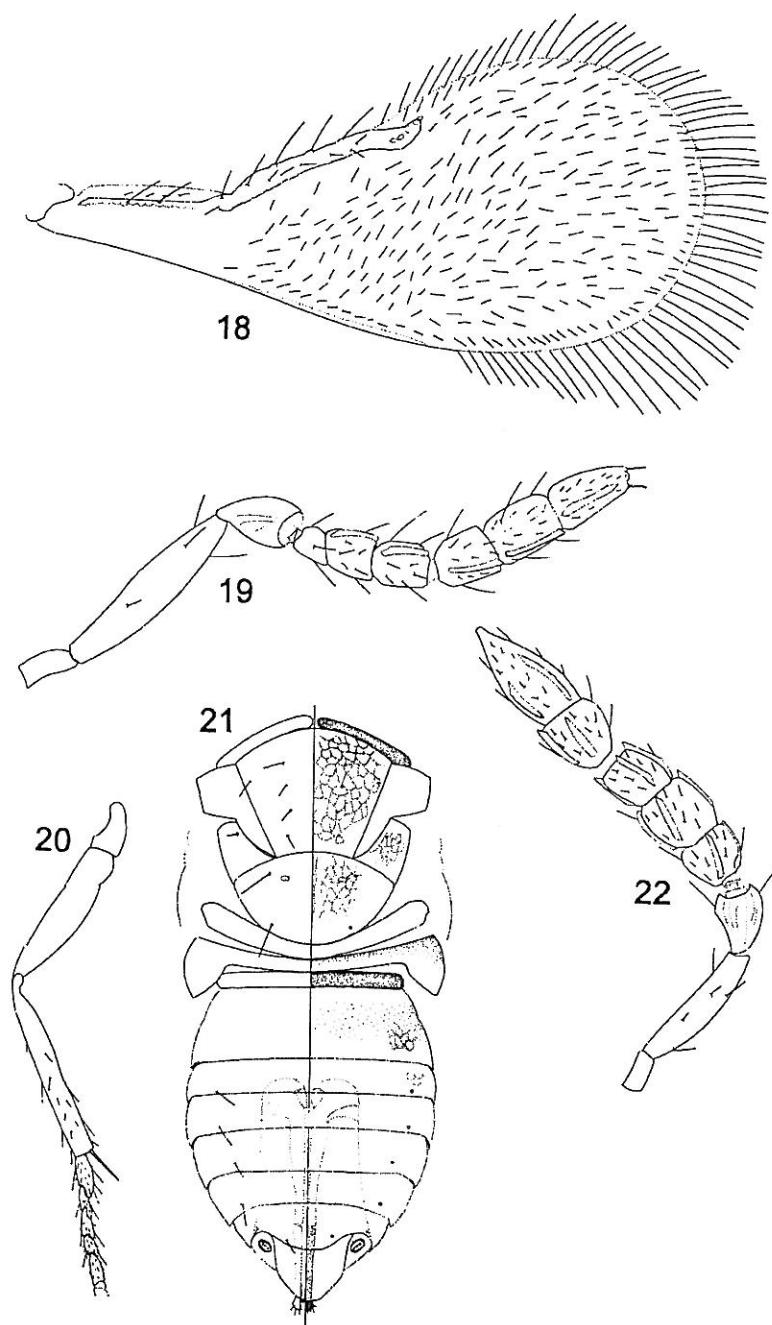
Diagnosis

Female

Colour. Head orange-yellow except a small dark spot next to each ocellus. Antennae dark from pedicel to F₆. Mesosoma largely yellow with pronotum and propodeum brown. Metasoma largely yellow with petiole and anterior part of GT₁ dark. Third valvulae conspicuously dark. Fore wings hyaline. Legs yellow.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-3-3. Pedicel 0.4× as long as scape and twice as long as F₁; F₁ quadrate, shorter and narrower than F₂ and F₃, which are subequal; Funicle 0.64× as long as clava; clava 0.36× maximum width. Flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:2–3, F₃:2–3, F₄:3, F₅:3, F₆:3 (Fig. 19).

Mid lobe of mesoscutum with four pairs of setae, from anterior to posterior margin: 2+2, 1+1, 1+1, occasionally an additional seta or pair of setae present. Placoid sensilla on scutellum rather widely separated, distance between placoid sensilla 7× the maximum width of one sensillum; distance between anterior pair of scutellar setae a little greater than that between posterior pair (Fig. 21). Fore wing length 2.3× as long as maximum width of wing; wing disc uniformly setose, with marginal fringe 0.25–0.27× disc width. Two setae on submarginal vein, 0–1 basal area setae, 5–6 setae in costal area, 2 parastigmal setae (Fig. 18). Tarsal formula 5-5-5. Mid



Figs 18–22 *Encarsia davidi* Viggiani: 18. Wing. 19. Female antenna. 20. Mid leg. 21. Meso- and metasoma. 22. Male antenna.

basitarsus 0.23× as long as corresponding tibia. Mid tibial spur as long as corresponding basitarsus (Fig. 20).

Petiole without distinct sculpture, GT_{I–II} with some reticulate sculpture laterally. GT_{II–VII} with 1+1, 1+1, 1+1, 2–3+2–3, 2–3+2–3 and 4 setae, respectively. Ovipositor 1.2× as long as middle tibia, shorter than middle tibia and basitarsus combined; third valvulae 0.35–0.40× as long as ovipositor.

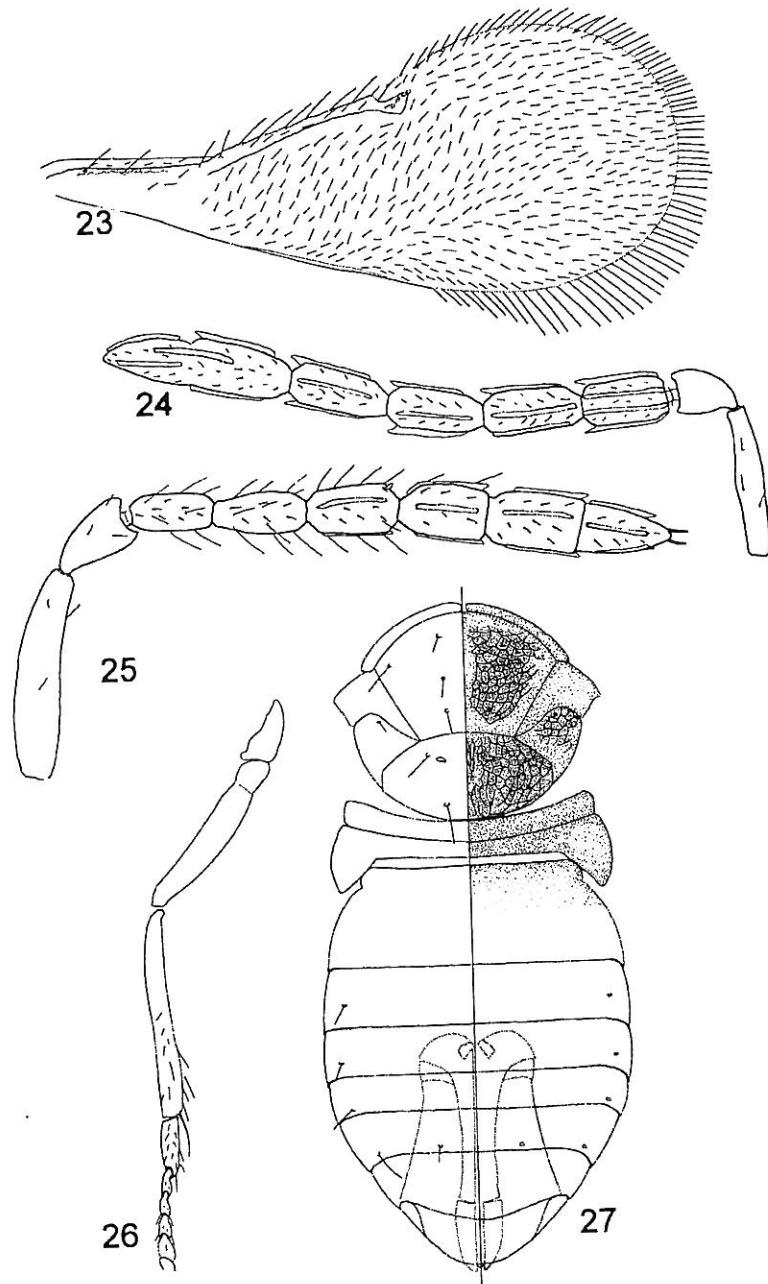
Male

Colour darker than female. Head yellow. Mesosoma pale, with pronotum, anterior margin of the mid lobe of mesoscu-

tum, axillae and propodeum brown. Metasoma dark brown. Legs pale. Fore wings hyaline. Morphology typical of the *E. lutea*-group, with F_{1–F₃} forming an enlarged, specialized sensory/glandular complex, F₅ and F₆ fused (Fig. 22). Metasoma with two pairs of setae present on ventral surface of GT_{I–V}.

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

Hosts in Macaronesia: *Acaudaleyrodes rachipora*; *Bemisia* sp. (*afer*-group); probably an undescribed species, on *Euphorbia* spp. Material has been examined by the first author and Dr J. Martin (The Natural History Museum, London).



Figs 23–27 *Encarsia dichroa* (Mercet): 23. Wing. 24. Male antenna. 25. Female antenna 26. Mid leg. 27. Meso- and metasoma.

Other recorded hosts: *Aleurolobus niloticus* Priesner & Hosny, *B. tabaci*, *S. phillyrae*, *T. leguminicola*.

Distribution: CANARY ISLANDS (new records): Lanzarote, Tenerife, La Gomera, La Palma.

Distribution outside Macaronesia: Egypt, Israel, South Africa.

Remarks: *E. davidi* is very close to *E. abatei* Viggiani (1982) and these species are difficult or impossible to distinguish. Polaszek *et al.* (1999) have suggested *E. abatei* may be synonymized and the necessity of revision of the *Encarsia lutea* species group, which is currently in preparation (P. Pedata & A. Polaszek, in prep.).

Encarsia dichroa (Mercet) (Figs 23–27)

Prospaltella brunnea Howard: Mercet, 1921:305. Misidentification.

Prospaltella dichroa Mercet, 1930b:76. LECTOTYPE ♀ (here designated): SPAIN, Madrid, unknown host on *Pinus halepensis* (MNCN, examined).

Encarsia dichroa (Mercet); Ferrière, 1965:139.

Encarsia pseudopartenopea Viggiani & Mazzone, 1980a:9. Synonymized by Viggiani, 1987a:139–140.

Diagnosis

Female

Colour. Head and mesosoma largely dark brown; metasoma yellow-white, sometimes with lateral brown infuscation on GT_{V–VII}. Antennae and legs pale. Hind coxae with anterior margin brown. Fore wings hyaline.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-3-3. Scape 2.6–2.8× as long as the pedicel. F₁ slightly shorter than F₂, F₂ and F₃ subequal and slightly longer than F₄. Clava as long as funicle. Flagellum with the following numbers of longitudinal sensilla: F₁:0–1, F₂:2, F₃:2–3, F₄:2–3, F₅:2–3, F₆:3. 2–3 pit sensilla on all flagellar segments (Fig. 25).

Mid lobe of mesoscutum with four pairs of setae, from anterior to posterior margin: 2+2, 1+1, 1+1. Distance between posterior scutellar setae 0.7× the distance between the anterior pair; distance between placoid sensilla on scutellum 6× the maximum width of one sensillum. Fore wing as in Fig. 23, 2.3× as long as maximum wing width. Wing disc uniformly setose. Two setae on submarginal vein, basal area with 3–4 setae, costal area with 6 setae; 5–6 setae on anterior margin of marginal vein and one parastigmal seta. Marginal fringe short, 0.2× disc width. Tarsal formula 5-5-5. Basitarsus of middle leg 0.28× as long as corresponding tibia. Mid tibial spur 0.4–0.6× as long as corresponding basitarsus.

Dorsum of metasoma with imbricate sculpture on GT_{I–IV}. GT_{I–VII} with 0+0, 1+1, 1+1, 1+1, 2+2, 1–2+1–2, 4 setae, respectively. Third valvulae 0.35× as long as ovipositor, with one pair of medial setae and 3–4 pairs of short apical setae.

Male

Body largely dark brown. Morphology similar to that of female except genitalia and the following characters: Antennae 7-segmented with F₅ and F₆ fused (Fig. 24); scape 2.6× as long as pedicel; pedicel half the length of F₁; F₁ slightly shorter than following segments which are subequal. Each flagellar segment with 5–6 longitudinal sensilla, F₅ and F₆ with 3–4 longitudinal sensilla.

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

Hosts in Macaronesia: *Siphoninus phillyreae* (Haliday), *Aleyrodes singularis* Danzig.

Distribution: CANARY ISLANDS: Lanzarote (new record), Fuerteventura (new record), Tenerife, La Palma (new record).

Distribution outside Macaronesia: Palaearctic: Italy, Morocco, Spain.

Remarks: Mercet (1921) recorded *E. brunnea* (Howard) from Spain (as *Prospaltella brunnea* Howard) referring to material collected in Madrid on *Pinus halepensis*. In 1930, Mercet, based on the same material assigned to *P. brunnea*, described the new species, *E. dichroa* (as *Prospaltella dichroa*). We have examined three female specimens on two slides in the collection of the Madrid Museum (MNCN) labelled in Mercet's handwriting '*Prospaltella dichroa* Mercet s/ *Pinus halepensis* Madrid 29.8.917'. These were originally misidentified as *brunnea* Howard (Mercet, 1921) and later described as the new species *dichroa* (Mercet, 1930b), although no specific mention is made of any type material. For that reason, and in interests of

nomenclatural stability, we are hereby designating the single specimen as the lectotype which has been clearly labelled as such. The remaining two specimens, together under a single coverslip are therefore paralectotypes.

Ferrière (1965) described the males of this species based on specimens collected from Morocco. In the Canary Islands, Viggiani & Mazzone (1980a) first recorded *E. dichroa* from Tenerife in their description of *E. pseudopartenopea*. *Encarsia dichroa* has been reared mainly from the ash whitefly, *S. phillyreae*. The morphology of the preimaginal stages, larval development and oviposition behaviour of *E. dichroa* are described and illustrated by Laudonia (1988). These studies showed that *E. dichroa* males develop as hyperparasitoids on larvae, prepupae and pupae of conspecific females, but also on other *Encarsia* species, such as *E. inaron*.

Encarsia estrellae Manzari and Polaszek (Figs 28–31)

Encarsia estrellae Manzari & Polaszek in Manzari et al., 2002:165–175. HOLOTYPE ♀: Azores, São Miguel, Lagoa Canarios, 715m, 27.ix.1998, (E. Hernández & A. Polaszek), ex *Aleyrodes singularis* on *Lysimachia nemorum* (BMNH, examined).

Diagnosis

Female

Colour. Head dark yellow; occiput and areas behind postocellar bar brown; clypeus, malar space brown to dark brown. Mesosoma brown, but pronotum, axillae and propodeum dark brown; middle of scutellum dark yellow to brown. Petiole brown, lateral parts dark brown. Metasoma brown to dark brown. Third valvula yellow to dark yellow. Antenna dark yellow except scape, pedicel, anterior half of F₅, F₆ brown. Fore wings (Fig. 28) hyaline, faintly infuscated below marginal vein. Legs yellow except basitarsus brown.

Morphology. Antennal formula (Fig. 31) 1-1-4-2. Pedicel shorter than F₁–F₆ individually. Flagellum with the following numbers of longitudinal sensilla: F₁:2, F₂:3, F₃:3, F₄:4, F₅:4, F₆:3.

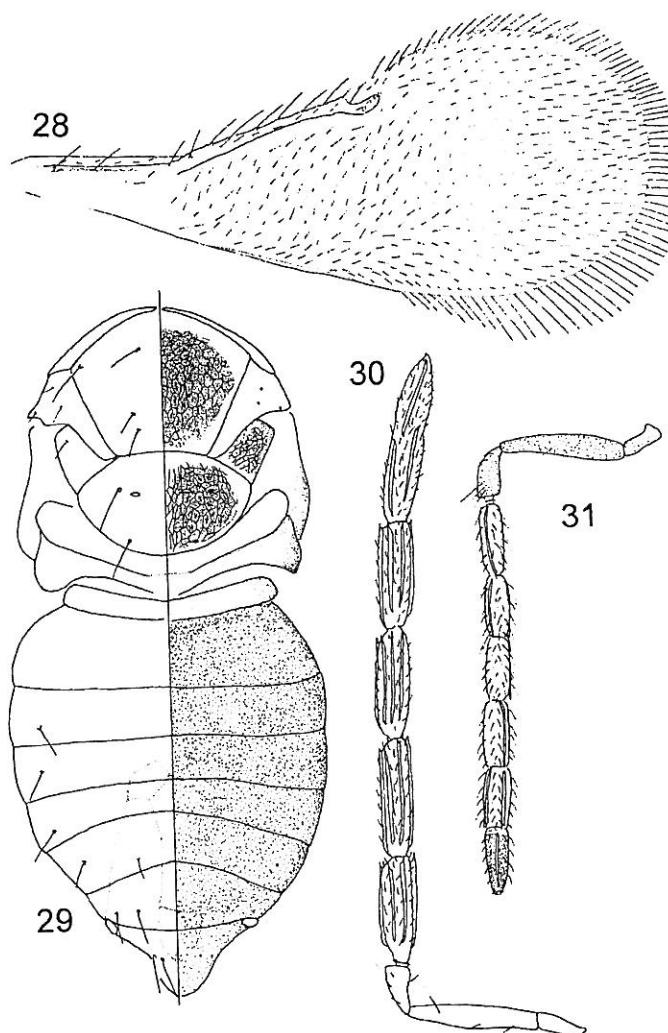
Mid lobe of mesoscutum, axillae and scutellum with distinctly reticulate sculpture, longitudinal on the central scutellum (Fig. 29). Mid lobe of mesoscutum with 4+2+2 setae. Placoid sensilla on scutellum relatively widely separated, distance between anterior pair of scutellar setae greater than that between posterior pair. Fore wing (Fig. 28) 2.4 times as long as wide. Marginal fringe of fore wing short. Tarsal formula 5-5-5.

T₁–T₇ with 0+0, 1+1, 1+1, 1+1, 4, 4 and 5 setae, respectively. Ovipositor shorter than mid tibia and basitarsus combined (41:66), third valvula 0.36 times as long as second valvifer (11:30).

Male

Colour. Similar to female.

Morphology. Structural details essentially as for female, except ovipositor, and antenna with abundant longitudinal



Figs 28–31 *Encarsia estrellaiae* Manzari & Polaszek; 28. Wing. 29. Meso- and metasoma. 30. Male antenna. 31. Female antenna.

sensilla on all flagellomeres. Two claval segments partially fused (Fig. 30). Male genitalia approximately as long as hind tibia.

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

Hosts in Macaronesia: *Aleyrodes singularis* Danzig, *A.?singularis*, *Bemisia* sp. *afer*-group.

Distribution: AZORES: Pico, São Miguel.

Diagnosis

Female

Colour. Head, mesosoma and petiole brown to dark brown, occasionally mid lobe of mesoscutum with black spots. Metasoma yellow except, narrowly, anterior margin of GT₁ brown. Third valvulae pale. Antennae yellow to dusky. Fore wings hyaline. Legs yellow except fore and hind coxae basally brown.

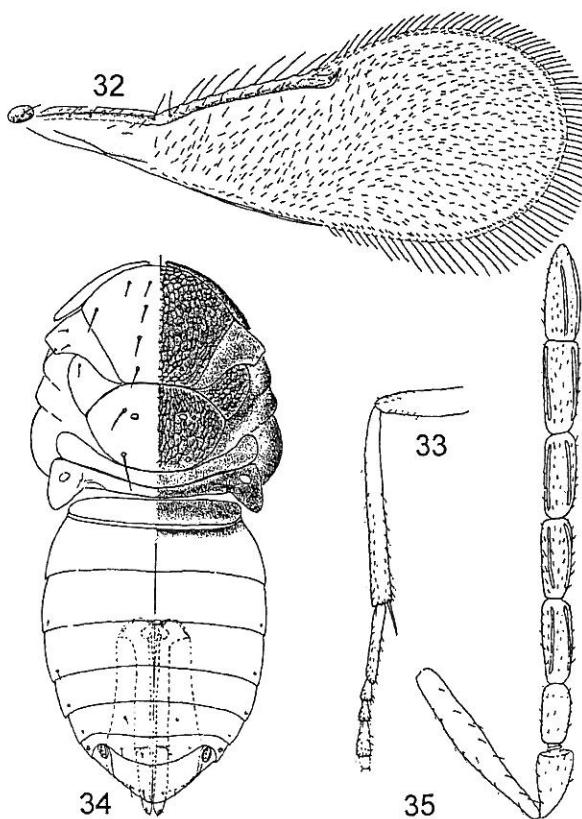
Morphology. Stemmaticum with striae sculpture. Antennal formula 1-1-4-2. Scape 3.4× as long as pedicel; pedicel longer than F₁; F₁ 1.60–1.70× as long as wide, shorter than F₂ and F₃; F₄ slightly longer (Fig. 35). Flagellum with the following numbers of longitudinal sensilla: F₁:0–2, F₂:2, F₃:2, F₄:3, F₅:3, F₆:2. 2–3 pit sensilla in all flagellar segments.

Mid lobe of mesoscutum with 6 pairs of setae. Placoid sensilla on scutellum widely separated, 5.5× as long as the width of one sensillum; distance between anterior pair of scutellar setae approximately equal to that between posterior pair. Fore wing (Fig. 32) 2.37–2.5× as long as maximum disc width; marginal fringe 0.28–0.3× disc width. Two setae on

Encarsia formosa Gahan (Figs 32–35)

Encarsia formosa Gahan, 1924:14. SYNTYPE ♀: USA, Idaho, Twin Falls, 9.v.1920 (R.H. Smith) ex Aleyrodidae on *Geranium* sp. (USNM, examined).

Encarsia formosa Gahan; Ferrière, 1965:137; Nikolskaya & Yasnosh, 1966:266; Viggiani & Mazzone, 1979:45; Huldén, 1986:18; Rivnay & Gerling, 1987:465; Viggiani, 1987a:144–145; Polaszek *et al.*, 1992:382; Schaufler *et al.*, 1996:19; Huang & Polaszek, 1998:1881; Polaszek *et al.*, 1999:146; Schmidt *et al.*, 2001:377.



Figs 32–35 *Encarsia formosa* Gahan: 33. Mid leg. 34. Meso- and metasoma. 35. Female antenna.

submarginal vein, 6–7 setae on anterior margin of marginal vein, 3–4 basal area setae, 5–6 setae in costal area. Tarsal formula 5-4-5. Basitarsus of middle leg 0.37× as long as corresponding tibia (Fig. 33). Mid tibial spur 0.4× as long as corresponding basitarsus.

GT_{II-VII} with 1+1, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor third valvula 0.60× as long as second valvifer.

Male

In Macaronesia, known so far only from Madeira.

Head brown, with ocellar area, clypeus, and malar space dark brown. Mesosoma, petiole and metasoma brown to dark brown. Antenna 8-segmented, each segment of flagellum with 5–6 longitudinal sensilla. Male genitalia as long as mid tibia.

Species-group placement: *E. luteola*-group (Gahan, 1924). *E. formosa* is closely related to *E. luteola* (Howard) and has been confused with it. Differences between the two species, both morphological and molecular, are summarized by Babcock & Heraty (2001).

Hosts in Macaronesia: *Aleyrodes proletella* (L.), *A. singularis*, *B. tabaci* complex, *T. vaporariorum*.

Other recorded hosts: *Aleuroglandulus malangae* Russell, *Aleurotrachelus trachoides* (Back), *Aleyrodes lonicerae* Walker, *Aleyrodes spiraeoides* Quaintance, *Dialeurodes chittendeni* Laing, *Dialeurodes citri* (Ashmead), *Tetraleurodes mori* (Quaintance), *Trialeurodes abutiloneus* (Haldeman), *Trialeurodes ricini*, *T. variabilis* (Quaintance).

Distribution: CANARY ISLANDS: Lanzarote (new record), Fuerteventura (new record), Gran Canaria, Tenerife, La Gomera (new record). MADEIRA. AZORES: São Miguel.

Distribution outside Macaronesia: Cosmopolitan.

Remarks: *E. formosa* is perhaps the best known of all parasitoids because of its widespread application in glasshouses for the control of the greenhouse whitefly *T. vaporariorum*. It has been introduced into the Canaries, Madeira and Azores for the control of *T. vaporariorum* and more recently, for the control of *B. tabaci* complex (Carnero, 1982; Carnero *et al.*, 1989; Rodriguez *et al.*, 1997). This species was first recorded from the Canary Islands in 1978 from Gran Canaria and is now widespread in the entire archipelago. *E. formosa* is a thelytokous species, producing occasional males, though males of *E. formosa* have so far been recorded only from Madeira. Although most reports associating *E. formosa* and *B. tabaci* complex are from glasshouses, in the Macaronesian Islands *E. formosa* has been field-collected on both hosts.

Encarsia guadeloupae Viggiani (Figs 36–39)

Encarsia guadeloupae Viggiani, 1987b:35–37. HOLOTYPE ♀: GUADELOUPE, Wonche, 12.vi.1985 (J. Etienne) ex *Aleyrodes* sp. on *Persea americana* (IEUN, examined).

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

Diagnosis

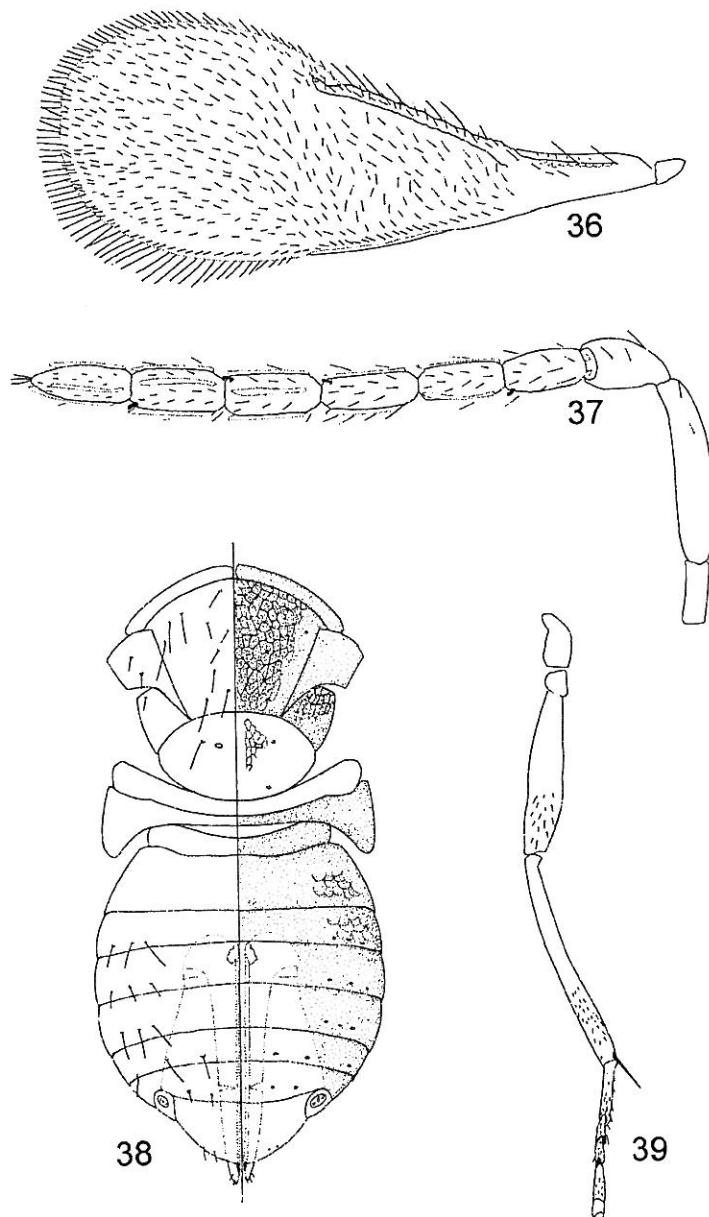
Female

Colour. Head, pronotum, mesoscutum, axillae and metasoma dark brown to black. Scutellum yellow. Legs pale except for brown hind coxae and hind femur. Antenna pale with radicle and scape brown. Fore wing faintly infuscate from base to stigmal vein. Ovipositor with the apex dark brown to black.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-4-2 (Fig. 37). Scape 2.5× as long as pedicel; F_1 slightly shorter than F_2 ; F_3 and F_4 subequal to, or slightly longer than, F_2 ; clava 0.7× as long as funicle. Flagellum with the following numbers of linear sensilla: F_1 :1, F_2 :2, F_3 :2, F_4 :2–3, F_5 :2–3, F_6 :3; F_1 – F_5 with 2–3 pit-like sensilla located along each segment.

Mid lobe of mesoscutum with 9–11 pairs of long and stout setae, often rather irregularly arranged; scutellum with 2 pairs of setae, distance between the anterior pair similar to that between the posterior pair; distance between placoid sensilla 7× width of one sensillum (Fig. 38). Fore wing broad (Fig. 36), 2.6× as long as wide. Wing disc uniformly setose. Marginal fringe 0.2× disc width. Two setae on submarginal vein, 3–5 setae in basal area, 7–8 setae in costal cell, marginal vein with 6–7 long and stout setae along its anterior margin, 2 parastigmal setae at its base. Tarsal formula 5-4-5. Middle leg basitarsus 0.3× as long as corresponding tibia; mid tibial spur 0.9× as long as corresponding basitarsus (Fig. 39).

Gastral dorsum with lateral margins of tergites imbricate; GT_{I-VII} with 0+0, 3+3, 3+3, 3+2, 3+3, 2+2, 4 setae respectively. Ovipositor 0.95× as long as mid tibia; third



Figs 36–39 *Encarsia guadeloupe* Viggiani: 36. Wing. 37. Female antenna. 38. Meso- and metasoma. 39. Mid leg.

valvulae 0.4× as long as ovipositor, with a pair of medial setae and 3–4 pairs of apical setae.

Male

Unknown.

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

Hosts in Macaronesia: *Aleurodicus dispersus*, *Lecanoideus flocossimus*.

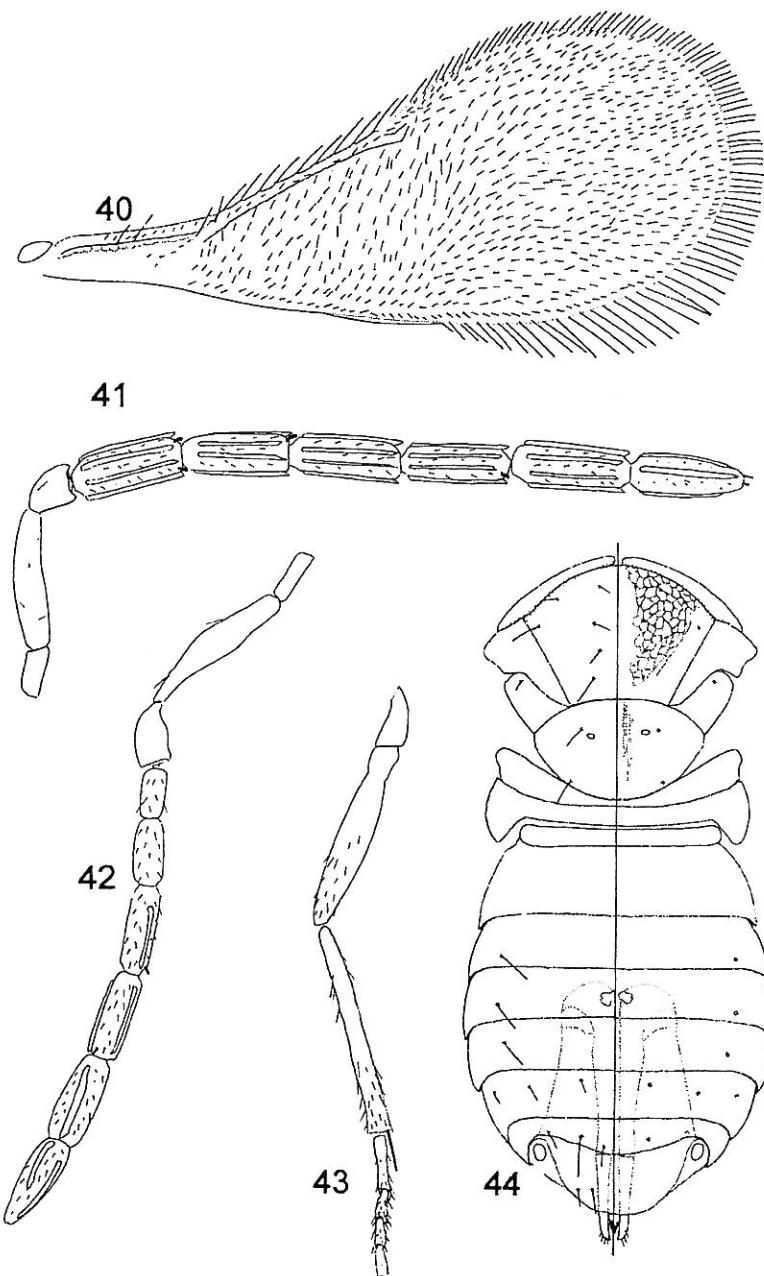
Other recorded hosts: *Aleurodicus dugesii* Cockerell; *T. vaporariorum*.

Distribution: CANARY ISLANDS: Tenerife.

Distribution outside Macaronesia: Neotropical: Guadeloupe; Oriental /Pacific /Australian: French Polynesia, Hawaii,

India, Micronesia, Nauru, Papua New Guinea, Philippines, Thailand; Afrotropical: Benin; Nearctic: USA (Florida).

Remarks: The female of *E. guadeloupae* can be distinguished from other members of the *E. luteola* species-group by its dark brown to black body, with yellow scutellum; 2-segmented clava; numerous pairs of mesoscutal setae, and 3 pairs of lateral setae on GT_{II–III}. *Encarsia guadeloupae* was introduced into the Canary Islands for the biological control of the whiteflies *A. dispersus* and *Lecanoideus flocossimus* Martin *et al.* (Nijhof *et al.*, 2000). Initial results appeared promising, but at the time of writing it would appear that the introduction of a second biocontrol agent is necessary.



Figs 40–44 *Encarsia hispida* De Santis: 40. Wing. 41. Male antenna. 42. Female antenna. 43. Mid leg. 44. Meso- and metasoma.

Encarsia hispida De Santis (Figs 40–44)

Encarsia hispida De Santis 1948a:45. HOLOTYPE ♀: ARGENTINA, Rosario, Santa Fe, ex aleurodoidea [=Aleyrodidae] on coral rojo [=*Salvia splendens*] (UNLP, paratype examined). Note: Mistakenly recorded as described from Brazil and published in De Santis 1948b (Polaszek et al., 1992 and some subsequent authors).

Encarsia hispida De Santis; Viggiani 1989a:207 as junior synonym of *Encarsia meritoria* Gahan.

Encarsia hispida De Santis; Polaszek et al., 1992:383 status revised. Schmidt et al., 2001:379.

Diagnosis

Female

Colour. Body pale yellow, sometimes with anterior margin of mid lobe, axillae anteriorly, and base of GT₁ fuscous. Eyes black, antennae and legs pale. Wings hyaline. Ovipositor apex dark in contrast with the rest of the ovipositor which is pale.

Morphology. Antennal formula 1-1-4-2. Scape 2.5× as long as pedicel; pedicel 1.3× as long as F₁; F₁ 0.6× as long as

wide; F_2 intermediate between F_1 and F_3 , $1.4 \times$ as long as F_1 and $0.6 \times$ as long as F_3 ; F_3 , F_4 and F_5 subequal in length; F_6 $1.1\text{--}1.2 \times$ as long as F_4 . Flagellum with the following numbers of longitudinal sensilla: $F_1:0$, $F_2:0$, $F_3:2$, $F_4:2\text{--}3$, $F_5:2\text{--}3$, $F_6:2$ (Fig. 42).

Mid lobe of mesoscutum with 5–8 pairs of setae arranged as: $2+4+2+4$, $1+1$, $0+1+0+1$, $1+1$, $1+1$. Anterior scutellar setae reaching bases of posterior pair; distance between placoid sensilla $4.0\text{--}5.0 \times$ the maximum width of one sensillum (Fig. 44). Fore wing length (Fig. 40) about $2.4 \times$ maximum disc width; wing disc uniformly setose. 4–5 basal area setae, marginal vein with 8–9 setae along its anterior margin, 2 parastigmal setae at its base, marginal fringe $0.3 \times$ disc width. Tarsal formula 5-4-5. Tibial spur of middle leg $0.75\text{--}0.85 \times$ as long as corresponding basitarsus. Middle leg basitarsus $0.2\text{--}0.25 \times$ as long as corresponding tibia (Fig. 43).

Gastral dorsum with imbricate lateral margins on GT_{I-IV} ; GT_{V-VII} weakly sculptured; GT_{I-VII} with $0+0$, $1+1$, $1+1$, $1+1$, $3+3$, $3+3$ and 4 setae, respectively. Ovipositor $1.0\text{--}1.2 \times$ as long as tibia of middle leg; third valvula $0.3\text{--}0.4 \times$ as long as ovipositor, with 1 pair of medial setae and 3–4 apical setae.

Male

Head yellow with base of occiput dark brown. Pronotum, basal part of mesoscutum, axillae and metasoma, except a basal yellow band, dark brown. Morphology similar to that of female except for genitalia and the following characters: Each flagellar segment with 4–5 longitudinal sensilla, F_5 and F_6 separate; GT_{VI} with 2 pairs of setae between cerci.

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

Hosts in Macaronesia: *Aleyrodes proletella*, *A. singularis*, *A. dispersus*, *Aleurotrachelus rhamnicola* (Goux), *Bemisia tabaci* complex, *Crenidorsum aroidephagus*, *Lecanoideus fuscissimus*, *Lipaleyrodes* sp.A, *Trialeurodes ricini*, *T. vaporariorum*.

Other recorded hosts: *Aleurothrixus malangae*, *A. porteri* Quaintance & Baker, *A. spiraeoides*, *S. phillyraeae*, *Tetraleurodes acaciae* (Quaintance), *T. abutiloneus*, *Trialeurodes floridensis* (Quaintance), *T. variabilis*.

Distribution: CANARY ISLANDS: Lanzarote, Fuerteventura, Gran Canaria, Tenerife, La Gomera. MADEIRA.

Distribution outside Macaronesia: Palaearctic: France, Italy, Spain. Nearctic: USA (Florida). Neotropical: Brazil, Chile, Colombia, Dominican Republic, Guadeloupe, Honduras, Jamaica, Mexico, Puerto Rico, Venezuela. Pacific: French Polynesia.

Remarks: *Encarsia hispida* is close to *Encarsia meritoria* and was treated as a synonym of the latter by Viggiani (1989a) and Schauff *et al.* (1996). Its status was revised by Polaszek *et al.* (1992) based on the following characters: F_5 and F_6 in *E. meritoria* male antenna partially fused, separate in *E. hispida*; F_2 of the female antenna in *E. hispida* smaller than F_3 and intermediate in size between F_1 and F_3 , whereas in *E. meritoria* F_2 and F_3 are equal in length. Recent detailed studies on this group have confirmed these differences, including molecular differences in the 28S-D2 region of ribosomal DNA (Polaszek *et al.*, in prep.).

New World populations of *E. hispida* appear to be commonly biparental, while Old World populations are mainly thelytokous, with males appearing occasionally under natural conditions. In the Canary Islands both biparental and uniparental populations have been observed.

Encarsia inaron (Walker)

(Figs 45–49)

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

Aphelinus idaeus Walker, 1839:12. Synonymized by Graham, 1976:142.

Encarsia inaron (Walker); Graham, 1976:142; Hayat, 1989:64–65; Polaszek *et al.*, 1992:383; 1999:148; Huang & Polaszek, 1998:1891–1893; Manzari *et al.* 2002:165.

Encarsia partenopea Masi, 1909:32; Mercet, 1912:159–162; Thompson, 1953:19. Synonymized by Polaszek *et al.*, 1992:383.

Trychaporus aleyrodis Mercet, 1930a:196. Synonymized by Polaszek *et al.*, 1992.

Encarsia brassicae Shafee & Darvas, 1984:29. Synonymized by Hayat, 1998.

Encarsia borealis Huldén, 1986:18. Synonymized by Huang & Polaszek, 1998:1891.

Encarsia indifferentis Mercet, 1929:220. Synonymized by Polaszek *et al.*, 1999:148.

Diagnosis

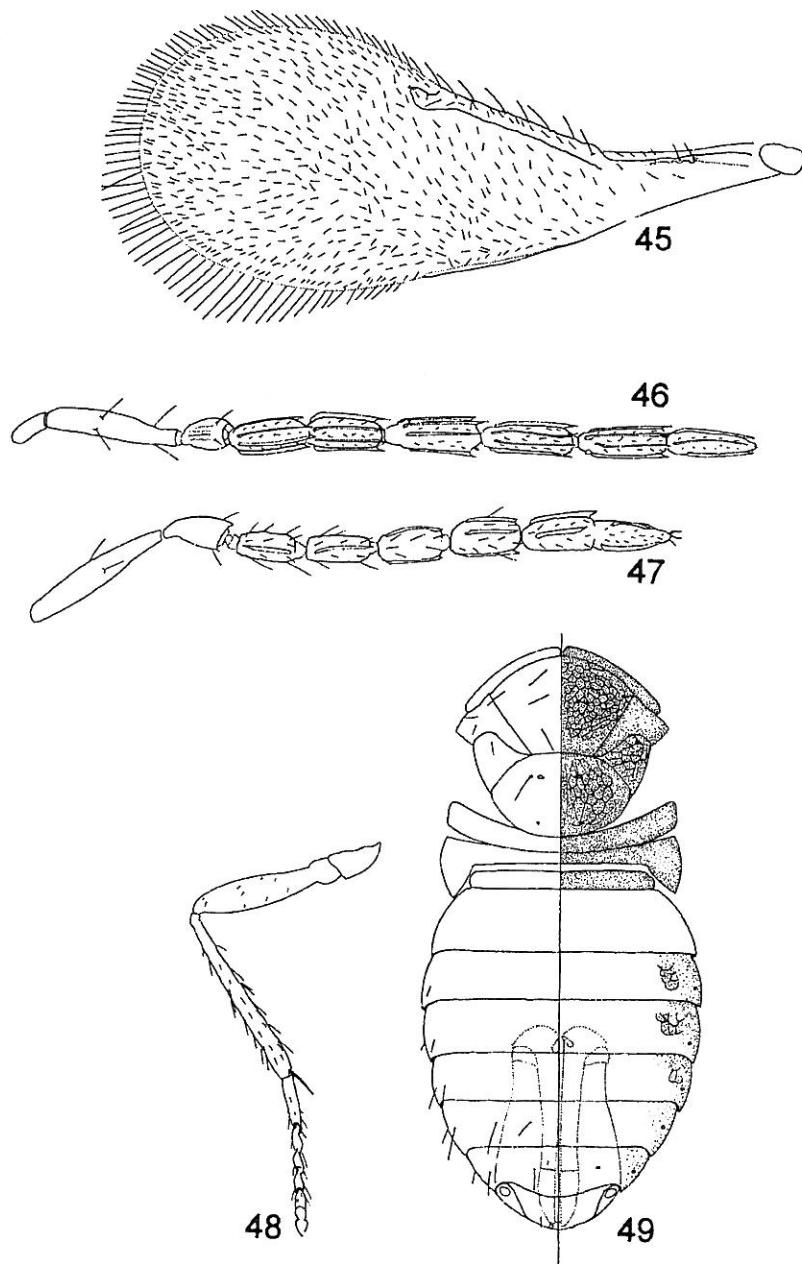
Female

Colour. Head, mesosoma and petiole dark brown to almost black. Metasoma variable, from largely pale, with a variable number of tergites laterally brown, to largely brown. Ovipositor pale. Antenna brown. Fore wing hyaline with some dark infuscation basally. Legs yellow except coxae, and (in dark specimens) mid and hind femora.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-4-2. Scape $2.5\text{--}2.7 \times$ as long as pedicel; F_1 $2 \times$ as long as wide and as long as F_2 ; $F_3\text{--}F_5$ slightly longer than previous segments. Flagellum with the following numbers of longitudinal sensilla: $F_1:1\text{--}2$, $F_2:2\text{--}3$, $F_3:2\text{--}3$, $F_4:3\text{--}4$, $F_5:2\text{--}3$, $F_6:2\text{--}3$. Pit sensilla present on all flagellum segments.

Mid lobe of mesoscutum with 3–4 pairs of setae, usually arranged as: $2+2$, $1+1$, $1+1$. Distance between anterior pair of scutellar setae $1.2\text{--}1.3 \times$ the distance between posterior pair. Placoid sensilla on scutellum widely separated by $5.3 \times$ the maximum width of one sensillum (Fig. 49). Fore wing (Fig. 45) $2.4 \times$ as long as wide. Wing disc uniformly setose. Marginal fringe of fore wing very short, $0.2 \times$ wing disc, 2 setae on submarginal vein, 4–5 basal area setae, 5–9 setae in costal cell, 6–7 setae on anterior margin of marginal vein, 3 parastigmal setae. Tarsal formula 5-5-5. Mid basitarsus $0.3 \times$ as long as corresponding tibia; mid tibial spur approximately $0.57 \times$ as long as corresponding basitarsus (Fig. 48).

Gastral dorsum with imbricate lateral margins on GT_{I-IV} , GT_{V-VII} weakly sculptured. GT_{I-VII} with $0+0$, $1+1$, $1+1$, $1+2$, $2+2$ and 4 setae, respectively. Ovipositor shorter than mid tibia and basitarsus combined. Third valvula



Figs 45–49 *Encarsia inaron* Walker: 45. Wing. 46. Male antenna. 47. Female antenna. 48. Mid leg. 49. Meso- and metasoma.

0.28× as long as ovipositor, with a pair of medial setae and 3–4 apical setae.

Male

Head and mesosoma dark brown. Metasoma from pale, with petiole and GT_{V–VII} brown, to largely brown. Morphology similar to that of female except genitalia and the following characters: Antennae 8-segmented with F₅ and F₆ separated; each segment with 6–7 longitudinal sensilla.

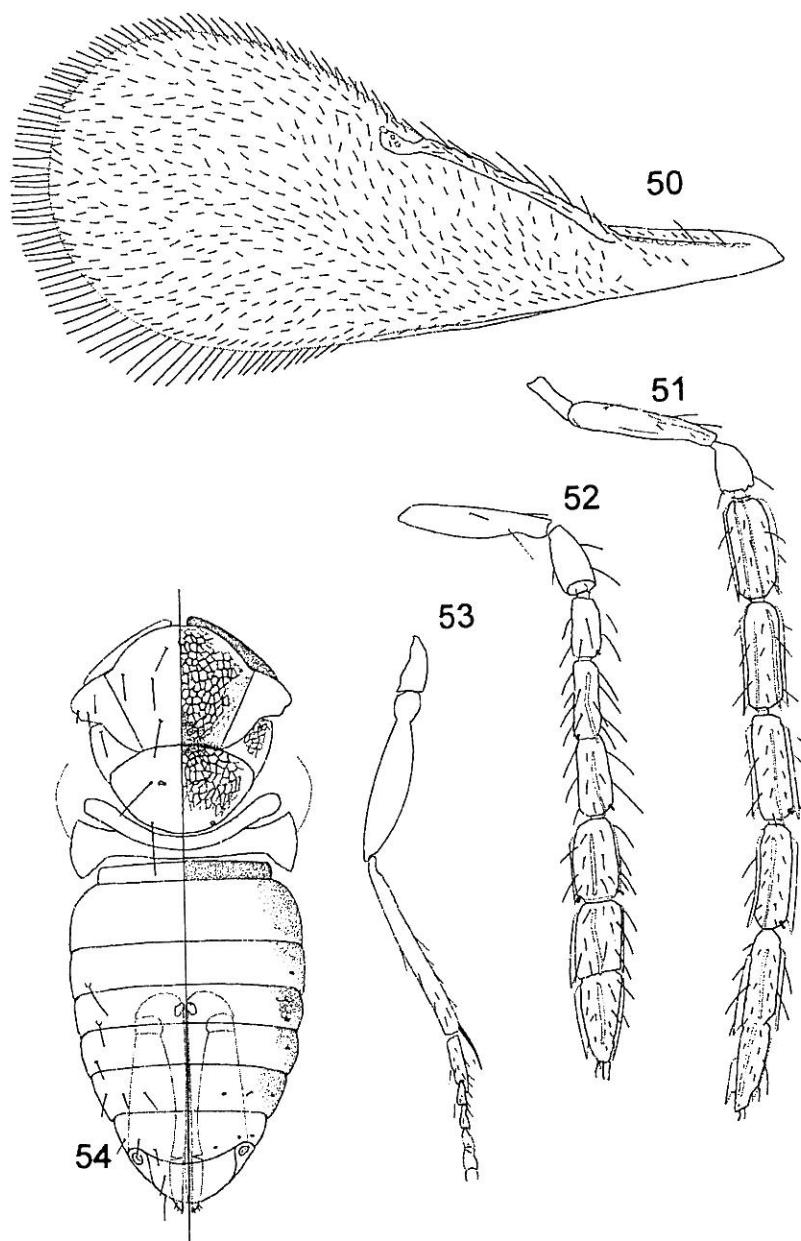
Species-group placement: *E. inaron*-group.

Hosts in Macaronesia: *Aleyrodes proletella*, *Pealius madeirensis* (Martin et al.), *Pealius azaleae* (Baker & Moles), *S. phillyreae*.

Other recorded hosts: *Acaudaleyrodes rachipora*, *Aleyrodes lonicerae*, *A. singularis*, *Asterobemisia carpini* (Koch), *A. paveli* (Zahradník), *Bemisia* sp., *B. tabaci*-complex, *Bulgarialeurodes cotesii* (Maskell), *Pealius quercus* (Signoret), *Siphoninus immaculatus* (Heeger), *Trialeurodes vaporariorum*.

Distribution: CANARY ISLANDS: Lanzarote (new record), Tenerife, La Gomera (new record), La Palma (new record). MADEIRA.

Distribution outside Macaronesia: Palaearctic: widespread in southern Europe and North Africa. Oriental: widespread in Asia. Nearctic: introduced into North America (Polaszek et al., 1992; Schaufler et al., 1996).



Figs 50–54 *Encarsia levadicola* Polaszek & Hernández sp. n.: 50. Wing. 51. Male antenna. 52. Female antenna. 53. Mid leg. 54. Meso- and metasoma.

Remarks: Laudonia & Viggiani (1995) and Polaszek *et al.* (1992) discussed gastral colour variation in *E. inaron*, and it has been suggested that it may constitute a complex of species. However, Manzari *et al.* (2002) have shown recently using a combination of morphometric and molecular taxonomic techniques that this appears not to be the case. Viggiani (1987a) recorded *E. inaron* as very common on *Aleyrodes elevatus* Silvestri and *A. proletella* in Italy, while on *S. phillyreae*, *E. dichroa* was more abundant. In the Canary Islands the same situation has been observed. Studies on the biology of *E. inaron* have been published by Mazzzone (1983) and Gould *et al.* (1995). The role of *E. inaron* in the biological control of whiteflies in Egypt has been published by Abd-Rabou & Abou-Setta

(1998), indicating that *E. inaron* is the most effective parasitoid of *S. phillyreae*. The introduction into California of *E. inaron* represented a major success in the classical biological control programme of the ash whitefly *S. phillyreae* (Gould *et al.*, 1992).

***Encarsia levadicola* Polaszek & Hernández sp. nov.
(Figs 50–54)**

HOLOTYPE ♀: MADEIRA: Levada da Serra, Bica da Cana, 16.v.97 (A. Polaszek) ex *Bemisia afer* (*sensu lato*) on *Clethra arborea*. (BMNH).

Description

Female

Colour. Variable. Head yellow with clypeus and malar sulcus black. Mesosoma yellow. Pronotum dark brown, mesoscutum yellow or with its central portion brown, when yellow with posterior margin dark; axillae from yellow to distal three-quarters light brown; propodeum yellow or brown. Metasoma yellow or with GT_{I-V} light brown laterally. Legs and antennae yellow. Wings hyaline.

Morphology. Antennal formula (Fig. 52) 1-1-3-3 although clava somewhat indistinct. Antennal segments subequal in length; F₁ slightly shorter than both F₂ and F₃, F₁ 1.5× as long as wide (Fig. 52). Flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:1, F₃:2, F₄:2, F₅:2, F₆:2.

Mid lobe of mesoscutum with 4 pairs of large setae, 3 pairs of setae present centrally and 1 pair laterally; Distance between scutellar sensilla 4–4.8× the width of one sensillum; distance between anterior pair of scutellar setae 0.8–1× that between posterior pair. Fore wing (Fig. 50) 2.4–2.6× as long as width. No setose area distally from the stigmal vein; 8–14 costal setae, 5–9 basal area setae, 2 submarginal vein setae, 7–10 long and stout setae on the anterior margin of marginal vein and 1–2 parastigmal setae at its base. Tarsal formula 5-5-5; mid tibial spur 0.66–0.74× the length of the corresponding basitarsus; basitarsus of mid leg 0.32× corresponding tibia (Fig. 53).

Gastral dorsum with rugose lateral margins on GT_{I-IV}; GT_{I-VII} with 0+0, 1+1, 1+1, 1+1, 2–3+2–3, 3+3 and 4 setae, respectively. Venter with 3–4 and 4–6 setae on GT_{II}, GT_{III} and GT_{IV} respectively. Ovipositor very slightly longer (1–1.2×) than mid tibia; third valvula less than 1.35× as long as mid tibia spur; ovipositor with one pair of medial setae and 4–5 pairs of short apical setae.

Male

Head yellow with clypeus and malar sulcus black. Body brown except the following yellow: lateral margins of mid lobe of mesoscutum, side lobes, scutellum and legs. Wings hyaline, slightly infuscated at base. Morphology similar to that of female except for genitalia characters and the following: antenna (Fig. 51) with 5–6 pit sensilla on F₁, F₂, F₃, F₄, F₅ and 2–3 on F₆; F₅ and F₆ partly fused. Aedeagus long, 1.2× as long as mid tibia.

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

Hosts in Macaronesia: *Bemisia lauracea* (Martin et al.), *Bemisia afer* *sensu lato*, *Bemisia* sp. (*afer*-group).

Distribution: MADEIRA, CANARY ISLANDS.

Remarks: *E. levadicola* is similar to *Encarsia silvestrii* Viggiani & Mazzone and *Encarsia melanostoma*, here described from the Canary Islands. *Encarsia levadicola* can be distinguished from *E. silvestrii* by the length of the ovipositor (longer than mid tibia in *E. levadicola*, while shorter than mid tibia in *E. silvestrii*) and the relative lengths of the third valvulae and mid tibial spur (between 1–1.35× in *E. levadicola*, while less than 1× in *E. silvestrii*). Moreover, there are differences in the length and morphology of the aedeagus in males, which is much shorter and broader in *E. silvestrii*. *E. levadic-*

ola is extremely close to *E. melanostoma*. *E. levadicola* differs in having shorter third valvulae and a longer mid tibial spur. It can also be distinguished from *E. melanostoma* by having the third valvulae less than 1.35× the length of the mid tibial spur.

Encarsia lutea (Masi) (Figs 55–64)

Prospaltella lutea Masi, 1909:25. SYNTYPES ♀♀: ITALY, Campania, Portici (IEUN, examined).

Prospaltella lutea Masi; Mercet, 1912:204–205.

Prospaltella indica Shafee, 1973:255. Synonymized by Hayat, 1981:466.

Encarsia lutea (Masi); Ferrière, 1965:132; Viggiani & Mazzone, 1979:46, 1980b:51; Hayat, 1981:466, 1986:162, 1989:48, 1998:230–231; Viggiani, 1987a: 155–156; Polaszek et al., 1992:384; Viggiani & Ren, 1993:223; Chou et al., 1996:198; Schauff et al., 1996:21; Huang & Polaszek, 1998:1912–1914; Polaszek et al., 1999:154; Schmidt et al., 2001:379.

Diagnosis

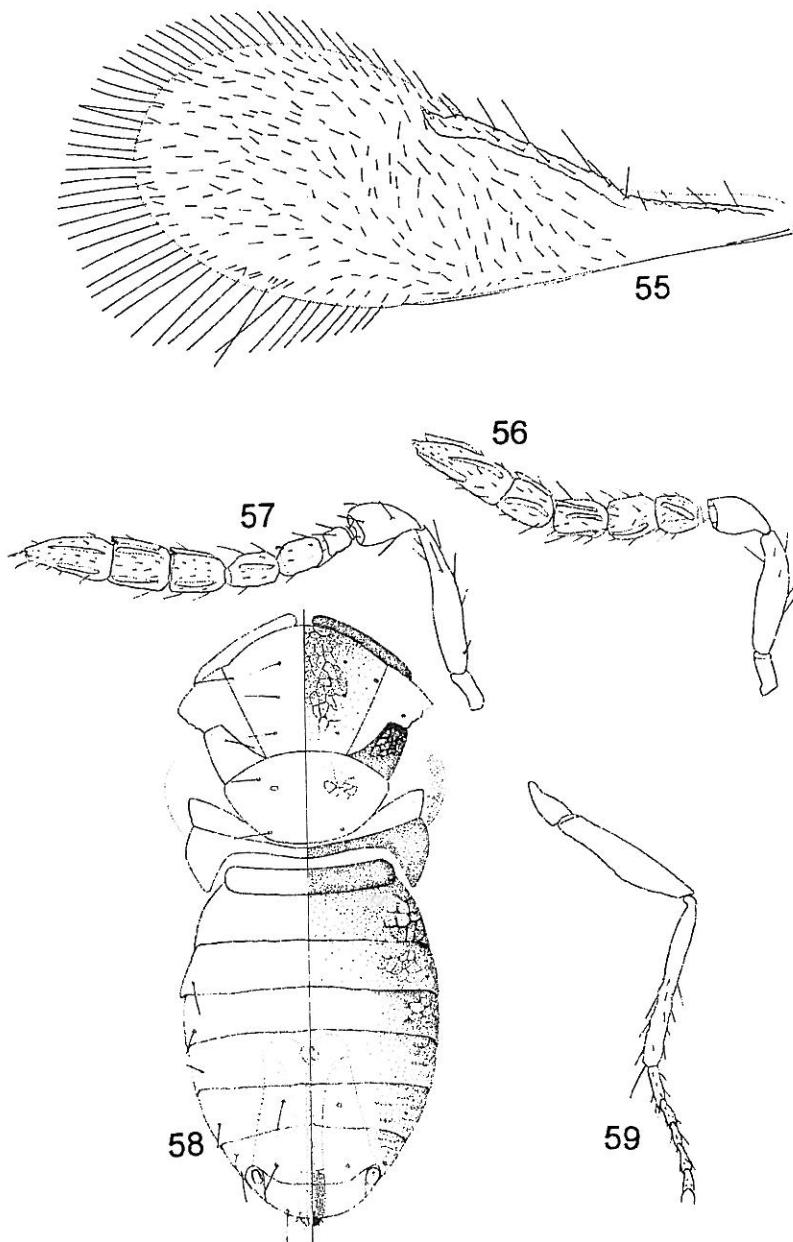
Female

Colour. Colour varying from entirely yellow, to yellow with the following brown: pronotum, axillae, petiole and GT_I laterally (Fig. 64). A second, darker, colour morph is also present (Fig. 58), but differences in the form of the antennae in both sexes suggest that further study may prove this to be a distinct species (see below). Third valvulae brown to black in striking contrast with the rest of ovipositor which is pale. Antenna yellow. Fore wings hyaline. Legs pale yellow.

Morphology. Stemmaticum with reticulate sculpture. Antennal formula 1-1-3-3. Scape 2.7× as long as pedicel; pedicel 2.1–2.2× as long as F₁; F₁ usually quadrate, less than 1.2× as long as wide; F₃, F₄ and F₅ subequal in length. Funicle length 0.6–0.9× length of the clava (Figs 57, 62). Flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:0–1, F₃:0–1, F₄:2, F₅:2–3, F₆:2–3.

Mid lobe of mesoscutum with 4 pairs of setae arranged as: 2+2, 1+1, 1+1. Distance between anterior pair of scutellar setae greater than that between posterior pair; placoid sensilla on scutellum widely separated, 7–9× the width of one sensillum. Fore wing (Figs 55, 60) 2.4–2.7× as long as wide. Wing disc uniformly setose. Marginal fringe 0.3× disc width. 2 setae on submarginal vein, 5–6 setae on anterior margin of marginal vein, 3–4 basal cell setae, 3–5 setae on costal area, 2 parastigmal setae. Tarsal formula 5-5-5. Basitarsus of mid leg 0.27× as long as corresponding tibia. Mid tibial spur 0.7× as long as corresponding basitarsus (Figs 59, 63).

Gastral dorsum with imbricate lateral margins on GT_{I-IV}; GT_{I-VII} with 0+0, 1+1, 1+1, 1+1, 2+2, 2–3+2–3 and 4 setae, respectively. Ovipositor 0.8–1× as long as middle leg tibia, shorter than middle tibia and basitarsus combined; third valvula 0.25–0.26× as long as ovipositor, with a pair of medial setae and 3–4 pairs of short apical setae.



Figs 55–59 *Encarsia lutea* (Masi) dark form: 55. Wing. 56. Male antenna. 57. Female antenna. 58. Meso- and metasoma. 59. Mid leg.

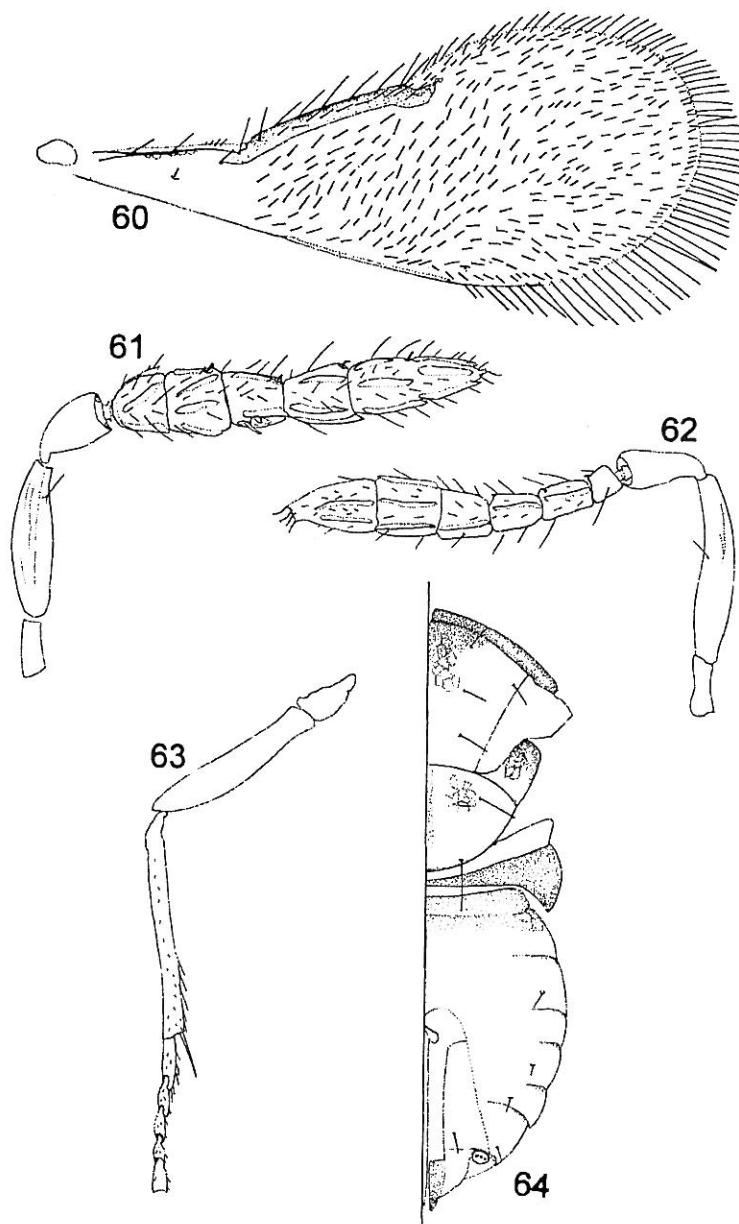
Male

Colour much darker than female. Head yellow with occipital strip brown. Mesosoma yellow with pronotum, anterior margin of mid lobe, axillae and propodeum dark brown. Metasoma dark brown. Morphology similar to that of female except the following: Antenna (Figs 56, 61) with a strongly developed glandular/sensorial complex on F_1 – F_3 , F_5 and F_6 partly fused. Species-group placement: *E. lutea*-group.

Hosts in Macaronesia: *A. rachipora*, *A. proletella*, *B. tabaci* complex, *Bemisia* sp., *T. vaporariorum*.

Other recorded hosts: *Aleurocanthus zizyphi* Priesner & Hosny, *Aleurocanthus cinnamomi* Takahashi, *Aleurolobus marlatii* (Quaintance), *A. niloticus*, *Aleurolobus rhod-*

dendri Takahashi, *Aleurolobus setigerus* Quaintance & Baker, *Aleurolobus wunni* (Ryberg), *Aleuroplatus pectiniferus* Quaintance & Baker, *Aleurotrachelus jelinekii* (Frauenfeld), *Aleurotrachelus rubi* Takahashi, *Aleurotuberculatus aucubaie* (Kuwana), *Aleurotuberculatus ficicola* (Takahashi), *Aleurotuberculatus gordoniae* Takahashi, *Aleurotuberculatus jasmini* Takahashi, *Aleurotuberculatus malloti* Takahashi, *Aleurotuberculatus melastomae* Takahashi, *Aleurotuberculatus psidii* (Singh), *Aleyrodes lonicerae*, *A. proletella*, *Asterobemisia atraphaxius* (Danzig), *A. carpini*, *Bemisia ovata* (Goux), *Bemisia salicaria* Danzig, *Bulgarialeurodes cotesii*, *D. citri*, *D. fici*, *D. formosanensis* Takahashi, *Dialeurodes kirkaldyi* (Kotinsky), *Dialeurodes* sp.,



Figs 60–64 *Encarsia lutea* (Masi) pale form: 60. Wing. 61. Male antenna. 62. Female antenna. 63. Mid leg. 64. Meso- and metasoma.

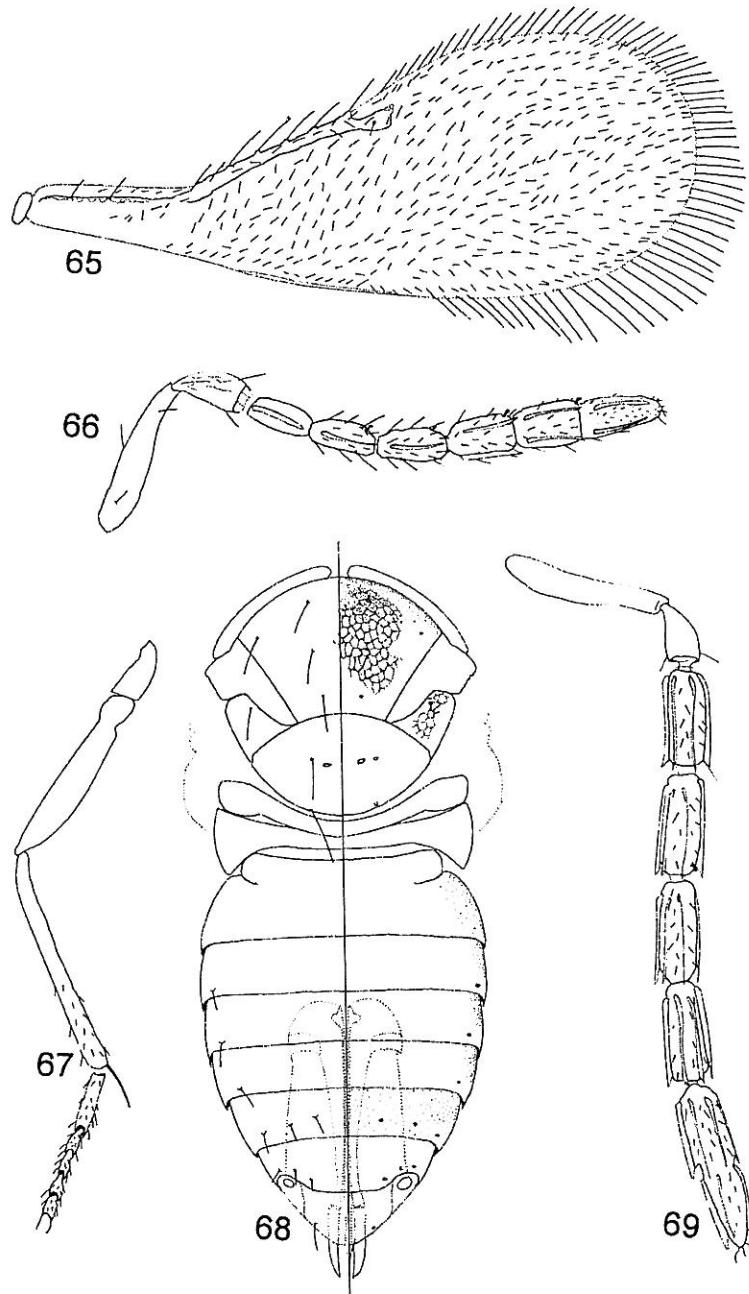
Pealius mori (Takahashi), *Pealius setosus* Danzig, *Singhius hibisci* (Kotinsky), *Taiwanaleyrodes meliosmae* Takahashi, *Tetralicia* sp., *Trialeurodes abutiloneus*, *Trialeurodes* sp.

Distribution: CANARY ISLANDS: Lanzarote (new record), Fuerteventura (new record), Gran Canaria (new record), Tenerife, La Gomera (new record), El Hierro (new record), La Palma (new record). MADEIRA.

Distribution outside Macaronesia: Cosmopolitan.

Remarks: We have observed considerable colour variation in *E. lutea*, something that has been noted also by other authors (Viggiani, 1987a; Viggiani & Ren, 1993; Huang & Polaszek, 1998; Polaszek et al., 1999). Specimens from Macaronesia

show morphological differences that might indicate the existence of more than one species (compare Figs 55–59 and Figs 60–64). However, no consistent morphological character could be found to separate them. The group is currently being studied in detail (P. Pedata and A. Polaszek). In Macaronesia, two species within the *lutea*-group have been recorded, *E. lutea* and *E. davidi*. Both species can be easily distinguished by the relative length of the third valvulae with respect to the total length of ovipositor. There are several published studies available concerning the impact of *E. lutea* on the *B. tabaci*-complex (Abdel-Fattah et al., 1984; Gerling, 1986; Gerling & Folty, 1987).



Figs 65–69 *Encarsia melanostoma* Polaszek & Hernández sp. n.: 65. Wing. 66. Female antenna. 67. Mid leg. 68. Meso- and metasoma. 69. Male antenna.

***Encarsia melanostoma* Polaszek & Hernández sp. nov.
(Figs 65–69)**

HOLOTYPE ♀: CANARY ISLANDS: Tenerife, Baranco de las Moradas, 18.v.97 (E. Hernández) ex *Bemisia medinae* on *Hypericum grandifolium* (BMNH).

Description

Female

Colour. Variable. Head yellow with clypeus and malar sulcus black. Mesosoma yellow with pronotum dark brown;

mesoscutum yellow with posterior margin dark. Propodeum yellow or brown. Metasoma yellow or with a variable number of tergites (from GT₁ to GT_V) light brown centrally or laterally. Legs and antennae yellow. Wings hyaline.

Morphology. Stemmaticum with striate sculpture. Mandibles with 2 teeth and a truncation; maxillary and labial palps one-segmented. Antennal formula 1-1-3-3 although clava not very distinct; F₁ 1.5× as long as wide; Antennal segments subequal in length; F₁ slightly shorter than F₂ (Fig. 66). Flagellum with the following numbers of longitudinal sensilla: F₁:1, F₂:2, F₃:2–3, F₄:2–3, F₅:2–3, F₆:2–3. Pit-like sensilla present on all flagellar segments.

Mid lobe of mesoscutum with 4 pairs of long setae, arranged as: 2+2, 1+1, 1+1; Distance between scutellar sensilla 3–3.7× the width of one sensillum; distance between anterior pair of scutellar setae 0.8–1.1× that between posterior pair. Fore wing as in Fig. 65, 2.4–2.9× as long as wide. No asetose area distally from the stigmal vein; 8–10 basal area setae, 7–8 basal cell setae, 2 setae on submarginal vein, 6–8 long setae in the anterior margin of marginal vein and 1 parastigmal seta at its base. Tarsal formula 5-5-5. Mid tibial spur 0.54–0.66× corresponding basitarsus; mid basitarsus 0.29–0.3× as long as corresponding tibia; tibia and basitarsus of mid leg with at least four short and stout spines (Fig. 67).

Gastral dorsum with rugose lateral margins on GT_{I–IV}; GT_{I–VII} with 0+0, 1+1, 1+1, 1+1, 3+3, 3+3 and 4 setae, respectively. Venter with 3, 4 and 6 setae on GT_{II}, GT_{III} and GT_{IV} respectively. Ovipositor very slightly larger than mid tibia; third valvula 1.6–2.1× as long as mid tibial spur; ovipositor with one pair of medial setae and 4–5 pairs of short apical setae.

Male

Head yellow with clypeus and malar sulcus black. Body brown except the following yellow: lateral margins of mid lobe of mesoscutum, side lobes, scutellum and legs. Wings hyaline, slightly infuscate at base. Morphology similar to that of female except for genitalia characters and the following: Antennae 8-segmented (Fig. 69) with 5–6 longitudinal sensilla on each segment; F₅ and F₆ partly fused. Aedeagus slightly shorter than mid tibia.

Species-group placement: *E. inaron*-group. Manzari *et al.* (2002) modified the definition of the *inaron*-group, showing that Hayat's (1998) and previous markers' definitions are unworkable. The group cannot as yet be defined morphologically, but is best characterized by the possession of a unique sequence of 30 bases in the D2 region of the 28S ribosomal DNA. Clearly, however, morphological similarities do exist between the species (e.g. the wing venation), and a morphological definition may be forthcoming (S. Manzari & A. Polaszek, in prep.).

Hosts in Macaronesia: *A. proletella*, *Bemisia afer* (*sensu lato*), *Bemisia medinae* Gómez-Menor, *B. tabaci*-complex, *Bemisia* sp., *T. vaporariorum*.

Distribution: CANARY ISLANDS: Lanzarote, Gran Canaria, Tenerife, La Gomera, La Palma, El Hierro.

Remarks: *E. melanostoma* is very close to *E. levadicola*, from Madeira, in colour and structure. It differs in having longer third valvulae, longer mid basitarsus and a shorter mid tibial spur. In males the aedeagus is also slightly shorter. In *E. levadicola* the third valvulae are less than 1.35× maximum length of the mid tibial spur, while in *E. melanostoma* the third valvulae are more than 1.67× the maximum length of the mid tibial spur. *E. melanostoma* is also close to *E. silvestrii* Viggiani, but differs in the same characters as *E. levadicola*. *E. melanostoma* can be distinguished from *E. silvestrii* by the length of the ovipositor (longer than mid tibia in *E. melanostoma*, while shorter than mid tibia in *E. silvestrii*) and the ratio of third valvulae to mid tibial spur less than in *E. silvestrii*. Moreover, there are differences in the length and

morphology of the aedeagus in males, which is much shorter and broader in *E. silvestrii*. In the Canary Islands the distribution of *E. melanostoma* is so far restricted to the laurisilva forest.

Encarsia noahi Polaszek & Hernández sp. nov. (Figs 70–74)

HOLOTYPE ♀: CANARY ISLANDS: Tenerife, Las Galletas, 29.iv.97 (E. Hernández.) ex *T. vaporariorum* on *N. glauca* (BMNH).

Description

Female

Colour. Head with occiput yellow; base of head, clypeus and area above clypeus dark brown. Mesosoma yellow with pronotum, central portion of mid lobe and side lobe of mesoscutum dark brown; axillae yellow with the distal quarter to three-quarters dark brown; propodeum and metasoma brown. Legs and antennae yellow. Wings hyaline.

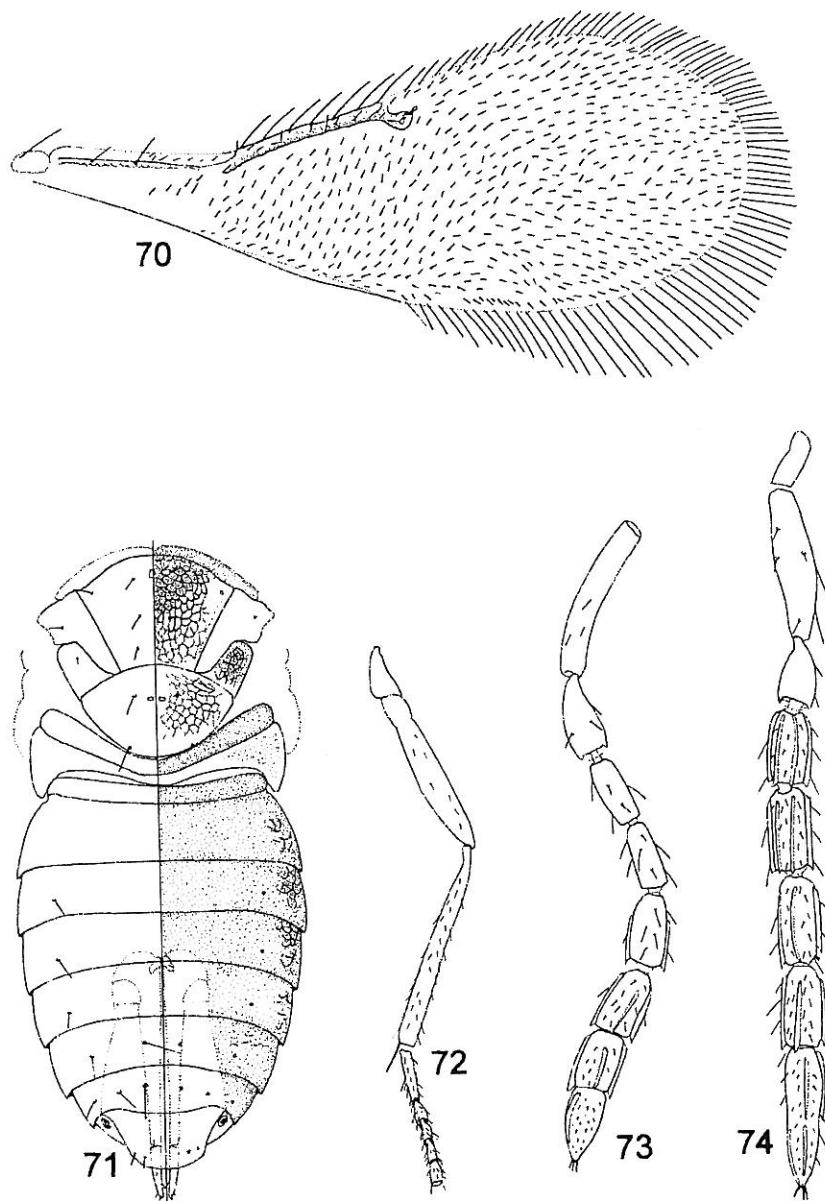
Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-3-3. Scape 2× as long as pedicel; pedicel subequal in length to F₁; F₁ slightly shorter than F₂ and F₃, 2.5× as long as wide; flagellum with the following numbers of longitudinal sensilla: F₁:0, F₂:0, F₃:2, F₄:2–3, F₅:2–3, F₆:2–3 (Fig. 73).

Mid lobe of mesoscutum with 4 pairs of large setae arranged as 2+2, 1+1, 1+1; Placoid sensilla on scutellum closely placed, distance between placoid sensilla half the width of one sensillum; distance between anterior pair of scutellar setae 0.6–0.9× than that between posterior pair. Fore wing (Fig. 70) 2.5× as long as maximum width. Longest setae on anterior marginal fringe 0.15× as long as disc width; longest setae on posterior marginal fringe 0.33–0.35× the greatest width of wing. No asetose area distally from the stigmal vein, wing disc uniformly setose. Wing with 4–16 setae in costal area, 4–8 basal area setae, 2 setae on submarginal vein, 5–7 long and stout setae on the anterior margin of marginal vein and one parastigmal seta at its base. Tarsal formula 5-5-5. Tibial spur of middle leg 0.42–0.44× corresponding basitarsus; basitarsus of middle leg 0.3× as long as corresponding tibia (Fig. 72).

Gastral dorsum with rugose lateral margins on GT_{I–IV}; GT_{I–VII} with 0+0, 1+1, 1+1, 1+1, 3+3, 3+3 and 4 setae, respectively. Ovipositor 1–1.2× mid tibia; third valvulae 0.26–0.31× second valvifer, third valvulae with one pair of medial setae and 4–5 pairs of short apical setae.

Male

Body entirely brown except the following pale: face and stemmaticum, lateral margins of mid lobe of mesoscutum, side lobes, scutellum and legs. Morphology similar to that of female except for genitalia characters and the following: Antennae (Fig. 74) with 5–6 longitudinal sensilla on F₁, F₂, F₃, F₄ and F₅ and F₆ partly fused. Wings hyaline, faintly infuscate at base. Aedeagus 0.7–1× as long as mid tibia.



Figs 70–74 *Encarsia noahi* Polaszek & Hernández sp. n.: 70. Wing. 71. Meso- and metasoma. 72. Mid leg. 73. Female antenna. 74. Male antenna.

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

Hosts in Macaronesia: *Aleyrodes proletella*, *A. singularis*, *A. floccosus*, *B. tabaci*-complex, *Bemisia afer sensu lato*, *Bemisia* sp., *Lipaleyrodes* "sp.B", *T. vaporariorum*.

Distribution: CANARY ISLANDS: Fuerteventura, Gran Canaria, Tenerife, La Gomera, La Palma, El Hierro. MADEIRA, AZORES: Pico.

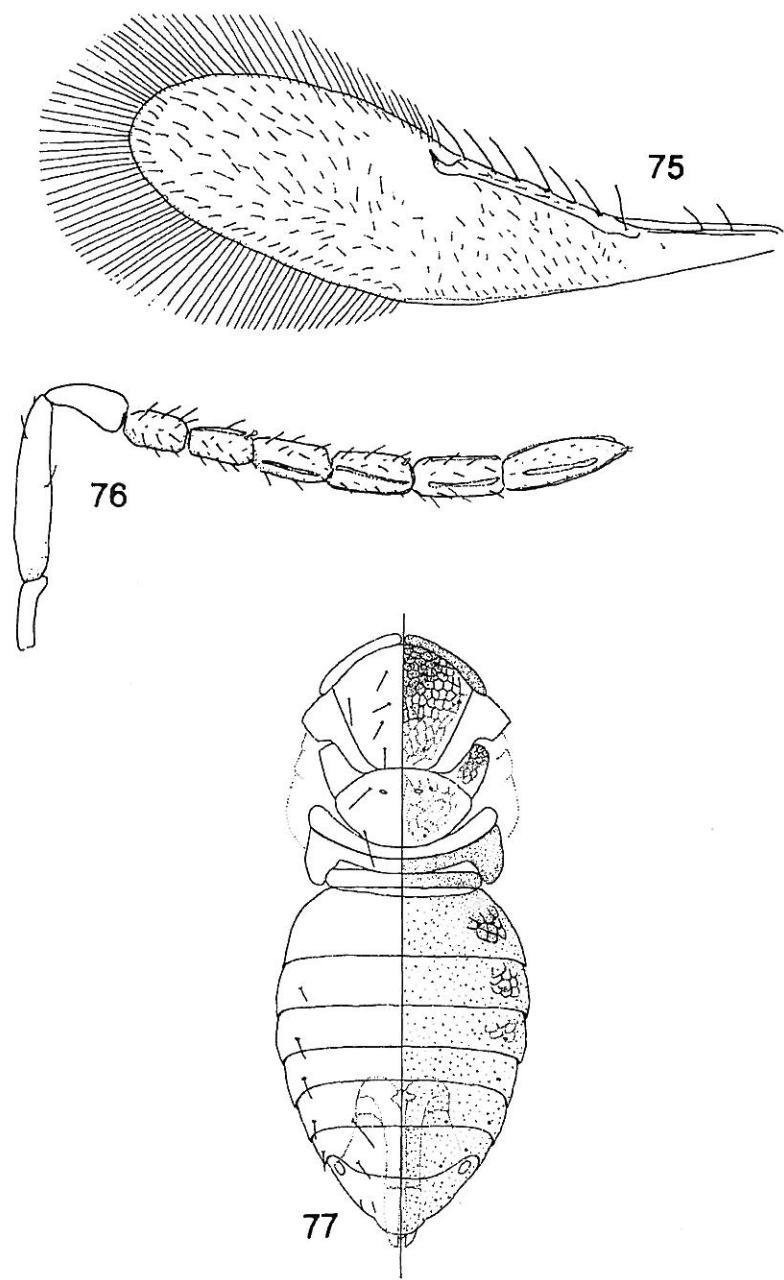
Remarks: Within the material examined we have observed the presence of a morphologically different population of *E. noahi* occurring sympatrically in the Canary Islands (La Palma, La Gomera and El Hierro). Individuals are paler and differ mainly in having narrower fore wings and the maximum length of the anterior marginal fringe (wings $2.4 \times$ as long as width and longest setae in anterior marginal fringe $0.23 \times$ as long as greatest width). *E. noahi* has here been placed within the *E. strenua* species-group.

strenua species-group, defined by the presence of 1–3 specialized setae at the apex of the costal cell, a bare area above the stigmal vein and closely placed scutellar sensilla. Its correct placement there has also been confirmed by DNA sequencing (S. Manzari & A. Polaszek, unpubl. obs.).

Encarsia pergandiella Howard (Figs 75–77)

Encarsia pergandiella Howard, 1907:78. HOLOTYPE ♀: USA, Washington, DC. 25.ix.1900 (T. Pergande) ex "Aleyrodes" on *Xanthium strumarium* (USNM, not examined).

Encarsia versicolor Girault, 1908:53. Synonymized by Gahan (in Peck, 1951):438.



Figs 75–77 *Encarsia pergandiella* Howard: 75. Wing. 76. Female antenna. 77. Meso- and metasoma.

Encarsia versicolor Girault; Mercet, 1912:167:172.

Aleurodiphus pergandiella (Howard): De Bach & Rose, 1981:666.

Encarsia bemisiae De Santis, 1981:37. Preoccupied by *bemisiae* Ishii, 1938.

Encarsia tabacivora Viggiani, 1985a:82. Replacement name for *E. bemisiae* De Santis. Synonymized by Polaszek *et al.*, 1992:387.

Encarsia pergandiella Howard; Viggiani & Mazzone, 1979:40; Viggiani, 1987a:160–162; Polaszek *et al.*, 1992:386–387; Schauss *et al.*, 1996:25; Schmidt *et al.*, 2001:381.

Diagnosis

Female

Colour. Head yellow with occipital strip brown. Mesosoma yellow with the following brown: Pronotum, anterior margin of mid lobe of mesoscutum and axillae, propodeum. Metasoma brown. Antennae and legs pale yellow. Wings hyaline, slightly infuscated below marginal vein.

Morphology. Antennal formula 1-1-4-2. Scape 2.3–2.4× as long as pedicel; pedicel slightly longer than F₁. F₁ 1.6–1.7× as long as wide; F₂ intermediate between F₁ and F₃, 1.2× as long as F₁ and 0.7× as long as F₃; F₃ and F₄ subequal in length, 1.5× as long as F₁; F₅ and F₆ slightly larger

than previous segments, 1.4–1.7× and 1.9–2.2× as long as F_1 respectively (Fig. 75). Flagellum with the following numbers of longitudinal sensilla: $F_1:0-1$, $F_2:0-1$, $F_3:2$, $F_4:1-2$, $F_5:2-3$, $F_6:2-3$; pit-like sensilla on all flagellar segments.

Mid lobe of mesoscutum with 5 pairs of setae arranged as: 2+2, 1+1, 1+1, 1+1 (Fig. 77). Distance between anterior pair of scutellar setae slightly greater than that between posterior pair. Distance between placoid sensilla 5× the width of one sensillum. Fore wing (Fig. 75) 3.7× as long as wide. Wing disc with an asetose area below stigmal vein; marginal fringe 0.6× as long as disc width. 2 setae on submarginal vein, basal area with 1–2 setae, costal cell with 5–6 setae; 5–7 vein, basal area with 1–2 setae, costal cell with 5–6 setae; 5–7 tarsal setae on anterior margin of marginal, 1 parastigmal seta. Tarsal formula 5-5-5. Basitarsus of middle leg 0.45× as long as corresponding tibia. Mid tibial spur 0.4× as long as corresponding basitarsus.

Gastral dorsum with rugose lateral margins on GT_{I-IV} , GT_{I-VII} with 0+0, 1+1, 1+1, 1+1, 2+2, 2+2, 4 setae respectively. Ovipositor 1.1× as long as mid tibia, but shorter than mid tibia and basitarsus combined; third valvula 0.4× as long as ovipositor, with a pair of medial setae and 3–4 pairs of apical setae.

Male

Head yellow with base brown. Mesosoma with pronotum, anterior margin of mid lobe, axillae and propodeum dark brown. Metasoma dark brown.

Morphology similar to that of female except genitalia and the following: Antennae 8-segmented with F_5 and F_6 partially fused, each flagellar segment with 2–3 longitudinal sensilla.

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

Hosts in Macaronesia: *B. tabaci* complex, *B. afer* *sensu lato*, *T. vaporariorum*, *Pealius azaleae*.

Other recorded hosts: *Aleuroplatus coronatus*, *T. variabilis*.

Distribution: CANARY ISLANDS: Gran Canaria (new record), Tenerife, La Gomera (new record), La Palma (new record). MADEIRA. AZORES: São Miguel (new record).

Distribution outside Macaronesia: Palaearctic: France, Italy, Israel, Spain. Neotropical: Brazil, Colombia, Costa Rica, El Salvador, Guadeloupe, Guatemala, Honduras, Mexico, Puerto Rico, Venezuela. Nearctic: USA.

Remarks: *E. pergandiella* is a Nearctic species introduced into Europe in 1980 for the biological control of *T. vaporariorum* (Viggiani & Mazzone, 1980a; Viggiani, 1987a). In the Canary Islands it was first recorded by Beitia *et al.* (1996) developing on the *B. tabaci*-complex. Males have been observed developing as hyperparasitoids of *E. formosa* in tomato and cucumber greenhouses where the latter species is inundatively released. Studies on *E. pergandiella* biology and its role in the biological control of *B. tabaci*-complex have been carried out by Hunter (1989a,b), Heinz & Parella (1994) and Videll et al. (1997). Although *E. tabacivora* Viggiani was synonymized with *E. pergandiella*, as yet unpublished studies by J.B. Woolley and R. Johnson strongly suggest that *E. tabacivora* is a valid species. In general, the *parvella*-group is one of the least-studied of the whitefly-associated species-groups of *Encarsia*.

Encarsia sophia (Girault and Dodd) (Figs 78–82)

Coccophagus sophia Girault & Dodd, 1915:49, 56. SYN-TYPE ♀: AUSTRALIA, Cairns (QM, examined).

Prospaltella transvena Timberlake, 1926:312–315. Synonymy by Heraty & Polaszek, 2000:163.

Prospaltella sophia (Girault & Dodd); Compere, 1931:11; Viggiani, 1985b:249.

Prospaltella sublutea Silvestri, 1931:20–22. Synonymized by Gerling and Rivnay in Viggiani, 1985a:90.

Prospaltella bemisiae Ishii, 1938:30. Synonymized by Polaszek *et al.*, 1992:389.

Prospaltella flava Shafee, 1973:254–255. Preoccupied by *E. flava* (Compere, 1936:300). Synonymized by Hayat, 1989:71.

Encarsia shafeei Hayat, 1986:163. Replacement name for *E. flava* (Shafee). Synonymized by Hayat, 1989:72.

Encarsia transvena (Timberlake); Gerling and Rivnay in Viggiani, 1985a: 90–92; Hayat, 1989:71–73, 1998:205–207; Polaszek *et al.*, 1992:388–389; Booth & Polaszek, 1996:73; Krishnan & David, 1996:16; Schaufuß *et al.*, 1996:312; Huang & Polaszek, 1998:1954; Schmidt *et al.*, 2001:383.

Diagnosis

Female

Colour. Body yellow. Third valvulae pale. Antenna yellow except clava faintly brown-yellow. Fore wings hyaline. Legs pale yellow.

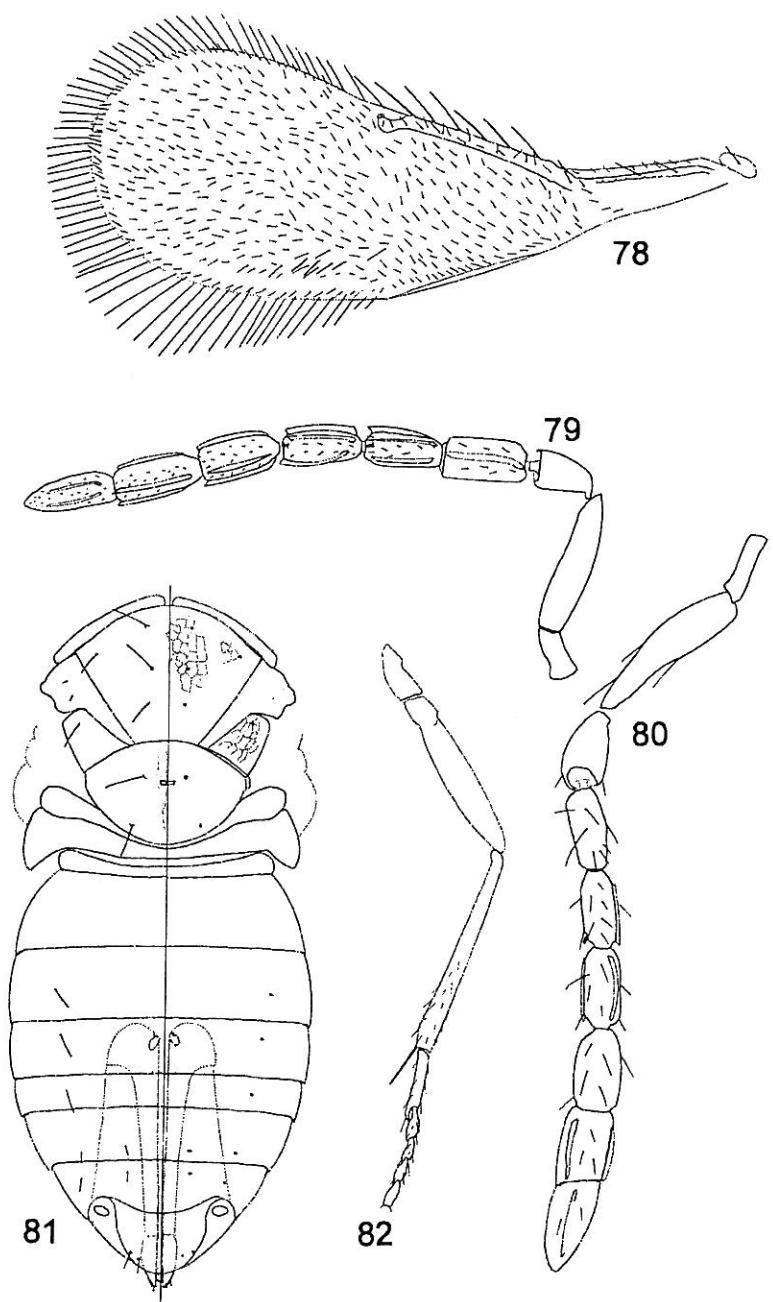
Morphology. Head including stemmaticum largely with transverse sculpture. Antennal formula 1-1-3-3. Scape 2.5× as long as pedicel; pedicel equal to F_1 ; F_1 2.25–2.4× as long as wide, equal to or slightly shorter than F_2 and F_3 respectively; F_3 , F_4 and F_5 equal in length, F_6 slightly longer (Fig. 80). Flagellum with the following numbers of longitudinal sensilla: $F_1:0$, $F_2:1-2$, $F_3:1$, $F_4:2$, $F_5:2-3$, $F_6:2-3$.

Mid lobe of mesoscutum with 4–5 pairs of setae arranged as: 2+2, 0–1+0–1, 1+1, 1+1. Distance between the anterior pair of scutellar setae 0.5× that between posterior pair; placoid sensilla on scutellum closely placed, separated by less than their own maximum diameter. Fore wing (Fig. 78) 2.6–2.7× as long as wide. Wing disc uniformly setose, with a conspicuous area of long setae near the hind margin; without an asetose area below stigmal vein. Marginal fringe 0.35× as long as width of wing. 2 setae on submarginal vein, 7–9 setae on anterior margin of marginal vein, 4–7 setae in basal area, 8–9 setae in costal cell, 2 parastigmal setae. Tarsal formula 5-5-5. Basitarsus of middle leg 0.3× as long as corresponding tibia; Mid tibial spur 0.55–0.6× as long as corresponding basitarsus (Fig. 82).

Gastral dorsum with imbricate lateral margins on GT_{I-IV} , GT_{I-VII} with 0+0, 1+1, 1+1, 2+2, 2+2 and 4 setae, respectively. Ovipositor shorter than middle tibia and basitarsus combined, third valvula 0.30× as long as second valvifer and 0.24× as long as ovipositor.

Male

Head yellow with occiput brown. Mesosoma largely dark yellow with pronotum, anterior margin of mid lobe, axillae and



Figs 78–82 *Encarsia sophia* (Girault & Dodd): 78. Wing. 79. Male antenna. 80. Female antenna. 81. Meso- and metasoma. 82. Mid leg.

propodeum brown. Metasoma dark brown. Morphology similar to that of female except the following: Antenna (Fig. 79) with F_5 and F_6 separated, each flagellar segment with 4–5 longitudinal sensilla.

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

Hosts in Macaronesia: *Aleurothrixus floccosus*, *A. proletella*, *B. tabaci*-complex, *T. vaporariorum*.

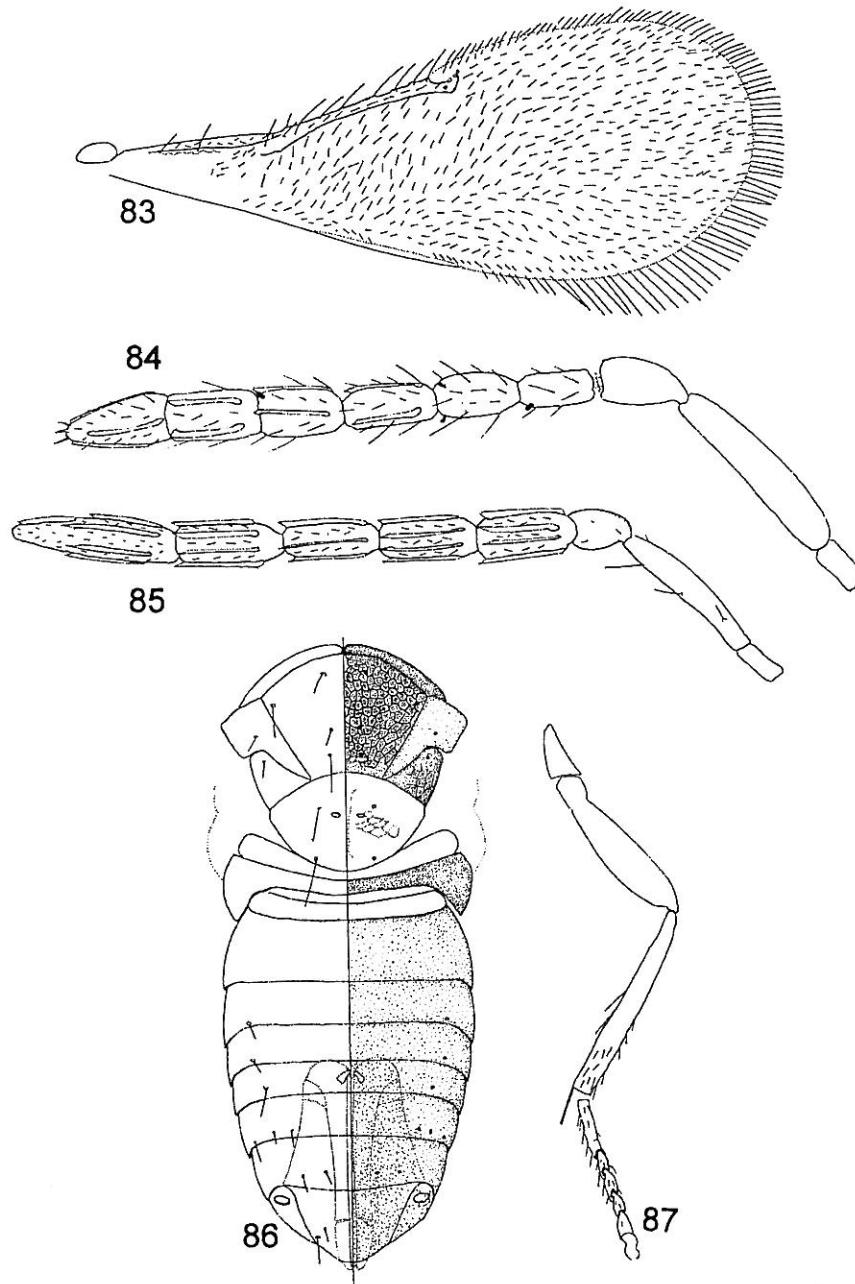
Other recorded hosts: *Aleurocybotus indicus* David & Subramaniam, *Aleurodicus dispersus*, *Bemisia afer* (Priesner & Hosny), *Dialeurodes citri*, *Parabemisia myricae* (Kuwana),

Pealius longispinus Takahashi, *Trialeurodes ricini*, *T. vaporariorum*.

Distribution: CANARY ISLANDS: Lanzarote (new record), Fuerteventura (new record), Gran Canaria (new record), Tenerife, La Gomera (new record).

Distribution outside Macaronesia: Virtually cosmopolitan, introduced into USA.

Remarks: *Encarsia sophia* (as *E. transvena*) has been only recently recorded from Europe (Viggiani, 1994; Booth & Polaszek, 1996). Although apparently cosmopolitan, recent



Figs 83–87 *Encarsia tricolor* Förster: 83. Wing. 84. Female antenna. 85. Male antenna. 86. Meso- and metasoma. 87. Mid leg.

morphometric and cytological studies (M. Giorgini, pers. comm.) suggest that *E. sophia* clearly consists of a complex of cryptic species.

Prospaltella (Doloresia) conjugata Mercet, 1921:307 (mis-spelling).

Encarsia tricolor Förster; Viggiani, 1987a:165–166.

Encarsia tricolor Förster (Figs 83–87)

Encarsia tricolor Förster, 1878:66. HOLOTYPE ♀: [lost] *Prospalta coniugata* Masi, 1908:146. Synonymy by Mercet, 1930a:193.

Prospaltella conjugata (Masi); Mercet, 1912:187–189 (misspelling).

Diagnosis

Female

Colour. Head brown with stemmaticum yellow. Mesosoma largely brown with lateral margins of mid lobe and side lobes of mesoscutum dark yellow-orange and scutellum pale yellow. Metasoma dark brown. Antennae and legs pale yellow. Wings hyaline with infuscation below marginal vein.

Morphology. Stemmaticum with striate sculpture. Antennal formula 1-1-3-3. Scape 2.4× as long as pedicel; the latter subequal in length to F₁; F₁ 2.2× as long as wide; F₂ intermediate between F₁ and F₃, 2.3× as long as F₁ and 0.9× as long as F₃; F₄ slightly shorter than F₃. Clava 1.1× as long as funicle (Fig. 84). Flagellum with the following numbers of longitudinal sensilla: F₁:1 F₂:2-3, F₃:3, F₄:3, F₅:3-4, F₆:3-4; having 2-3 pit-like sensilla on the first flagellum segments.

Mid lobe of mesoscutum with 4 pairs of setae arranged as: 2+2, 1+1, 1+1. Scutellum with 2 pairs of setae; distance between the anterior and posterior pair of scutellar setae similar. Sculpture of mid lobe, axillae and scutellum reticulate (Fig. 84). Fore wing (Fig. 83) 2.60-2.65× as long as wide. Wing disc uniformly setose. Marginal fringe short, 0.17× disc width. 2 setae on submarginal vein, basal area with 6-12 setae, costal cell with 9-11 setae, 6-7 setae on anterior margin of marginal vein, 2 parastigmal setae. Tarsal formula 5-5-5. Mid tibia (Fig. 87) 3.8× as long as corresponding basitarsus; mid tibial spur 0.7× as long as corresponding basitarsus. Mid tibia with short spines distally.

Gastral dorsum with imbricate lateral margins on GT_{1-IV}, GT_{V-VII} with 0+0, 1+1, 1+1, 1+1, 3+3, 2+2, 4 setae respectively. Third valvulae 0.26-0.27× as long as ovipositor, with one pair of medial setae and 3-4 pairs of apical setae.

Male

Colour similar to that of female but darker. Fore wings with dark infuscation below marginal vein. Morphology similar to that of female except genitalia and the following characters: Antenna (Fig. 85) 7-segmented with F₅ and F₆ fused; each flagellum segment with 5-6 longitudinal sensilla, except F₅-F₆ which have 8 longitudinal sensilla.

Species-group placement: *E. tricolor* has been placed in the *Encarsia tricolor* species-group *sensu* Viggiani & Mazzzone (1979).

Hosts in Macaronesia: *Aleyrodes proletella*, *A. singularis*, *Bemisia tabaci*-complex, *Trialeurodes vaporariorum*.

Other recorded hosts: *Aleurotuba jelineki* (Frauenfeld), *Aleyrodes elevatus*, *A. ionicae*, *A. philadelphi*, *Bemisia* sp., *Dialeurodes citri*, *Pealius azaleae*, *Tetraleurodes hederae* Goux.

Distribution: CANARY ISLANDS: Fuerteventura (new record), Gran Canaria, Tenerife, La Palma (new record). MADEIRA, AZORES (new record): São Miguel.

Distribution outside Macaronesia: Palaearctic: widespread.

Remarks: *E. tricolor* is a biparental species with a very wide range of hosts. Studies on its biology have been carried out by Arzone (1976; 1977); Avilla & Copland (1987, 1988); Avilla et al. (1991).

Genus *Eretmocerus* Haldeman

Eretmocerus Haldeman, 1850:111. Type species *Eretmocerus corni* Haldeman, 1850:111.

Ricinusa Risbec, 1951:403. Synonymized by Ferrière, 1965:170.

Diagnosis

Colour. Body largely pale in males and females, although males often with different patterns of darker infuscation. Wings hyaline, rarely with infuscation. Legs pale.

Morphology. Females with antenna 5-segmented; antennal formula 1-1-2-1; radicle long; funicle segments short and anneliform; clava long, elongate, spatulate or fusiform. Males with antennae 3-segmented, antennal formula 1-1-0-1; clava very long with numerous longitudinal sensilla. Mandibles with two teeth and a truncation or with three teeth; maxillary and labial palps one-segmented. Head longer than wide in frontal view; antennae inserted close to the mouth margin. Pronotum medially membranous. Mid lobe of mesoscutum with 2-8 setae; side lobes with 2-3 setae; axillae short, widely separated and with 1 seta; scutellum with 4 setae. Propodeum with posterior margin triangular, with one seta on each side. Fore wing variable in dimensions and shape, usually sparsely setose with marginal fringe variable in length. Marginal vein at least 2× as long as stigmal vein, with 3-4 setae; stigmal vein long with 4 sensilla; parastigma well developed; submarginal vein with 2-3 setae; wing disc with linea calva posteriorly closed by several setae; basal area setose or rarely with 1-3 setae. Hind wings narrow. Legs long and slender; tarsal formula 4-4-4; mid tibial spur usually not longer than 0.5× corresponding basitarsus. Metasoma of variable length.

Remarks

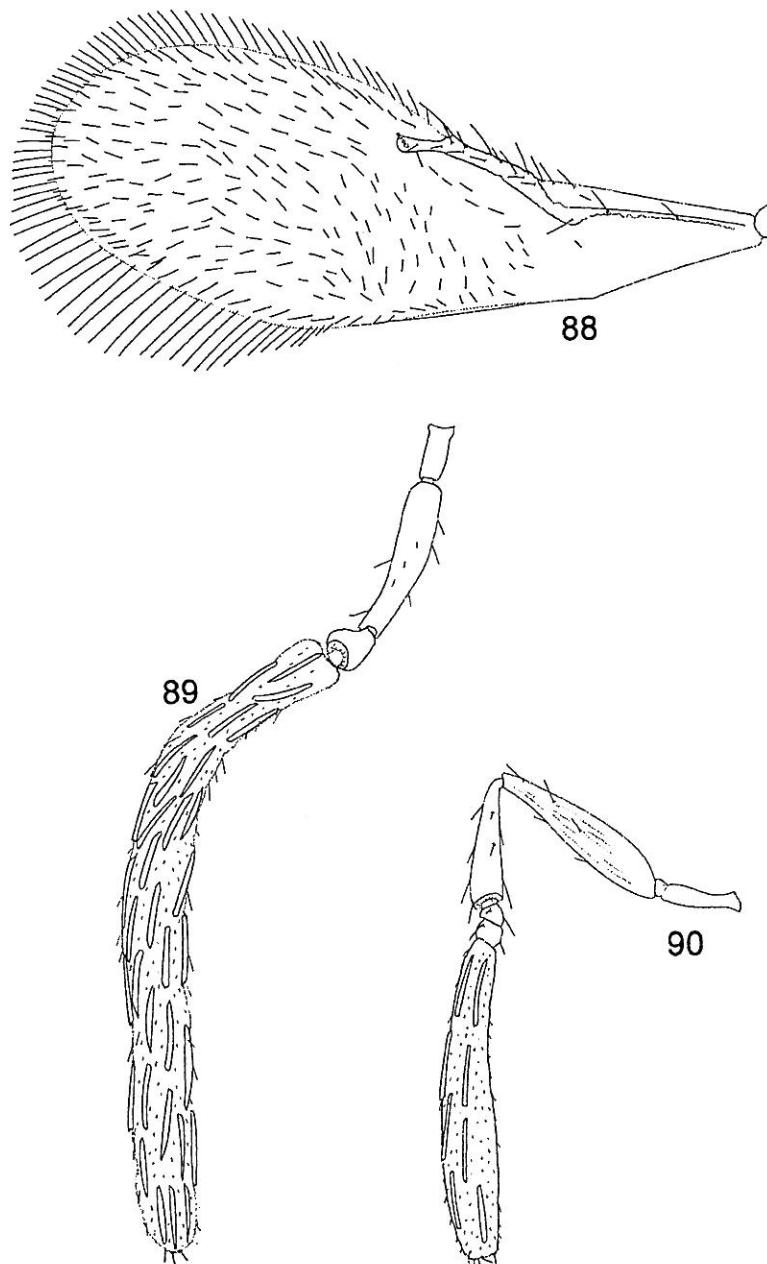
All known species of *Eretmocerus* are primary whitefly parasitoids, and many species are considered to offer great potential as effective biological control agents. There are approximately 50 species of *Eretmocerus*, described from all continents where whiteflies occur. Most *Eretmocerus* species are arrhenotokous, but thelytokous species have also been reported (De Barro et al., 2000). They are ecto-endoparasitoids; eggs are deposited underneath the whitefly larvae, and the first instar larva penetrates into the host.

Species level identification is extremely difficult. Recent works have emphasized the importance of pigment patterns of males, chaetotaxy of the habitus, and morphological differences in antennae and fore wings as significant species characters (Rose & Zolnerowich, 1997; Zolnerowich & Rose, 1998). Major recent contributions to *Eretmocerus* taxonomy have been made by Gerling (1972), Hayat (1972, 1998), Khan & Shafee (1980), Viggiani & Battaglia (1983), Rose & Zolnerowich (1997), Zolnerowich & Rose (1998) and De Barro et al. (2000). For a detailed explanation of terminology and diagnosis see Rose & Zolnerowich (1997).

Eretmocerus eremicus Rose & Zolnerowich (Figs 88-90)

Eretmocerus eremicus Rose & Zolnerowich, 1997:10-14.

HOLOTYPE ♀: USA. Arizona, Phoenix, iii.91 (G. Butler), ex *Bemisia tabaci* on *Gossypium hirsutum* (USNM, not examined; paratypes examined).



Figs 88–90 *Eretmocerus eremicus* Rose & Zolnerowich: 88. Wing. 89. Male antenna. 90. Female antenna.

Diagnosis

Female

Colour. Body pale yellow. Head yellow with ocelli red. Mesosoma and metasoma largely yellow. Legs paler than body with tarsal claws darker. Antennae yellow with pedicel and flagellum slightly darker. Fore wings hyaline.

Morphology. This species can be distinguished by a combination of the following characters: 6 setae on the mesoscutum; antenna (Fig. 90) with first funicular segment triangular, slightly shorter ventrally than the second funicular segment; female clava 6.5–7.3× as long as wide, with dorsal and ventral

surfaces parallel and the apex truncate. Gastral tergites usually with one pair of lateral setae. See Rose & Zolnerowich (1997) for a detailed description.

Male

Colour darker than in female. Antennal radicle and scape of the same colour as face, pedicel darker. Body largely yellow with pronotum, anterior margin of mesoscutum and propodeum fuscous. Metasoma dark yellow to orange brown dorsally. Legs yellow, with hind tibia fuscous.

Hosts in Macaronesia: *B. tabaci*-complex, *T. vaporariorum*.

Other recorded hosts: *Bemisia tabaci*-complex, *T. vaporariorum*, possibly *T. abutiloneus* (Haldeman) (Rose & Zolnerowich, 1997).

Distribution: CANARY ISLANDS: released in Tenerife and Gran Canaria, but extent of establishment not yet known (see 'Remarks', below).

Distribution outside Macaronesia: Nearctic: USA. Also widely distributed and released by biocontrol companies, hence its precise present distribution is unknown.

Remarks: *Eretmocerus eremicus*, often misidentified in the past as *E. californicus* or *Eretmocerus* sp. nr *californicus*, has been included in this study as it is being imported and released inundatively in the Canary Islands for biological control of mixed populations of *B. tabaci*-complex and the greenhouse whitefly *T. vaporariorum*. Nevertheless, it has not yet been found outside agricultural situations. *E. eremicus* is commercially available from suppliers of beneficial organisms, and is used to control populations of *B. tabaci*-complex or *T. vaporariorum* in commercial tomato greenhouses. It has been evaluated in commercial poinsettia greenhouses for biological control of the *B. tabaci*-complex (Hoddle *et al.*, 1999; van Driesche *et al.*, 1999).

Eretmocerus eremicus can be readily distinguished from native *Eretmocerus* species by the chaetotaxy, as all native species recorded for Macaronesia have only 4 setae on the mesoscutum, in contrast with *E. eremicus* which has 6.

Eretmocerus mundus Mercet (Figs 91–93)

Eretmocerus mundus Mercet, 1931:395. LECTOTYPE ♀:
SPAIN, Jaen, Beas de Segura, La Mesa (MCNM, examined).

Eretmocerus corni Haldeman, Masi, 1909:21. Misidentification.

Eretmocerus masii Silvestri, 1934:404. *Nomen nudum*
Identified as *E. mundus* by Viggiani, 1965.

Eretmocerus aligarhensis Khan & Shafee, 1980:365. Synonymized by Hayat, 1998.

Eretmocerus longipilus Khan & Shafee, 1980:366. Synonymized by Hayat, 1998.

Eretmocerus mundus Mercet; Gerling, 1972:156; Hayat, 1972:104; Viggiani & Battaglia, 1983:99; Rivnay & Gerling, 1987:472; Zolnerowich & Rose, 1998:318 lectotype designation.

Diagnosis

Female

Colour. Body largely yellow. Head yellow, with ocelli red. Mesosoma yellow with pronotal collar brown. Metasoma yellow. Antennae and legs pale; distal tarsal segments darker; scape and pedicel slightly darker. Fore wings hyaline, with marginal vein darker.

Morphology. Antennal formula 1-1-2-1. Radicle long. Scape 2.5× as long as pedicel which is 0.3× as long as the clava. F_1 1.3× as long as wide; dorsal surface 0.76× as long as ventral surface; F_2 also subtrapezoidal, 1.3× as long as wide. F_1 and F_2 equal in length ventrally. Clava

length 6.3× maximum width and 5.5× as long as funicle (Fig. 92).

Mid lobe of mesoscutum with four setae. Scutellum with two pairs of setae equal in length; distance between anterior pair 1.4× that between posterior pair. Anterior half of mid lobe with reticulate sculpture and elongate sculpture marginally; scutellum with longitudinally elongate sculpture. Fore wing (Fig. 91) length 2.8× maximum width. Wing disc sparsely setose, with speculum and linea calva present below stigmal vein. Basal area with 0–1 seta; costal cell with 3–4 setae distally; 3–4 setae on anterior margin of marginal vein; 2–3 parastigmal setae. Marginal fringe long, 0.2× disc width on its anterior margin and 0.4× disc width on its posterior margin. Stigmal vein less than half the length of marginal vein. Mid tibial spur 0.33× as long as corresponding basitarsus.

GT_{I-VII} with 1+1, 1+1, 1+1, 1+1, 1–2+1–2, 1+1 and 4 setae respectively. Ovipositor slightly longer than mid tibia.

Male

Colour generally darker than female. Head pale. Mesosoma largely pale, with anterior margins of scutellum and mid lobe of mesoscutum with brown infuscation. Metanotum pale, only slightly fuscous laterally. Metasoma pale with faint infuscation on dorsal GT_{I-IV} . Antennae with pedicel and clava dark fuscous, longitudinal sensilla dark (Fig. 93). Wings hyaline, slightly infuscate below submarginal vein. Morphology similar to that of female except genitalia and the following characters: Antennal formula 1-1-0-1. Clava long, more than 3.5× as long as scape and more than 10.8× as long as wide (Fig. 93).

Hosts in Macaronesia: *B. tabaci*-complex, *B. afer* *sensu lato*, *T. vaporariorum*.

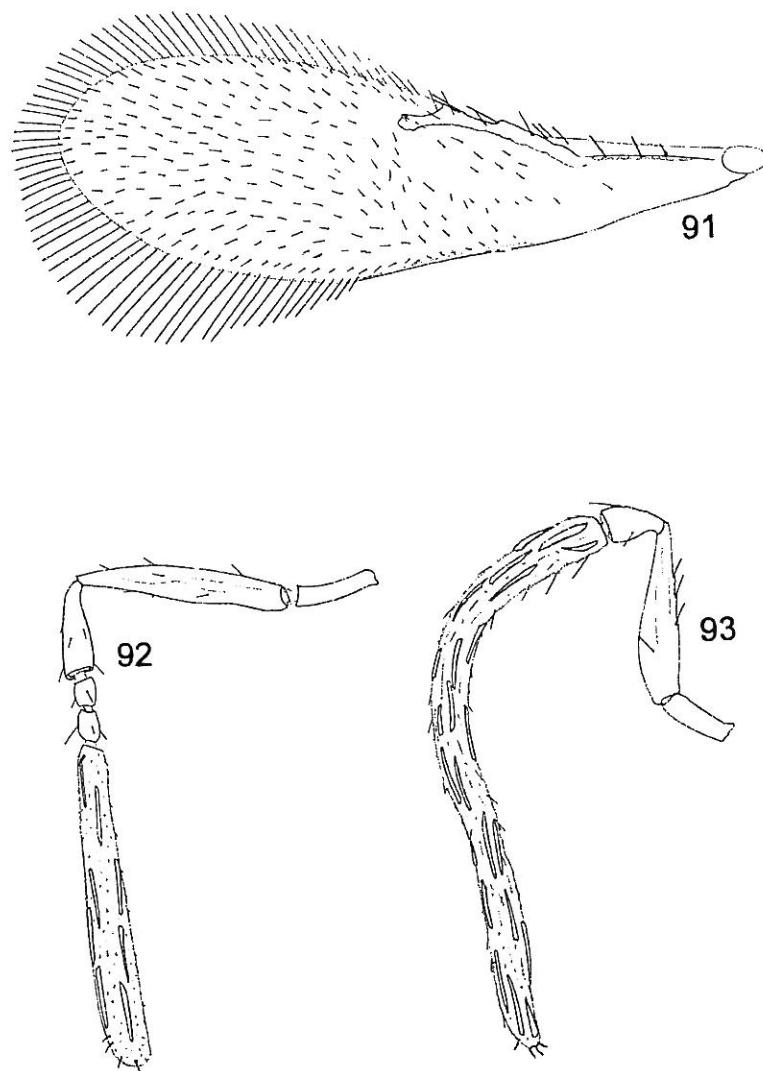
Other recorded hosts: *Asterobemisia carpini*, *Bemisia ovata*, *Neomaskellia bergii*, *Trialeurodes ricini* (Misra), *Aleyrodes* sp.

Distribution: CANARY ISLANDS: Lanzarote (new record), Fuerteventura (new record), Tenerife, La Gomera (new record), La Palma (new record). MADEIRA (new record).

Distribution outside Macaronesia: Palaearctic: widely distributed in the Mediterranean basin and Africa. Oriental: India. Nearctic: USA. Released in Arizona, California, Florida, South Carolina and Texas (Zolnerowich & Rose, 1998). A thelytokous population of *E. mundus* has been recently recorded from Australia (De Barro *et al.*, 2000).

Remarks: In the original description Mercet (1931a) assigned to *E. mundus* 2 setae on the mid lobe of mesoscutum. Recent studies of the lectotype have shown that Mercet made an error in his description, as the mesoscutum has a total of 4 setae (Zolnerowich & Rose, 1998). *Eretmocerus mundus* can be distinguished from the other *Eretmocerus* species present in Macaronesia by a combination of the following characters: the shape of the first funicular segment, which is subequal in size to the second funicular segment; a slender clava rounded at the apex in female antennae; and 2 pairs of setae on the mesoscutum.

Eretmocerus mundus is a common parasitoid of the *B. tabaci*-complex (Abdel-Fattah *et al.*, 1986; Abdel-Gawaad *et al.*, 1990 – Egypt; Kapadia & Puri, 1990 – India; Folty & Gerling, 1985 – Israel). In the Canary Islands, Cebrián *et al.* (1994) recorded *E. mundus* as the most common parasitoid of



Figs 91–93 *Eretmocerus mundus* Mercet 91. Wing. 92. Female antenna. 93. Male antenna.

the *B. tabaci*-complex. Although most populations of *E. mundus* appear to be specific to the *B. tabaci*-complex (Gering, 1972), populations of *E. mundus* from Madeira have been reared on *T. vaporariorum*, *B. tabaci* and *Bemisia afer* sensu lato.

***Eretmocerus* sp. nr *rajasthanicus* Hayat
(Figs 94–96)**

Diagnosis

Female

Colour. Body pale yellow. Tips of mandibles red-brown. Antennae and legs pale. Wings hyaline.

Morphology. Antennal formula 1-1-2-1. Scape 1.8× as long as pedicel. F_1 triangular-trapezoidal, length of ventral surface 2.5× the length of dorsal surface; F_2 longer than F_1 , 0.8× as long as wide, with dorsal and ventral surfaces subequal in length. Clava truncated distally, short, 4–5× as long as wide.

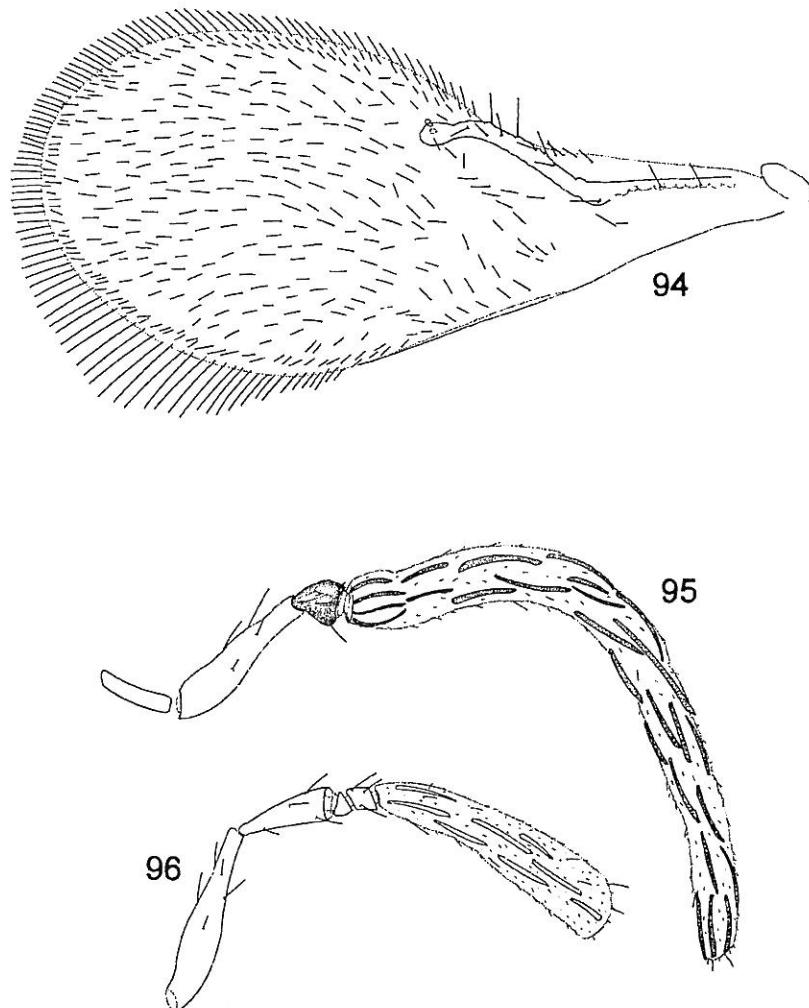
Mid lobe of mesoscutum and scutellum each with two pairs of setae. Mid lobe with reticulate sculpture, scutellum

with elongate sculpture. Distance between the anterior pair of scutellar setae slightly greater than that between posterior pair. Fore wings (Fig. 94) 2.3× as long as wide. Marginal vein short; stigmal vein 0.7–0.8× as long as marginal vein. 2–3 setae on marginal vein, 1 seta in basal area, 4–5 costal setae. Mid tibial spur slightly less than half the length of corresponding basitarsus. Ovipositor slightly longer than mid tibia.

Male

Colour darker than female; mesosoma with brown infuscation on mid lobe and scutellum. Pronotum, anterior half of mid lobe, posterior margin of scutellum and lateral sides of metanotum and propodeum dark brown. Metasoma yellow with dark bands on dorsal surface of GT_1 , GT_{IV-VI} . Wings hyaline. Antennae with pedicel red-brown and longitudinal sensilla dark brown. Morphology similar to that of female except genitalia and the following characters: Antennal formula 1-1-0-1 (Fig. 95).

Hosts in Macaronesia: *Acaudaleyrodes rachipora*, *Bemisia* sp. (*afer*-group).



Figs 94–96 *Eretmocerus nr rajasthanicus* Hayat: 94. Wing. 95. Male antenna. 96. Female antenna.

Distribution: CANARY ISLANDS (new records): Tenerife, La Gomera, La Palma.

Remarks: Specimens collected in the Canary Islands have been assigned to *E. nr rajasthanicus* on the basis of the body colour in males and females, and wing and antennal characters as follows: fore wing $2.3 \times$ as long as wide; female clava $5 \times$ as long as wide. However, the Canarian material has a slightly shorter stigmal vein and marginal fringe, and a shorter clava in females, than *E. rajasthanicus* from India (*Eretmocerus rajasthanicus* Hayat, 1976:160. HOLOTYPE ♀: INDIA, Rajasthan, Sardar Samand, i.1974 (Hayat) ex *A. rachipora* on *Prosopis juliflora* (ZSIC, not examined).

Eretmocerus nr rajasthanicus is rather close to *Eretmocerus roseni* Gerling, which is also present in the Canaries (see below). The two species can be distinguished by antennal and wing characters as follows: *E. nr rajasthanicus* females have F_2 wider than long, and fore wings comparatively broader, $2.3 \times$ as long as wide; while *E. roseni* has F_2 quadrate or slightly longer than wide, and narrower fore wings. *E. roseni* males do not have a dark antennal pedicel.

Eretmocerus roseni Gerling (Figs 97–98)

Eretmocerus roseni Gerling, 1972:158–160. SYNTYPES(?)
See below.

Eretmocerus roseni Gerling; Viggiani & Battaglia, 1983:99;
Rivnay & Gerling, 1987:472.

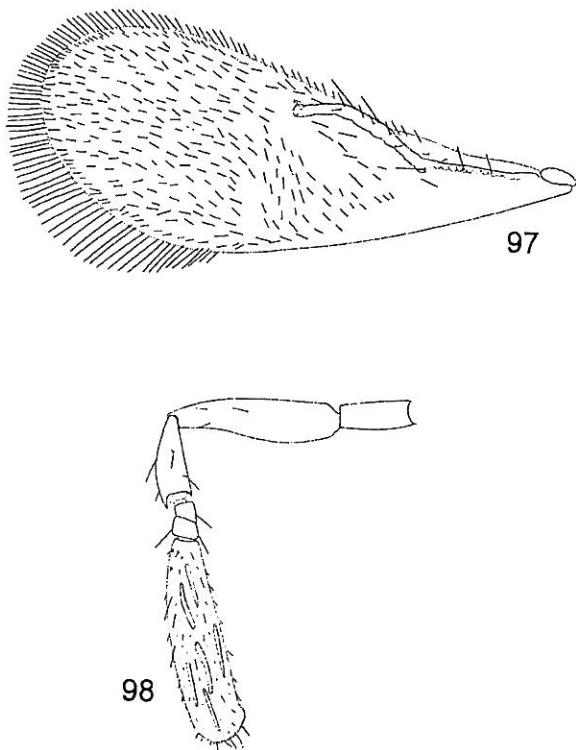
Diagnosis

Female

Colour. Largely pale yellow, scutellum faintly infuscated. Antennae and legs pale. Wings hyaline.

Morphology. Antennal formula 1-1-2-1. F_1 subtriangular, F_2 slightly wider than long (Fig. 98).

Mid lobe of mesoscutum with two pairs of setae and with reticulate sculpture centrally; scutellum with two pairs of setae and elongate sculpture. Fore wing (Fig. 97) $2.2\text{--}2.5 \times$ as long as wide. Marginal fringe $0.28 \times$ disc width. Wing disc with speculum and linea calva closed distally by a row of setae. Basal area with 2–3 setae; costal area with 5 setae; marginal



Figs 97–98 *Eretmocerus roseni* Gerling: 97. Wing. 98. Female antenna.

vein with 2–3 setae. Stigmal vein 0.8× as long as marginal vein. Ovipositor slightly longer than mid tibia.

Male

Colour generally darker than in female. Antennae pale with scape and pedicel fuscous; longitudinal sensilla brown; radicle shorter than half the length of scape. Mid lobe of mesoscutum, and scutellum, with dark infuscation; GT_{III–V} with dark infuscation. Wings hyaline with marginal vein fuscous. Morphology similar to that of female except genitalia and antennal characters.

Hosts in Macaronesia: *Acaudaleyrodes rachipora*, *Bemisia* sp. (*afer*-group).

Other recorded hosts: *Bemisia afer*.

Distribution: CANARY ISLANDS (new records): Gran Canaria, Tenerife, La Gomera, La Palma.

Distribution outside Macaronesia: Palaearctic: Israel, Italy.

Remarks: *E. roseni* has been collected developing on *A. rachipora* and associated with *E. davidi*. Gerling (1972) recorded this species as a common and widespread parasitoid of *A. rachipora*, controlling naturally its populations in Israel. In Italy, material recorded as *E. roseni* was reared from *Bemisia afer* (as *Bemisia hancocki* Corbett, which is considered a junior synonym by Bink-Moenen, 1983) (Viggiani & Battaglia, 1983). It has been also recorded as the dominant parasitoid of *A. rachipora* in citrus trees in Egypt (Abd-Rabou, 1999). Unfortunately, Gerling (1972) did not mention any type material, and it is not known whether any such material still exists.

Genus *Cales* Howard

Cales Howard, 1907:82. Type species *Cales noacki* Howard, 1907:82, by monotypy.

Diagnosis

Colour. Body largely yellow, orange or pale red.

Morphology: Legs with tarsi 4-segmented. Antennae 6-segmented in females (Fig. 100), 4-segmented in males (Fig. 101), radicle very long; male antennae with long setae. Fore wings narrow, sparsely setose, with long marginal fringe. Submarginal vein with 1 seta (Fig. 99).

Remarks

Cales species are primary parasitoids of Aleyrodidae, but *C. noacki* appears to be extremely polyphagous (see below) having been reared from aleyrodids, diaspids, ortheziids and even eggs of Lepidoptera (Polaszek, 1991).

Cales was included in Aphelinidae by Howard (1914), it was transferred to Mymaridae by Brèthes (1914) and subsequently to Trichogrammatidae by Dozier (1933). Its status was reviewed by De Santis (1948b) who included *Cales* again in Aphelinidae within the subfamily Calesinae. Hayat (1989) excluded *Cales* from Aphelinidae. In fact, the placement of several taxa currently included in the Aphelinidae is questionable, in particular *Cales*, and Eriaporinae (LaSalle *et al.*, 1997) but also *Eretmocerus*, a morphologically very distinctive genus. Molecular taxonomy, in particular sequencing the 28S ribosomal DNA, is proving useful at species- and species-group level in Aphelinidae (Babcock *et al.*, 2001; Manzari *et al.*, 2002). It is highly probable that current studies combining morphological and DNA sequence data (Woolley & Hayat, Polaszek *et al.*, in prep.) will soon resolve the phylogenetic relationships between several currently problematic genera currently included in Aphelinidae, including several of the genera attacking whiteflies, and treated here.

Cales is known from three species: *C. noacki* Howard, *Cales spenceri* Girault and *Cales orchamoplati* Viggiani & Carver.

Cales noacki Howard (Figs 99–101)

Cales noacki Howard, 1907:82. HOLOTYPE ♀: BRAZIL, Campinas (Fritz Noack) ex *Orthezia* sp. (USNM, not examined).

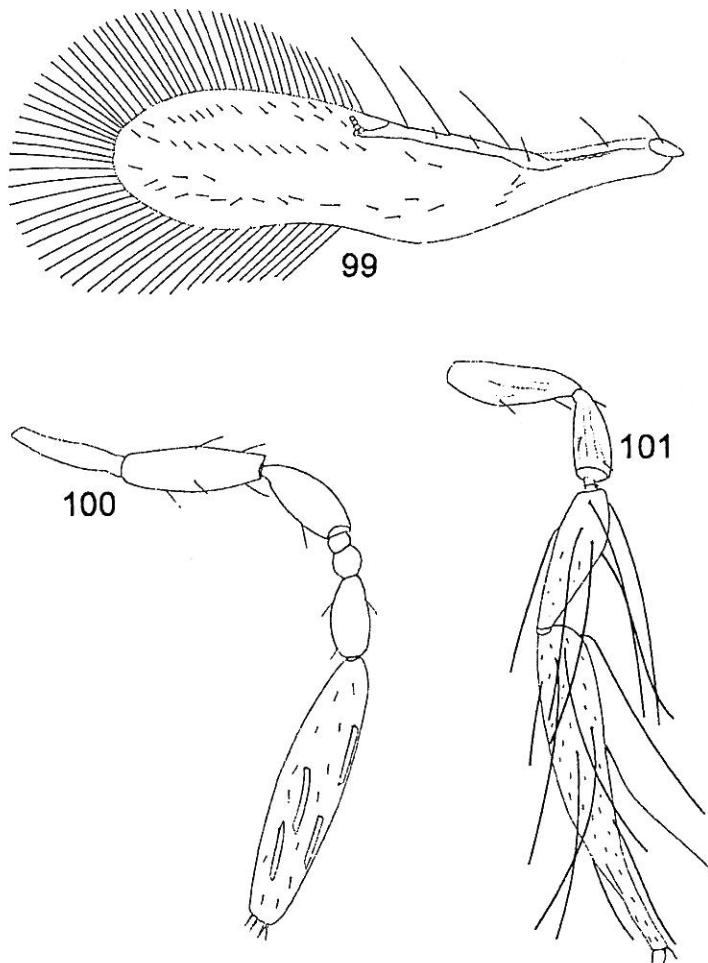
Diagnosis

Female

Colour. Body yellow. Antennae and legs pale. Wings hyaline with dark venation.

Morphology. Antennal formula 1-1-3-1. Radicle long, 0.7× as long as scape; scape 1.4× as long as pedicel. Flagellum with 3 funicle segments, the first 2 reduced (Fig. 100). F₃ 2× as long as wide. Clava elongate, 4.5× as long as wide; distally truncate and wider in its medial portion; longer than funicle and pedicel together (Fig. 100).

Mid lobe of mesoscutum and scutellum each with 2 pairs of setae. Sculpture in mesoscutum reticulate. Fore wing narrow, as in Fig. 99, 3.8× as long as wide. Wing disc sparsely



Figs 99–101 *Cales noacki* Howard: 99. Wing. 100. Female antenna. 101. Male antenna.

setose, with few parallel rows of setae. Submarginal vein with 1 seta; marginal vein with 3 long setae on anterior margin; 1 parastigmal seta. Marginal fringe long, 0.8× as long as wing width.

Male

Body largely yellow. Antennae and legs pale. Wings hyaline with dark venation. Morphology similar to that of female except genitalia and the following characters: Antenna (Fig. 104) 4-segmented, flagellar segments with very long setae.

Hosts in Macaronesia: *Aleurothrixus floccosus*, *Aleurotrachelus atratus* Hempel, *Aleurotulus nephrelepidis* Quaintance, *Bemisia afer* (*sensu lato*), *Crenidorsum aroidephagus* Martin & Aguiar.

Other recorded hosts: *Aleurocanthus woglumi* Ashby, *Aleurothrixus porteri*, *Aleurotrachelus jelineki*, *Aleurotrachelus* sp. nr. *espunae* Gómez-Menor, *Aleyrodes lonicerae*, *Tetraleurodes* sp. **Diaspididae:** *Lepidosaphes* sp., *Pseudaulacaspis pentagona* Targioni-Tozetti. **Ortheziidae:** *Orthezia* sp. **Lepidoptera:** Notodontidae: *Phalera bucephala* L.

Distribution: CANARY ISLANDS: Lanzarote (new record), Fuerteventura (new record), Gran Canaria, Tenerife, La

Gomera (new record), La Palma (new record), El Hierro (new record). MADEIRA. AZORES: São Miguel.

Distribution outside Macaronesia: Cosmopolitan.

Remarks: *C. noacki* is a Neotropical species with a very wide host range, which has been successfully introduced into many areas for the biological control of the woolly whitefly *Aleurothrixus floccosus*. This parasitoid was introduced into the Canaries in the mid 1960s for the biological control of *A. floccosus* (Rodríguez-Rodríguez, 1977a,b) and is currently widespread in the archipelago. In Madeira and the Azores it is known to play an important role in the natural control of the woolly whitefly. However, its ability to complete its development on early instars, its extremely broad host range which includes eggs of Lepidoptera, and its apparent capability of rapidly extending its range into climatically very diverse regions, suggest that it could actually be a problem to indigenous natural enemies in several ways. By outcompeting indigenous natural enemies and by attacking indigenous or even endemic hosts, *C. noacki* has the potential to cause, and may already have caused, the extinction of indigenous species.

Laudonia & Viggiani (1986) studied the morphology of the different larval stages in detail.

Eulophidae

Genus *Euderomphale* Girault

Euderomphale Girault, 1916:410. Type species *E. fuscipennis* Girault, 1916:155.
Aleurodiphagus Nowicki, 1929:154–155.

Diagnosis

Diagnostic characters are also provided and illustrated by LaSalle & Schauff (1994) and LaSalle (1999).

Colour. Head and mesosoma dark brown-black, without metallic colours.

Morphology. Head usually smooth to slightly sculptured. Frontal suture and scrobal suture absent, malar sulcus present but incomplete and extending away from the mouth margin. Antenna clavate; funicle shorter than pedicel, 2-segmented, with the first segment smaller than the second and often anelliform. Pronotum reduced and not visible in dorsal view. Mesosoma depressed, with the dorsal surface sculpture not pronounced. Mid lobe of mesoscutum usually with 2 pairs of setae. Scutellum much broader than long, with 2 pairs of setae, although the posterior pair is distinctly smaller than the anterior pair. Axillae large, as wide as long, subcircular, completely separated from mesoscutum by a sulcus. All tarsi 4-segmented. Dorsal surface of submarginal vein with two setae.

Remarks

Euderomphale is a cosmopolitan genus of whitefly parasitoids. There are fifteen described species, and major recent contributions to *Euderomphale* taxonomy have been made by LaSalle & Schauff (1994) and LaSalle (1999). Keys to regional species have been published by Erdös (1966) and Huldén (1986), and other contributions have been made by Viggiani (1977), Graham (1986) and Shafee *et al.* (1988).

Euderomphale was placed in the tribe Euderomphalini (in the subfamily Entedoninae), containing only species known to attack whiteflies, by LaSalle & Schauff (1994). Several additional genera of euderomphalines have also been described recently (Hanson & LaSalle, 2003). These were from trapped material, though can be assumed to be mostly, or all, parasitoids of Aleyrodidae. Euderomphalini was recently divided into two species groups, the *flavimedia* group and the *sinuata* group (LaSalle, 1999).

All whitefly species which are known to be hosts of *Euderomphale* belong to the subfamily Aleyrodinae. Although there are 15 described species, the only detailed biological data available are for *E. flavimedia* (Howard, 1881) and *E. chelidonii* Erdös (Gerling, 1990). Some notes on the biology of *E. secreta* Huldén were given by Huldén (1986).

Euderomphale cortinae Graham (Figs 102–107)

Euderomphale cortinae Graham, 1986:37. HOLOTYPE ♀:
MADEIRA, Caldeirao Verde, 13.viii.85 (E.M. Graham)
(BMNH, examined).

Diagnosis

Female

Colour. Head and mesosoma dark brown-black. Metasoma largely dark brown. Antenna brown with scape and pedicel fuscous. Legs largely brown, patterned as in Figs 105–107. Fore wing infuscated from base to apex of venation, the area beyond venation hyaline; venation slightly fuscous.

Morphology. Antennal formula 1-1-2-3; scape narrow, 4.5× as long as wide; clava 2.2× as long as wide (Fig. 103). Fore wing (Fig. 102) 2.3× as long as broad, postmarginal vein distinct, nearly as long as stigmal vein; marginal vein with 12 setae; without linea calva, speculum closed by a group of basal setae.

Male

Colour generally similar to that of female but somewhat darker, with a different colour pattern in the legs as follows: all coxae dark brown; fore femur basally dark brown, mid and hind femora largely dark brown; fore tibia dark laterally, mid and hind tibiae largely dark brown. In mid and hind legs all tarsal segments dark, fore leg with only the first and fourth tarsal segments dark brown. Fore wings with dark infuscation below submarginal vein; marginal vein fuscous. Morphology similar to that of female except genitalia and antennal characters. Scape of antenna 2.6× as long as broad and clearly sculptured; clava with 2–3 linear sensilla on each segment (Fig. 104).

Hosts in Macaronesia: *Bemisia afer* (*sensu lato*).

Other recorded hosts: no other recorded hosts.

Distribution: MADEIRA.

Remarks: *Euderomphale cortinae*, whose host was previously unknown, has been reared from *Bemisia afer* (*sensu lato*) collected in the laurisilva vegetation. Known only from Madeira, *E. cortinae* is readily separated from *E. gomer* by the presence of a postmarginal vein in the fore wing. *E. cortinae* differs from *E. insularis*, in which the postmarginal vein is also present, in several characters including the infuscated fore wing and colour pattern of the legs in both sexes, and much narrower antennal scape, which is about 2.6× as long as wide.

Euderomphale gomer LaSalle & Hernández sp. nov. (Figs 108–114)

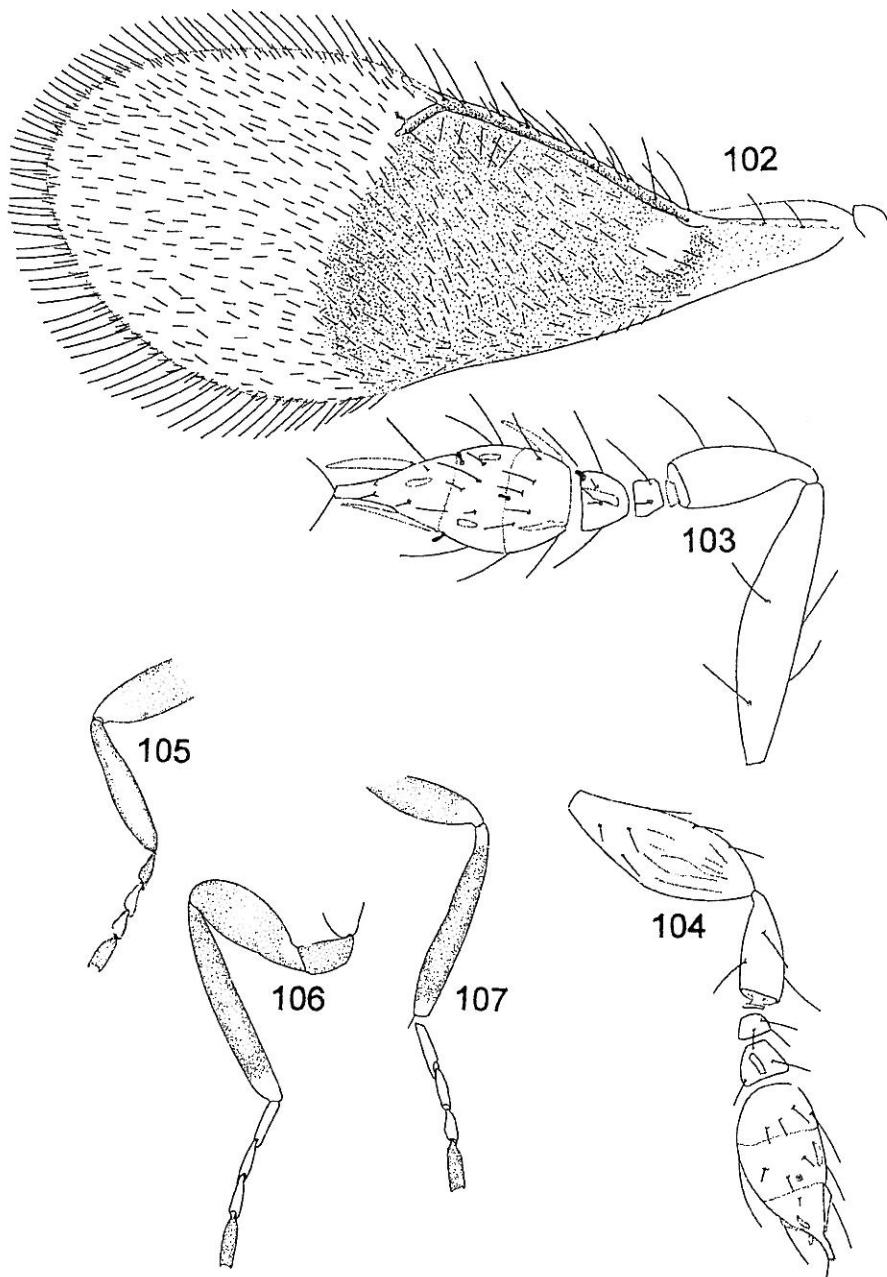
HOLOTYPE ♀: CANARY ISLANDS: La Gomera, El Cedro, 15.vi.97 (E. Hernández) ex *Bemisia afer* *sensu lato* on *Gesnouinia arborea* (BMNH).

Description

Female

Colour. Head and mesosoma dark brown-black. Antenna brown with darker scape. Metasoma dark brown; in material mounted in Canada Balsam, metasoma dark yellow with dorsal dark brown-black transverse markings as shown in Fig. 111. Colour pattern of legs as in Fig. 113. Fore wing lightly infuscated from base to apex of venation, the disc beyond venation hyaline. Marginal vein fuscous.

Morphology. Antennal formula 1-1-2-3. Scape only moderately swollen, 4× longer than wide and 1.8× as long as pedicel; F_1 anelliform, 4× wider than long; F_2 about 1.4×



Figs 102–107 *Euderomphale cortinae* Graham: 102. Wing. 103. Female antenna. 104. Male antenna. 105–107. Female fore, mid and hind legs.

wider than long; length of clava $2.2 \times$ its maximum width, with 1–3 longitudinal sensilla on each segment (Fig. 110). Fore wing as in Fig. 108. $2.2 \times$ as long as wide; postmarginal vein not developed; marginal fringe of fore wing comparatively long, $0.2 \times$ the maximum width of wing disc; 2 setae on submarginal vein, marginal vein with 10 long setae.

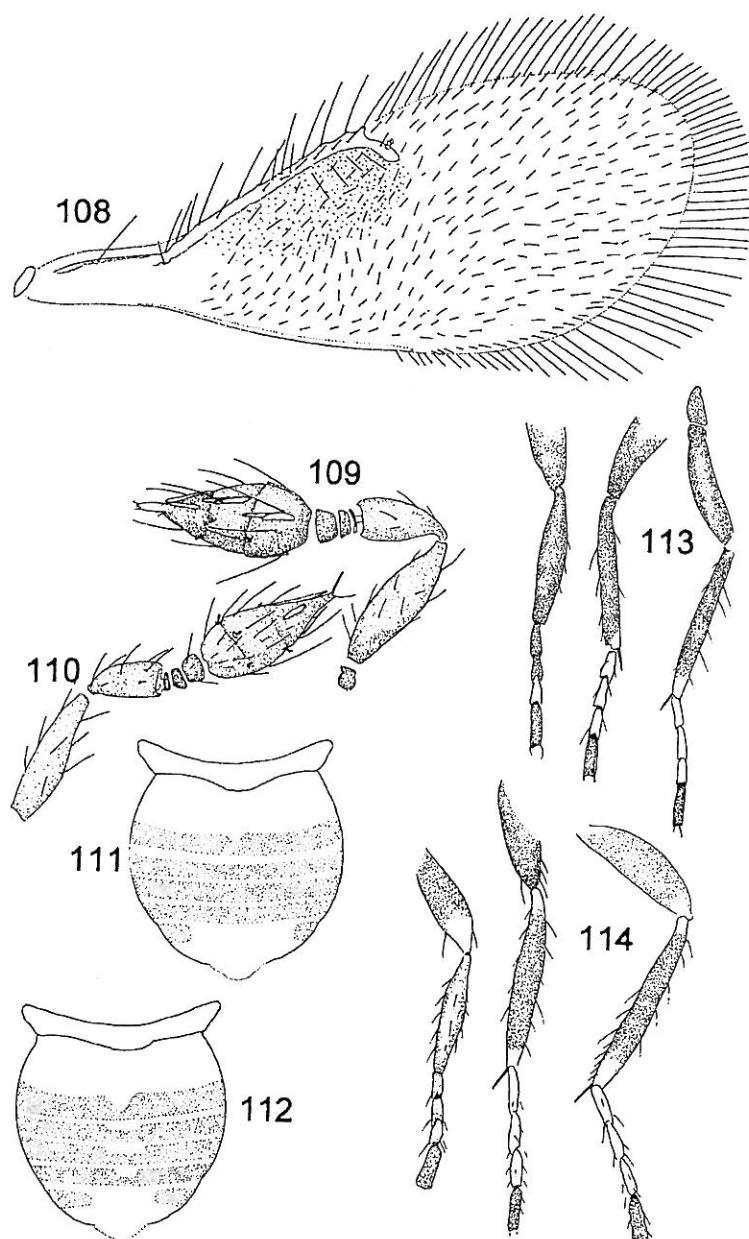
Male

Colour generally similar to that of female but darker, with a different colour pattern on the legs (Fig. 114). Femora and tibiae dark brown, pale at the ends; four tarsal segments of fore leg dark, middle and hind legs with only fourth tarsal

segment dark brown; in material mounted in Canada Balsam metasoma as shown in Fig. 112. Wings with faint infuscation below submarginal vein; marginal vein fuscous. Morphology similar to that of female except genitalia and antennal characters. Antenna with scape moderately swollen, $3.3–3.4 \times$ as long as wide, $1.7 \times$ the length of pedicel; F_1 anelliform, $2.2–2.3 \times$ as wide as long; F_2 trapezoidal, $1.3 \times$ as wide as long; clava $2 \times$ as long as wide, with 3–4 linear sensilla on each segment.

Hosts in Macaronesia: *Aleyrodes singularis*, *A. proletella*, *Bemisia afer* sens. lat., *B. medinae*, *Bemisia* sp.

Distribution: CANARY ISLANDS: Tenerife, La Gomera, La Palma. AZORES: São Miguel.



Figs 108–114 *Euderomphale gomer* LaSalle & Hernández sp. n.: 108. Wing. 109. Male antenna. 110. Female antenna. 111. Female metasoma. 112. Male metasoma. 113. Male fore, mid and hind legs (l–r). 114. Female fore, mid and hind legs (l–r).

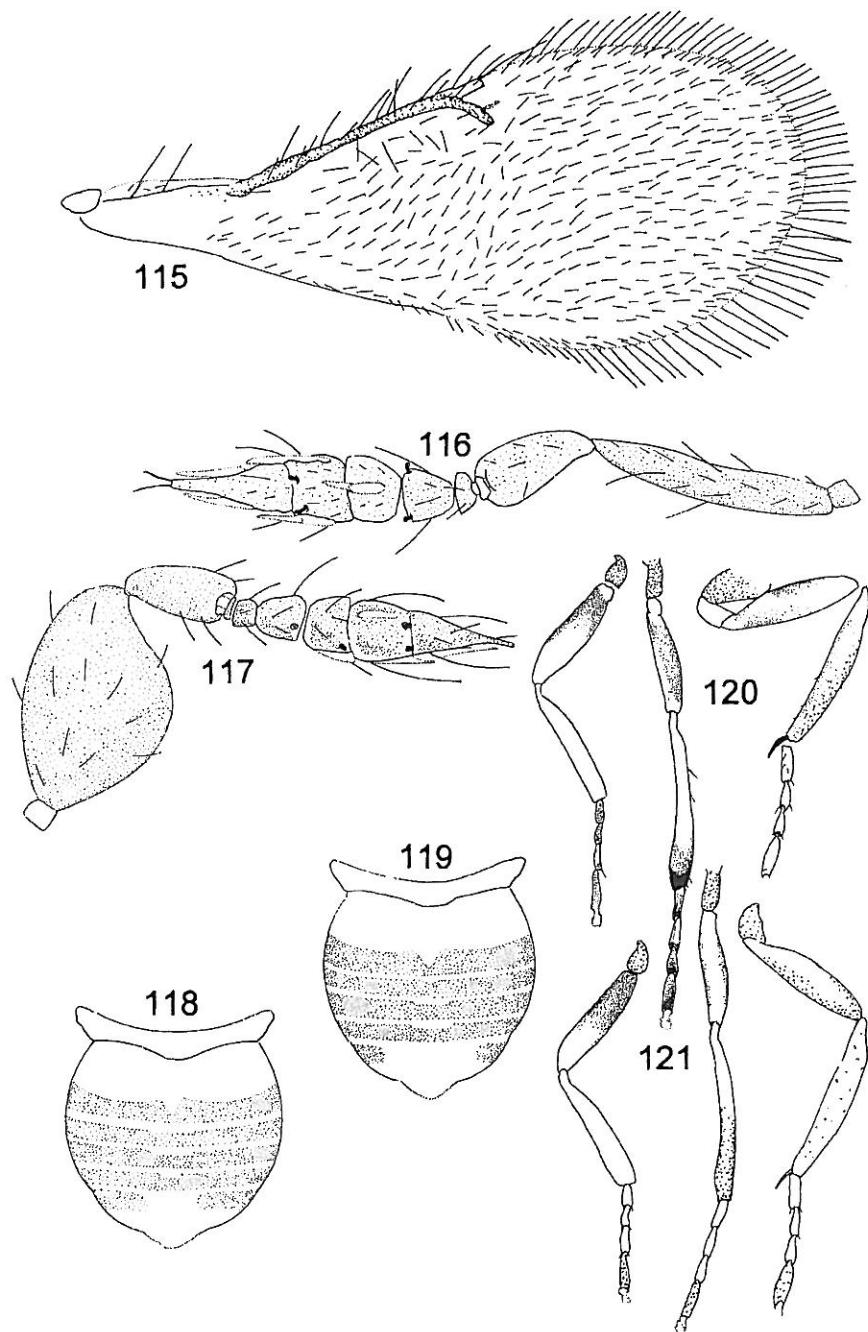
Remarks: *Euderomphale gomer* is readily distinguished from the other two species of the genus treated here by the absence of a postmarginal vein and presence of a relatively narrow male antennal scape. It resembles *E. bemisiae* Viggiani, another European species in which the postmarginal vein is also absent, and which also parasitizes the *Bemisia afer* species-group (Viggiani, 1977). The two species can, however, be separated by the shape of the male antenna in which the scape is much broader in *E. bemisiae* than in *E. gomer*.

Euderomphale gomer, both sexes of which develop as primary parasitoids, has a wide host range and has been generally found to be associated with laurisilva vegetation. Aleyrodid puparia from which *E. gomer* have emerged can be

easily separated from those parasitized by species of *Encarsia*, *Amitus* or *Eretmocerus* by their lemon-yellow colour and the large, irregularly shaped emergence hole. A red meconium is deposited below the vasiform orifice by *E. gomer*. This can be used to distinguish puparia parasitized by this species and *E. insularis*, which does not leave a meconium.

Euderomphale insularis LaSalle & Hernández sp. nov. (Figs 115–121)

HOLOTYPE ♀: CANARY ISLANDS: La Gomera, San Sebastian, 15.vi.97 (E. Hernández) ex *Aleyrodes proletella* on *Lactuca serriola* (BMNH).



Figs 115–121 *Euderomphale insularis* LaSalle & Hernández sp. n.: 115. Wing. 116. Female antenna. 117. Male antenna. 118. Female metasoma. 119. Male metasoma. 120. Male fore, mid and hind legs (l–r). 121. Female fore, mid and hind legs (l–r).

Description

Female

Colour. Head and mesosoma dark brown-black. Antenna brown with scape darker and flagellum paler. Metasoma brown; in material mounted in Canada Balsam, metasoma dark yellow with dorsal dark brown-black transverse markings as shown in Fig. 118. Colour pattern of legs as shown in Fig. 121; fore femur basally dark brown, mid femur darkened laterally; fore, mid and hind tibiae pale. Fore wing hyaline.

Morphology. Antennal formula 1-1-2-3. Scape 4× longer than wide and 1.8× as long as pedicel; F_1 transverse; F_2 quad-

rate; length of clava about 3× its maximum width, with 1–3 longitudinal sensilla on each segment (Fig. 116). Mesoscutum with faint sculpture. Fore wing as in Fig. 115, 2.2× as long as wide; postmarginal vein present; marginal fringe 0.2× the maximum width of wing disc; 2 setae on submarginal vein.

Male

Colour generally similar to female but darker, with a different colour pattern on the legs (Fig. 120). Fore femur basally dark brown, mid femur largely dark brown, hind femur pale with dark infuscation; mid tibia apically dark brown; four tarsal

segments of fore and mid legs dark brown. Metasoma, in material mounted in Canada Balsam, as shown in Fig. 119. Wings hyaline, marginal vein fuscous. Morphology similar to that of female except genitalia and antennal characters. Scape of antenna strongly swollen, length $1.4 \times$ its width and $2 \times$ the length of the pedicel; F_1 $1.2 \times$ as wide as long; F_2 distinctly longer than wide; clava more than $3 \times$ as long as wide, with 3–4 linear sensilla on each segment (Fig. 117).

Hosts in Macaronesia: *Aleyrodes proletella*.

Distribution: CANARY ISLANDS: Lanzarote, La Gomera, La Palma.

Remarks: *E. insularis* is very close to *Euderomphale secreta*, described by Huldén (1986) parasitizing *Aleurochiton aceris* in Finland, but differs in the colour pattern of legs in both sexes and lacking clear sculpture on the male scape.

Platygastridae

Genus *Amitus* Haldeman

Amitus Haldeman, 1850. Type species *Amitus aleurodinis* Haldeman, 1850, by monotypy.

Diagnosis

Colour. Body largely dark brown-black. Legs and antennae dark brown.

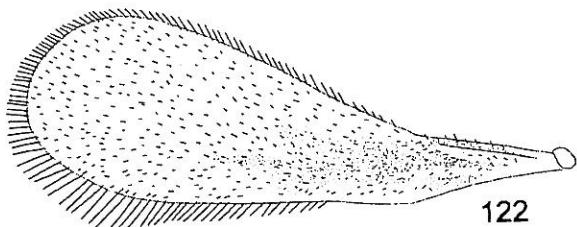
Morphology. Small, robust insects. Mesoscutum dorsoventrally flattened, with notauli well developed. Propodeum with foam-like structures. Metasoma moderately sclerotized. Gastral tergite III of mesosoma distinctly longer than other metasomal tergites, several times longer than tergite IV. Fore wing with reduced venation, without marginal, stigmal and postmarginal veins. Pterostigma absent. Male antenna 10-segmented, with a specialized sensory/secretory area on fourth antennal segment; female antenna 8-segmented, with the clava unsegmented.

Remarks

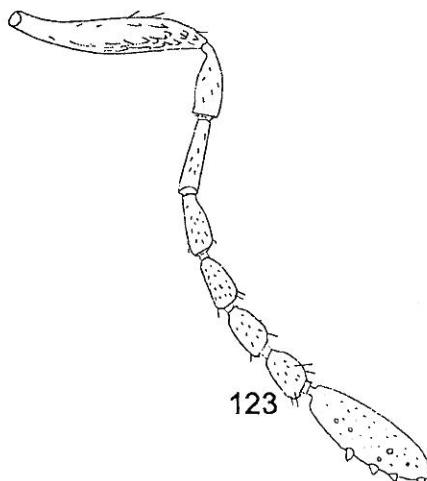
Amitus is a taxonomically poorly known genus. Species of *Amitus*, together with the Oriental genus *Aleyroctonus*, are the only known primary endoparasitoids of Aleyrodidae among the Platygastridae. *Amitus* has a cosmopolitan distribution, and several species, e.g. *Amitus hesperidum* Silvestri and *Amitus spiniferus* (Brèthes), have been used in classical biological control programmes (Viggiani 1991; Polaszek 1997b). About 15 species have been described, with major recent contributions by MacGown & Nebeker (1978), Viggiani & Mazzone (1982), Viggiani (1997) and Viggiani & Evans (1992). MacGown & Nebeker (1978) proposed the presence of a plate-like process on the outer side of the fourth antennal segment of males as a reliable character for species group identification. Species of *Amitus* are proovigenic, with a very short adult lifespan.

Amitus fuscipennis MacGown & Nebeker (Figs 122–123)

Amitus fuscipennis MacGown & Nebeker, 1978:281.
HOLOTYPE ♀: COSTA RICA, Cerro Las Vueltas, 8.x.1972 (USNM, not examined).



122



123

Figs 122–123 *Amitus fuscipennis* MacGown & Nebeker: 122. Wing,
123. Female antenna.

Amitus fuscipennis MacGown & Nebeker; Viggiani, 1991:177; 1997:97.

Diagnosis

Female

Colour. Body dark brown to black. Antennae and legs dark brown. Wings hyaline with dark infuscation in basal area.

Morphology. Head as long as wide in dorsal view; vertex in front view forming a low arc. Ocelli placed in an obtuse-angled triangle, the lateral ocelli closer to median ocellus than to eyes. Area between antennal toruli smooth. Mandibles with two teeth. Maxillary palps 1-segmented; labial palps reduced. Antennal formula 1-1-5-1. Antenna (Fig. 122) with radicle long; scape fusiform, $4.5 \times$ as long as wide; pedicel equal in length to F_1 , $2.3\text{--}2.5 \times$ as long as wide. Flagellar segments long and loosely connected. F_1 $3.6 \times$ as long as wide; F_2 to F_5 gradually shorter and wider. F_5 $1.6 \times$ as long as wide. Clava ovoid, $2.5 \times$ as long as wide with 4 basiconic, robust sensilla on the interior margin. Antennal pubescence almost spine-like, especially near the ends of the segments.

Mid lobe of mesoscutum with imbricate sculpture at anterior margin, smoother in the posterior half; notauli present. Mesopleura smooth. Fore wing (Fig. 122) long, $2.9\text{--}3.0 \times$ as long as wide; without submarginal, marginal and postmarginal veins; marginal fringe short, $0.2 \times$ as long as width of wing disc. Tarsal formula 5-5-5. Mid tibia $2.7 \times$ as long as corresponding basitarsus. First gastral tergite short, with 5–6 longitudinal carinae placed centrally; second gastral tergite wider; following gastral tergites becoming smaller.

Male

Recorded in Macaronesia so far only from Madeira.

Colour and morphology similar to that of female except genitalia and the following characters: wing disc with darker infuscation below marginal vein. Antennae 10-segmented; scape narrow, $5.5 \times$ as long as wide; length of pedicel equal to that of F_1 ; F_2 slightly longer and wider than F_3 ; F_4 and remaining funicular segments becoming gradually shorter and broader; clava 2-segmented with both segments totally fused, shorter than F_5 and F_6 combined. Genitalia similar in shape to those of other *Amitus* species, digitis as long as wide.

Hosts in Macaronesia: *T. vaporariorum*.

Other recorded hosts: None.

Distribution: CANARY ISLANDS (new record): Tenerife. MADEIRA.

Distribution outside Macaronesia: Palaearctic: Europe. Neotropical: widespread in South and Central America.

Remarks: *Amitus fuscipennis* was originally described from the female sex by MacGown & Nebeker (1978) and re-described by Viggiani (1991) after its introduction to Italy for the biological control of *T. vaporariorum*. The male was first described by Viggiani (1997). *Amitus fuscipennis* can be distinguished from its congeners by the long, loosely connected antennal segments, rounded vertex, absence of sculpture in the area between the antennae, and fore wings that are deeply infuscated basally.

As far as is known, *A. fuscipennis* normally reproduces by thelytoky and males are rare. It is an effective parasitoid of *T. vaporariorum* in Central and South America and has been shown to be more efficient than *Encarsia formosa* in controlling this whitefly at lower temperatures (Manzano et al., 2000). The biology of *A. fuscipennis* has been studied by Medina et al. (1994) and Manzano et al. (2000).

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Appendix 1. List of material examined

Superfamily Chalcidoidea

Family Aphelinidae

Genus Encarsia Förster

Encarsia acaudaleyrodis Hayat

Material examined (all BMNH): *CANARY ISLANDS*: LANZAROTE: 1♀2♂ Playa Blanca, 4.i.97 (E. Hdez.) ex *Acaudalerodes rachipora* on *Euphorbia balsamifera*; 2♀3♂; same data but 3.v.97; 1♀1♂ same data but 30.xii.97 ex *A. rachipora* on *Euphorbia regis-jubae*; FUERTEVENTURA: 1♂ Nuevos Horizontes, 5.v.97 (E. Hdez.) ex *B. tabaci* complex on *Lantana camara* L. GRAN CANARIA: 1♀ Mogan, 12.viii.97 (E. Hdez.) ex *B. tabaci* complex on *Poinsettia pulcherrima*. LA PALMA: 1♂ Los Llanos, 15.x.96 (E. Hdez.) ex *B. tabaci* complex on *Ipomoea batatas*.

Encarsia atlantica Polaszek and Hernández sp. nov.

Material examined: HOLOTYPE: *CANARY ISLANDS*: TENERIFE: 1♀ Bco. de Badajoz, 1.v.98 (E. Hdez.) ex *Aleyrodes* sp. on *Bencomia caudata*. (BMNH). PARATYPES: 6♀; same data as Holotype (BMNH, ICIA). Additional material: 2♀ Bco. de Badajoz, 11.i.98 (E. Hdez. and A. Polaszek) ex *Aleyrodes* sp. on *B. caudata* (ICIA, BMNH).

Encarsia azimi Hayat

Material examined (all BMNH): *CANARY ISLANDS*: LANZAROTE: 2♀ Haría, 4.i.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 1♀ San Bartolomé, 27.xii.94 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*. FUERTEVENTURA: 2♀ La Lajita, 2.viii.95 (E. Hdez.) ex *T. vaporariorum* on unknown plant.

Encarsia davidi Viggiani & Mazzone

Material examined: *CANARY ISLANDS*: LANZAROTE: 6♀2♂ Playa Blanca, 3.v.97 (E. Hdez.) ex *A. rachipora* on *E. balsamifera* (BMNH); 2♀1♂ same data but 10.iii.97 (ICIA); 1♀ same data but 29.xi.96 (ICIA). TENERIFE: 1♀ 23.v.97 (J.H. Martin & A. Polaszek) ex *A. rachipora* (BMNH). LA GOMERA: 1♀1♂ Bco. de Santiago, 24.i.98 (E. Hdez.) ex *A. rachipora* on *E. regis-jubae* (BMNH). LA PALMA: 2♀ Bco. de Las Angustias, 22.vi.97 (E. Hdez.) ex *A. rachipora* on *E. regis-jubae*; 2♀ Los Cancajos, 21.vi.97 (E. Hdez.) ex

A. rachipora on *E. regis-jubae*; 2♀3♂ Pto. Nao, 22.vi.97 (E. Hdez.) ex *A. rachipora* on *E. balsamifera*; 2♀ same data but ex *Bemisia* sp. (after-group) (BMNH, ICIA).

Encarsia dichroa (Mercet)

Material examined (all BMNH): **CANARY ISLANDS:** FUERTEVENTURA: 1♀1♂ Pájara, 22.viii.95 (E. Hdez.) ex *Siphoninus phillyrae* on *Punica granatum*; same data: 9♀9♂ 3.i.96 (E. Hdez.); 1♂ Vega del Rio Palma, 28.xii.94 (E. Hdez.) ex *S. phillyrae* on *P. granatum*. LANZAROTE: 1♀ Haría, 25.viii.95 (E. Hdez.) ex *S. phillyrae* on *P. granatum*; 2♂2♀ same data but 4.i.96. TENERIFE: 2♀ Las Mercedes, 13.vii.95 (E. Hdez.) ex *S. phillyrae* on *Picconia excelsa*; 1♀ same data but 18.v.97. LA PALMA: 1♂ El Paso, 22.vi.97 (E. Hdez.) ex *Aleyrodes singularis* on *Lactuca serriola* L.

Encarsia estrellae Manzari & Polaszek

Material examined: AZORES: Holotype ♀ Azores, São Miguel, Lagoa Canarios, 715 m, 27.ix.98, (E. Hdez & A. Polaszek), ex *Aleyrodes singularis* on *Lysimachia nemorum* (BMNH). Paratypes 2♀; same data as holotype (BMNH). 2♀1♂, São Miguel, Serra da Tronquiera, 26.ix.98, (E. Hdez & A. Polaszek) ex *Bemisia afer*-group on *Ilex perado azorica* (BMNH). 1♀1♂, Azores, São Miguel, Sete Cidades, 27.ix.98, (E. Hernandez & A. Polaszek), ex *Bemisia* sp. on *Hedera helix canariensis* (BMNH). 1♀1♂, Azores, São Miguel, Serra da Tronquiera, 26.ix.98, (A. Polaszek & E. Hernandez), ex *Aleyrodes singularis* on *Lysimachia nemorum* (BMNH). 1♀, Azores, São Miguel, Serra da Tronquiera, 26.ix.98, (A. Polaszek & E. Hernandez), ex *Bemisia* sp. on *Viburnum tinus subcordatum* (BMNH). 2♀6♂, Azores, Pico, Lagoa do Caiado 27.vi.00 (A. Polaszek) ex *Aleyrodes ?singularis* on *Euphorbia stygiana* (BMNH; USNM).

Encarsia formosa Gahan

Material examined (all Canarian material in ICIA): **CANARY ISLANDS:** FUERTEVENTURA: 6♀ Nuevo Horizonte, 5.v.97 (E. Hdez.) ex *Trialeurodes vaporariorum* on *Sonchus* sp.; 14♀ same data but ex *Aleyrodidae* on *L. camara*. LA GOMERA: 1♀ Langrero, 4.iii.95 (E. Hdez.) ex *Aleyrodidae* on *Cucurbita* sp.; 7♀ San Sebastian, 15.vi.97 (E. Hdez.) ex *A. singularis* on *L. serriola*. GRAN CANARIA: 15♀ Vecindario, 18.iii.98 (A. Carnero) ex *T. vaporariorum* on *Nicotiana glauca*; 13♀ same data but: ex *Aleyrodidae* on *Pelargonium* sp.; 10♀ Arucas, vii.98 (M. Rguez.) ex *B. tabaci* complex on *Cucurbita* sp. LANZAROTE: 12♀ Costa Teguise, 4.v.97 (E. Hdez.) ex *B. tabaci* complex on *Sonchus oleraceus* L.; 1♀ Haría, 25.vii.95 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*. TENERIFE: 2♀ Güímar, 1.vii.97 (E. Hdez.) ex *B. tabaci* complex on *Capsicum annuum* L.; 1♀ La Laguna, 21.i.97 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*; 4♀ Pta. del Hidalgo, 27.iii.98 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; 12♀ Valle de Guerra, 9.iv.96 (E. Hdez.) ex *Aleyrodes proletella* on *Brassica oleracea*; 6♀ same data but ex *T. vaporariorum* on *Ageratum* sp.; 1♀ 15.ix.95 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*, 1♀

15.ix.95 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*, 1♀ 15.ix.95 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*, 2♀ 15.iv.93 (R. Torres) ex *T. vaporariorum* on *Lycopersicon esculentum* Mill., 3♀ 23.i.95 (E. Hdez.) ex *B. tabaci* complex on *Nicotiana tabacum* L., 1♀ 7.vii.95 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*; 1♀ Agua Dulce, 19.x.94 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*. MADEIRA: 4♀ Sº. da Igreja, Campanário CB1016, 6.x.94 (F. Aguiar) P212a ex *T. vaporariorum* on *Bidens pilosa* L. (ICLAM, BMNH); 2♂ Sº. da Madalena, Funchal CB1914, 8.xi.94 (F. Aguiar) P220b ex *T. vaporariorum* on *Conyza* sp. (ICLAM, BMNH); 42♀ same data but 8.xi.94 (F. Aguiar) P221 ex *T. vaporariorum* on *Conyza* sp (ICLAM, BMNH), 3♀ 4.x.94 (F. Aguiar) P209b ex *T. vaporariorum* on *Ruta officinalis* (ICLAM), 2♀ (BMNH); 2♀ Fonte do Til, Arco da Calheta BB9820, 31.x.94 (A. Felix) P234 ex *T. vaporariorum* on *C. annuum*; 12♀ 31.x.94 (A. Felix) P236 ex *T. vaporariorum* on *Cucumis sativus* L. (ICLAM); 1♀ Sº. dos Moinhos, Caniço CB2815, 17.x.94 (A. Felix) P235 ex *T. vaporariorum* on *Solanum tuberosum* L. (BMNH); 2♀ Sº. dos Barreiros, Caniço CB2814, 7.i.95 (A. Felix) P274 ex *T. vaporariorum* on *C. sativus* (ICLAM); 1♂ Preces, Cº. de Lobos CB1414, 16.i.95 (A. Felix) P275b ex *T. vaporariorum* on *P. pulcherrima*; same data: 1♀1♂ 16.i.95 (A. Felix) P282, 209(♀) 4.vi.95 (A. Felix) P279 (ICLAM), 1♀ 15.v.97 (A. Polaszek) ex *T. vaporariorum* on *Erigeron* sp. (BNHM); 15♀ Sº. da Igreja, Qtº. Grande CB1115, 16.ii.95 (A. Felix) P276 ex *T. vaporariorum* on *Phaseolus vulgaris* (ICLAM); 10♀ Quebradas, São Martinho CB1613, 17.iii.95 (A. Felix) P278 ex *T. vaporariorum*. AZORES: SÃO MIGUEL: 1♀ Furnas, B.G. Terra Nostra, 26.ix.98 (A. Polaszek and E. Hdez.) ex *T. vaporariorum* on *Cucurbita* sp. (BMNH).

Encarsia guadeloupae Viggiani

Material examined: CANARY ISLANDS: 3♀ Rearing chamber Cabildo Tenerife (origin Taiwan) ex *A. dispersus*.

Encarsia hispida De Santis

Material examined: CANARY ISLANDS: FUERTEVENTURA: 1♀ Cañada del Rio, 22.viii.95 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; 34♀ same data but 3.i.96; 8♀ 2.v.96 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*, 5♀ 2.v.96 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*, 11♀1♂ 11.iii.97 (E. Hdez.) ex *Aleyrodidae* on *N. glauca*, 1♂ 11.iii.97 ex *T. vaporariorum* (BNHM), 17♀ 5.v.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*, 1♀ 5.v.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca* (BNHM); 14♀ Corralejo, 3.i.96 (E. Hdez.) ex *A. dispersus* on *Strelitzia nicolai*; same data: 1♀ 21.iv.96 (E. Hdez.) ex *A. dispersus* on *Strelitzia alba*, 1♀ 11.iii.97 (E. Hdez.) ex *A. dispersus* on *Ficus rubiginosa*. LA GOMERA: 5♀ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *B. oleracea*; same data: 4♀ ex *Aleyrodidae* on *Lactuca sativa* L., 3♀ ex *A. proletella* on *L. serriola*; 3♀ Hermigua, 15.vi.97 ex *A. proletella* on *B. oleracea*. GRAN CANARIA: 2♀ San Agustín, 11.ii.96 (E. Hdez.) ex *A. dispersus* on *Solandra maxima*; 1♀ same data but ex *A. dispersus* on *Coccocloba uvifera* (L.), 1♀ ex *A. dispersus* on *Schinus terebinthifolius*. LANZAROTE: 1♀

Costa Teguise, 9.iii.97 (E. Hdez.) ex *B. tabaci* complex on *Hibiscus rosa-sinensis* L.; 8♀ Fariones, 4.i.96 (E. Hdez.) ex *A. dispersus* on *S. terebinthifolius*; same data: 1♀ 5.i.96 ex *B. tabaci* complex on *P. pulcherrima*, 12♀ 21.iv.96 (E. Hdez.) ex *A. dispersus* on *S. terebinthifolius*; 1♀ Pto. del Carmen, 25.viii.95 (E. Hdez.) ex *A. dispersus* on *S. terebinthifolius*; same data: 2♀ 8.iii.97 (E. Hdez.) ex *A. dispersus* on *S. terebinthifolius*, 1♀ 3.v.97 (E. Hdez.) ex *T. vaporariorum* on *H. rosa-sinensis*. TENERIFE: 1♀2♂ Agua Dulce, (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; 1♀ Buenavista, 12.vii.95 (E. Hdez.) ex *A. proletella* on *B. oleracea*; 1♀ Güímar, 9.ii.97 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*; 1♀ Las Mercedes, 7.vi.97 (E. Hdez.) ex *A. singularis* on *Canarina canariensis* (L.) Vatke; 10♀ Pto. de la Cruz, 1.xii.97 (E. Hdez.) ex *A. dispersus* on *Myrica faya*; 1♀ same data but 18.iii.98 ex *A. dispersus* on *C. uvifera*; 12♀ Santa Cruz (E. Hdez.) ex *A. dispersus* on *C. uvifera*; 12♀ Santa Cruz Tenerife, 27.xi.97 (E. Hdez.) ex *A. dispersus* on *Spathodea campanulata*; 3♀ same data but ex *A. dispersus* on *S. maxima*, 1♀ ex *A. dispersus* on *Ficus macrophylla*; 30♀ ex *A. dispersus* on *Ficus* sp.; 2♀ viii.98 (E. Hdez.) ex *Trialeurodes ricini* on *Ricinus communis*; 12♀ Valle de Guerra, 25.iv.96 (E. Hdez.) ex *A. proletella* on *B. oleracea*; 9♀ ex *B. tabaci* complex on *B. oleracea*, 12♀1♂ 1.iv.98 (E. Hdez.) ex *B. tabaci* complex on *B. oleracea*, 1♂ 9.iv.96 (E. Hdez.) ex *T. vaporariorum* on *Ageratum* sp. MADEIRA: 1♀ Corujeira, Tabúa CB0618, 16.vii.97 (A. Felix) P468 ex *B. tabaci* complex on *C. sativus* (ICLAM); 1♀ São Pedro, Funchal CB2013, 30.v.93 (F. Aguiar) P121b ex *T. vaporariorum* on *Eugenia uniflora* (BMNH); 1♀ Funchal CB2213, 8.vii.93 (F. Aguiar) P130 ex *Aleurotrachelus rhamnicola* on *Passiflora edulis* Sims (BMNH); 1♀ Sta. Luzia, Funchal CB2114, 27.I.94 (F. Aguiar) P160 ex *T. vaporariorum* on *Hibiscus* sp. (BMNH); 7♀ Lombo da Boa Vista, Funchal CB2214, 9.iv.95 (F. Aguiar) P263 ex *Lipaleyrodes* sp.A on *Chlorophytum comosum* (BMNH).

Encarsia inaron (Walker)

Material examined: CANARY ISLANDS: LANZAROTE: 6♀2♂ Arrecife, 10.vi.95 (E. Hdez.) ex *A. proletella* on *Sonchus* sp. TENERIFE: 1♀ Las Mercedes (E. Hdez.) ex *S. phillyreae* on *P. excelsa*. LA GOMERA: 9♀5♂ Bco. de Santiago (E. Hdez.) ex *A. proletella* on *L. serriola*. PALMA: 1♀1♂ Los Llanos, 22.vi.97 (E. Hdez.) ex *Aleyrodidae* on *L. serriola*. MADEIRA: 2♂ Caldeirão do Inferno, Santana (985 m) CB1827, 27.vi.93 (F. Aguiar) P126 ex *Pealius madeirensis* on *P. excelsa* (ICLAM); same data: 1♀ P132, 2♂2♀ (BMNH); 2♀1♂ Ribeiro Frio, Santana (880 m) CB2323, 11.vii.93 (F. Aguiar) P131 ex *P. madeirensis* on *P. excelsa* (ICLAM); same data: 2♂1♀ ex *P. azaleae* on *Azalea* sp (ICLAM); same data: 5♂5♀ (A. Polaszek) (BNHM).

Encarsia levadicola Polaszek and Hernández sp. nov.

Material examined: HOLOTYPE: MADEIRA: 1♀ Levada da Serra, Bica da Cana, 16.v.97 (A. Polaszek) ex *Bemisia afer* sens. lat. on *Clethra* sp. (BMNH). PARATYPES: 11♀4♂ same data as Holotype (3♀2♂ on slides) (BMNH). Other material examined: MADEIRA: 7♀2♂ Levada da Serra, Bica da Cana, 16.v.97 (F. Aguiar) P357a ex *Bemisia afer* sens. lat.

on *Clethra arborea* (BMNH); 1♀ Canical (250 m) CB3523, 28.v.92 (F. Aguiar) P99 ex *Bemisia afer* sens. lat. on *Phyllis nobla* (BMNH); 1♂ Fajã da Nogueira (600 m) CB2223, 15.xii.93 (F. Aguiar) P119 ex *Bemisia afer* sens. lat. on *M. faya* (BMNH); 1♀ Encumeada (1007 m) CB1125, 3.ii.94 (M.A. Carvalho) P158 ex *Bemisia lauracea* on *Persea indica* (L.) K. Spreng (BMNH); 1♀ Ribeiro Frio, Santana (980 m) CB2323, 16.xi.94 (F. Aguiar) P228 ex *Bemisia afer* sens. lat. on *Sonchus fruticosus* (BMNH) same data: 5♀ 13.v.97 (A. Polaszek) on *Echium candicum*; 4♀ Fanal (1100 m) CB0031, 14.v.97 (A. Polaszek) ex *B. lauracea* on *Ocotea foetens* (BMNH); 2♀ Lombadinha, Ponta Delgada (100 m) CB1533, 14.v.97 (A. Polaszek) ex *Bemisia afer* sens. lat. on *Maracetella maderensis* (BMNH). CANARY ISLANDS: GRAN CANARIA, 1♀ Moya 22.i.97 (E. Hdez. & A. Polaszek) ex *Bemisia* sp. (afer-group) on *E. regis-jubae* (ICIA).

Encarsia lutea (Masi)

Material examined: CANARY ISLANDS: LANZAROTE: 1♀ Famara, 15.viii.95 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*; 1♀ Fariones, 5.i.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 7♀7♂ Costa Teguise, 4.v.97 (E. Hdez.) ex *B. tabaci* complex on *S. oleraceus*; same data: 4♂ ex *T. vaporariorum*, 2♂ 9.iii.97 (E. Hdez.) ex *B. tabaci* complex on *H. rosa-sinensis*, 1♂ 9.iii.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. balsamifera*; 1♀2♂ Playa Blanca, 30.xii.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. regis-jubae*; same data: 10.iii.97 (E. Hdez.) ex *A. rachipora* on *E. balsamifera*; 1♀ Pto. del Carmen, 5.i.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; same data: 1♂ 3.v.97 (E. Hdez.), 1♀ 3.v.97 (E. Hdez.) ex *B. tabaci* complex on *H. rosa-sinensis*; 2♀ Haría, 25.viii.95 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*; same data: 1♀ 8.iii.97 (E. Hdez.) on *H. rosa-sinensis*. FUERTEVENTURA: 1♀ Pájara, 3.i.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; same data: 1♀ 10.iii.97 on *H. rosa-sinensis*; 1♂ Nuevo Horizonte, 5.v.97 (E. Hdez.) ex *T. vaporariorum* on *H. rosa-sinensis*; same data: 4♀9♂ ex *B. tabaci* complex on *S. oleraceus*, 1♂ ex *T. vaporariorum* on *S. oleraceus*, 5♀1♂ on *L. camara*, 9♀1♂ ex *T. vaporariorum* on *L. camara*, 1♀1♂ ex *B. tabaci* complex on *L. camara*; 1♀ Cañada del Rio, 11.iii.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; same data: 1♀2♂ 3.i.96, 3♀3♂ 22.viii.95 (E. Hdez.) ex *B. tabaci* complex, 2♂ 22.viii.95 (E. Hdez.) ex *T. vaporariorum*; 1♀ Corralejo, 28.xii.94 (E. Hdez.) ex *B. tabaci* on *H. rosa-sinensis*. GRAN CANARIA: 1♀2♂ La Aldea, 12.viii.97 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*; 1♂ Moya, 22.i.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. regis-jubae*; 2♀6♂ Vecindario, 18.iii.98 (A. Carnero) ex *T. vaporariorum* on *N. glauca*; same data: 14♂ ex *Aleyrodidae* on *Pelargonium* sp., 1♀3♂ ex *Aleyrodidae* on *Ruta* sp. TENERIFE: 5♀8♂ Pajalillos, 4.xii.96 (E. Hdez.) ex *B. tabaci* complex on *B. oleracea*; 1♀1♂ La Laguna, 17.vii.95 (E. Hdez.) ex *T. vaporariorum* on *Sechium edule* (Jacq.) Sw.; 3♀ Buenavista, 12.vii.95 (E. Hdez.) ex *B. tabaci* complex on *C. sativus*; same data: 1♀ ex *T. vaporariorum*; 1♀1♂ Cuevas Negras, 29.vi.97 (E. Hdez.) ex *A. rachipora* on *Euphorbia obtusifolia*; 1♀3♂ Las Galletas, 31.iii.98 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; 1♀6♂ Güímar, 1.vii.97 (E. Hdez.) ex *B. tabaci* complex on *C.*

annuum; same data: 1♀ 3.ii.97, 6♀1♂ 24.vi.96, 2♀ 20.v.96, 2♂ 9.ii.97 on *P. pulcherrima*; 3♂ Pto. de la Cruz, 28.iv.97 (E. Hdez.) ex *B. tabaci* complex on *Pelargonium* sp.; 2♂ Agua Dulce, 29.iv.97 (E. Hdez.) ex *B. tabaci* complex on *S. oleraceus*; 1♀ Bco. de Badajoz, 11.i.98 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *Euphorbia* sp.; 1♂ Pta. del Hidalgo, 13.vii.95 (E. Hdez.) ex *B. tabaci* complex; 2♀ Valle de Guerra, 7.vii.95 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*; same data: 2♀ 15.ix.95 ex *B. tabaci*, 1♂ 15.ix.95 ex *T. vaporariorum* on *N. glauca*. LA GOMERA: 1♀ San Sebastian, 15.vi.97 (E. Hdez.) ex *Aleyrodidae* on *L. serriola*; same data: 1♀1♂ 14.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *Euphorbia berthelotii* Bolle; 1♀ Bco. de Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*; same data: 1♀ 1.v.96 (E. Hdez.) ex *B. tabaci* complex on *Helianthus annuus*, 1♂ 1.v.96 (E. Hdez.) ex *T. vaporariorum* on *H. annuus*. EL HIERRO: 1♀ Pozo de la Salud, 2.viii.95 (E. Hdez.) ex *B. tabaci* complex on *Amaranthus cruentus*. LA PALMA: 2♀ Los Cancajos, 21.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 1♀2♂ Los Llanos, 15.x.96 (E. Hdez) ex *B. tabaci* complex on *I. batatas*; 8♀ 2♂ Pto. Nao, 22.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. balsamifera*; same data: 1♂ ex *B. tabaci* complex on *P. pulcherrima*. MADEIRA: 1♀ Assomada, Caniço CB2914, 29.xii.97 (A. Felix) P439 ex *B. tabaci* complex on *P. pulcherrima* (ICLAM); same data: 4♀ 3.xii.97 (A. Felix) P450b ex *B. tabaci* complex on *P. pulcherrima* (ICLAM); 2♀1♂ Corujeira, Tabúa CB0618, 16.vii.97 (A. Felix) P467 ex *B. tabaci* complex on *C. sativus* (ICLAM).

Encarsia melanostoma Polaszek and Hernández sp. nov.

Material examined: HOLOTYPE: CANARY ISLANDS: TENERIFE: 1♀ Bco. de las Moradas, 18.v.97 (E. Hdez.) ex *Bemisia medinae* on *Hypericum grandifolium* (BMNH). PARATYPES: CANARY ISLANDS: 29♀ Bco. de las Moradas, 18.v.97 (E. Hdez.) ex *B. medinae* on *H. grandifolium*; same data: 6♀5♂ ex *Bemisia afer sens. lat.* on *Echium virescens*, 2♀ ex *Bemisia afer sens. lat.* on *Cistus* sp., 1♀2♂ 6.iv.97 (E. Hdez.) ex *Bemisia afer sens. lat.* on *E. virescens*; same data: 1♂ ex *B. medinae* on *H. grandifolium* (BMNH, ICIA). Other material examined: CANARY ISLANDS: LANZAROTE: 1♀ Famara, 15.viii.95 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*. TENERIFE: 2♂ Bco. de Badajoz, 11.i.98 (E. Hdez.) ex *Bemisia afer sens. lat.* on *E. virescens*; same data: 1♂ 25.viii.98 (E. Hdez.) ex *Bemisia afer sens. lat.* on *Artemisia thuscula* Cav., 1♀ 25.viii.98 (E. Hdez.) ex *Bemisia afer sens. lat.* on *A. thuscula*, 1♂ 6.iv.97 (E. Hdez.) ex *B. medinae* on *H. grandifolium*; 1♂ Buenavista, 12.vii.95 (E. Hdez.) ex *A. proletella* on *B. oleracea*; 2♀1♂ Erjos, 18.v.97 (E. Hdez.) ex *B. medinae* on *H. grandifolium*; same data: 3♀2♂ ex *Bemisia afer sens. lat.* on *E. virescens*; 2♂ Las Mercedes, 7.vi.97 ex *B. medinae* on *H. grandifolium*; 1♂1♀ Valle Guerra, 20.v.97 (J. Martin) ex *Bemisia* sp. (afer-group) on *Euphorbia* sp; same data: 1♀1♂ 12.vi.97 on *Pterocephalus* sp. LA GOMERA: 1♀10♂ El Cedro, 15.vi.97 (E. Hdez.) ex *B. medinae* on *H. grandifolium*; 1♂ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*; same data: 1♀ 4.iii.95 (E. Hdez.) ex *T. vaporariorum* on *Cucurbita ficifolia* Boucé. EL HIERRO:

1♀2♂ Sabinosa, 1.xii.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*. PALMA: 8♀4♂ Pista de Barlovento, 21.vi.97 (E. Hdez.) ex *Bemisia afer sens. lat.* on *Rubus* sp. 1♀ Bco. Las Angustias, 22.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. obtusifolia*.

Encarsia noahi Polaszek & Hernández sp. nov.

Material examined: HOLOTYPE: CANARY ISLANDS: TENERIFE: 1♀ Las Galletas, 29.iv.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca* (BNHM). PARATYPES: CANARY ISLANDS: 39♀1♂ Las Galletas, 29.iv.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca* (BMNH, ICIA). Other material examined: CANARY ISLANDS: FUERTEVENTURA: 1♀ Cañada del Rio, 5.v.97 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*; 1♀ Nuevo Horizonte, 5.v.97 ex *A. proletella* on *Sonchus* sp. LA GOMERA: 1♀5♂ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *B. oleracea*; same data: 1♂ ex *A. proletella* on *L. sativa*, 3♂ ex *A. proletella* on *L. serriola*, 2♀13♂ ex *Aleyrodidae* on *L. serriola*, 2♀ ex *A. proletella* on *Tolpis laciniata*, 15♀14♂ ex *T. vaporariorum* on *L. sativa*, 2♂ ex *Aleurothrixus floccosus* on *Citrus limon* (L.), 24♀ Hermigua, 15.vi.97 (E. Hdez.) ex *T. vaporariorum* on *C. ficifolia*; 1♂ Jardín Tesina, 14.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 1♀3♂ San Sebastian, 15.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*. GRAN CANARIA: 1♀ La Aldea, 12.viii.97 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima*; 2♀ Moya, 22.vii.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. regisjubae*. EL HIERRO: 1♀ Pozo de la Salud, 2.viii.95 (E. Hdez.) ex *B. tabaci* complex on *A. cruentus*; 3♀ Sabinosa, 1.xii.96 (E. Hdez.) on *H. annuus*; same data: 6♀1♂ ex *B. tabaci* complex on *P. pulcherrima*, 1♀ 2.viii.95 ex *T. vaporariorum*; 1♀ Tigaday, 1.xii.96 (BNHM). PALMA: 1♀ Bco. Las Angustias, 22.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. obtusifolia*; 2♀2♂ Ctra. El Paso, 22.vi.97 (E. Hdez.) ex *B. tabaci* complex on *L. serriola*; same data: 1♀1♂ ex *A. proletella* on *L. serriola*; 13♀ Ctra. Los Llanos, 22.vi.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; 1♀ El Paso, 22.vi.97 (E. Hdez.) ex *T. vaporariorum* on *L. serriola*; same data: 6♀8♂ ex *A. proletella* on *L. serriola*; 5♀3♂ Los Cancajos, 21.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; same data: 2♀ 5.v.96 ex *T. vaporariorum*; 7♀3♂ Los Llanos, 15.x.96 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*; 1♀ Los Sauces, 5.v.96 (E. Hdez.) ex *T. vaporariorum* on *C. ficifolia* (dry); 4♀ Los Tilos, 21.vi.97 ex *A. singularis* on *Crambe santosi*; same data: 1♀ ex *T. vaporariorum* on *S. oleracea*, 4♀2♂ ex *A. singularis* on *C. canariensis*, 1♀ ex *A. proletella* on *L. serriola*; 8♀ Pico de Las Nieves, 21.vi.97 (E. Hdez.) ex *A. singularis* on *Lactuca viminea*. 1♀ Pto. Nao, 22.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. balsamifera*; 1♀ Tazacorte, 22.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*. TENERIFE: 1♀1♂ 1.x.82 (A. Carnero) ex *Aleyrodidae* on *N. glauca* (BMNH), 9♀5♂ Agua Dulce, 7.iv.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; same data: 3♀2♂ 5.vii.94 (J.C. Onillon) (BNHM), 3♀ 17.i.96, 3♀1♂ 12.vii.95, 1♀ 3.xi.94, 3♀ 29.iv.97 (E. Hdez.) ex *T. vaporariorum* on *S. oleracea*, 1♀ 21.v.97 (A. Polaszek) ex *T. vaporariorum* on *L. serriola* (BNHM), 1♀ 12.vii.95 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*, 1♀ 22.xi.95, 1♀1♂ 5.xii.94; 1♂ Arafo, 31.iii.95 (E. Hdez.) ex *B. tabaci* complex on *I.*

batatas; 1♂ Bco. de Blas, 20.vii.97 (A. Polaszek) ex *Lipaleyrodes* sp.B on *Hypericum reflexum*; same data: 2♀ (BMNH); 1♀ Bco. de Badajoz, 11.i.98 (A. Polaszek and E. Hdez.) ex *Bemisia afer* sens. lat. on *B. caudata* (BMNH); same data: 1♀ 20.vii.97 (E. Hdez.) ex *Lipaleyrodes* sp.B on *H. reflexum*; 2♀ Buenavista, 12.vii.95 (E. Hdez.) ex *A. proletella* on *B. oleracea*; 13♀ Cuevas Negras, 29.vi.97 ex *A. singularis* on *Cruciferae*; same data: 3♀ ex *A. proletella* on *L. serriola*; 3♀ Güímar, 24.vi.97 (E. Hdez.) ex *T. vaporariorum* on *H. annuus*; same data: 1♀ 2♂ 9.ii.97 ex *B. tabaci* complex on *P. pulcherrima*, 1♀ 9.ii.97 ex *T. vaporariorum* on *P. pulcherrima*, 3♀ 21.vii.96 ex *A. singularis* on *Crambe strigosa* L'Hér (BNHM); 1♀ Icod 29.vi.97 ex *T. vaporariorum* on *L. serriola*; 1♂ La Guancha, 25.v.95 (E. Hdez.) ex *A. proletella* on *Cruciferae*; 2♀ 2♂ La Laguna, 20.v.97 (J. Martin) ex *Bemisia* sp. (afer-group) on *Euphorbia* sp (BNHM); 20♀ Las Galletas 29.iv.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; same data: 1♀ 1.ii.95 ex *B. tabaci* complex on *P. pulcherrima*; Los Realejos, 8.ii.95 (E. Hdez.) ex *B. tabaci* complex on *C. ficifolia*; 2♀ 1♂ Pajalillos, 4.xii.96 ex *B. tabaci* complex on *B. oleracea*; 9♀ 6♂ Pto. (E. Hdez.) ex *B. tabaci* complex on *Pelargonium* sp.; same data: 2♀ 20.v.97 (A. Polaszek) (BNHM), 8♀ 2♂ ex *T. vaporariorum* on *H. annuus* (BNHM), 1♀ 28.iv.97 (E. Hdez.) ex *B. tabaci* complex on *Pelargonium* sp.; 4♂ Valle Guerra, 20.x.82 (A. Carnero) ex *A. floccosus* on *N. glauca* (ZMA), 5♀ Valle Guerra, 23.i.98 (A. Polaszek and E. Hdez.) ex *Bemisia afer* sens. lat. on *B. caudata*, 3♀ 22.v.97 (E. Hdez.) ex *Bemisia* sp (afer-group) on *Euphorbia atropurpurea*; 1♀ Las Cañadas, Mirador Pico Viejo, primavera 95 (M. Arechavaleta) 25W/HI2250. MADEIRA: 3♀ 95 (M. Arechavaleta) 25W/HI2250. MADEIRA: 3♀ 95 (M. Arechavaleta) 25W/HI2250. Lombadinha, Ponta Delgada (100 m) CB1533, 20.iii.92 (F. Aguiar) P95a ex *Bemisia afer* sens. lat. on *M. maderensis* (BNHM); 3♀ Faja do Penedo, Sao Vicente 20.iii.92 (F. Aguiar) P95 ex *Bemisia afer* sens. lat. on *M. maderensis*; same data: 1♀ (dry) (BNHM). AZORES: 1♀ Pico, Misterio da Prainha, 1–4.vii.00 (A. Polaszek) malaise trap (BMNH).

Encarsia pergandiella Howard

Material examined: CANARY ISLANDS: GRAN CANARIA: 1♀ Bco. Azuaje, 22.i.98 (E. Hdez.) ex *B. tabaci* complex on *Crambe cf. pritzelli*; 2♀ Arucas, viii.98 (J. Rguez.) ex *B. tabaci* complex on *Cucurbitaceae*. TENERIFE: 1♀ ex *B. tabaci* complex on *C. annuum*; 1♂ Agua Dulce, 15.i.97 (E. Hdez.) ex *B. tabaci* complex on *Ageratum* sp.; 1♀ Bco. de Badajoz, 25.i.98 (E. Hdez.) ex *Bemisia afer* sens. lat. on *A. thyscula*. LA GOMERA: 1♀ Langrero, 4.iii.95 (E. Hdez.) ex *Aleyrodidae* on *Cucurbita* sp.; 6♀ Hermigua, 15.vi.97 (E. Hdez.) ex *T. vaporariorum* on *C. ficifolia*. PALMA: 5♀ Los Cancajos, 21.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; same data: 4♀ ex *T. vaporariorum*. MADEIRA: 1♀ Fonte do Til, Arco da Calheta BB9820, 31.x.94 (A. Felix) P238 ex *T. vaporariorum* on *C. sativus* (ICLAM); same data: 1♀ (BMNH); 1♀ Sº da Corujeira, Tabúa CB0618, 19.vii.95 (A. Felix) P281 ex *T. vaporariorum* on *C. sativus* (ICLAM); 5♀ Corujeira, Tabúa CB0618 (A. Felix), 16.vii.97 P394 ex *B. tabaci* complex on

C. sativus (ICLAM); 1♀ Sº da Madalena, Funchal CB1914, 8.xi.94 (F. Aguiar) P220a ex *T. vaporariorum* on *Conyza* sp. (BMNH). AZORES: SÃO MIGUEL: 2♀ Furnas, B.G. Terra Nostra, 26.ix.98 (A. Polaszek and E. Hdez.) ex *T. vaporariorum* on *Cucurbita* sp. (BMNH).

Encarsia sophia (Girault & Dodd)

Material examined: CANARY ISLANDS: TENERIFE: 41♀ 7♂ Valle Guerra, 1.iv.98 (E. Hdez.) ex *B. tabaci* complex on *B. oleracea*; same data: 3♂ 24.vii.96, 88♀ 2.v.96, 1♀ 2.v.97 ex *T. vaporariorum*, 2♀ 25.iv.96 (E. Hdez.) ex *A. proletella*, 10♀ 25.iii.97 (E. Hdez.) ex *B. tabaci* complex; 8♂ S/C Tenerife, 26.xi.96 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*; 2♀ Pto. de la Cruz, 20.v.97 (E. Hdez.) ex *T. vaporariorum* on *Pelargonium* sp.; same data: 6♀ 28.iv.97, 1♀ 28.iv.97 (E. Hdez.) ex *B. tabaci* complex, 22♀ ex *B. tabaci* complex on *H. annuus*; 1♀ Los Realejos, 26.xi.97 (E. Hdez.) ex *Aleyrodidae* on *N. glauca*; same data: 4♂ ex *A. floccosus* on *Citrus sinensis* (L.) Osbeck; 2♀ Los Cristianos, 14.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 1♀ Las Galletas 29.iv.97 (E. Hdez.) ex *T. vaporariorum* on *S. oleraceus*; same data: 9♀ 25.i.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*, 2♀ x.94 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 1♀ Güímar, 24.vi.97 (E. Hdez.) ex *T. vaporariorum* on *H. annuus*; same data: 1♂ 20.i.97 (E. Hdez.) ex *B. tabaci* complex on *C. annuum*; 13♀ rearing chamber ICIA (origin Agua Dulce), 22.xi.95 (E. Hdez.) ex *B. tabaci* complex on *H. rosa-sinensis*; 10♀ Bahía del Duque, 4.viii.97 (E. Hdez.) ex *T. vaporariorum* on *L. camara*; same data: 1♂ 22.xi.96 (E. Hdez.) ex *T. vaporariorum* on *L. camara*; 1♀ 13♂ Agua Dulce, 3.iv.98 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*; same data: 4♀ 4.vii.97 (E. Hdez.) ex *B. tabaci* complex on *L. serriola*, 3♂ 4.vii.97 (E. Hdez.) ex *B. tabaci* complex on *L. serriola*, 1♀ 29.iv.97 (E. Hdez.) ex *B. tabaci* complex on *S. oleraceus*, 1♀ 9.iv.97 (E. Hdez.) ex *T. vaporariorum* on *S. oleraceus*, 1♂ 29.iv.97 *B. tabaci* complex on *S. oleraceus*, 2♀ 7.iv.97 (A. Polaszek et al.) ex *T. vaporariorum* on *N. glauca* (BNHM), 1♂ 17.i.96 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*, 5♀ 22.ix.95 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*, 3♀ 1♂ 12.vii.95 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*, 1♀ 5.xii.94 (E. Hdez.) ex *B. tabaci* complex on *H. rosa-sinensis*, 1♀ 19.x.94 (E. Hdez.) ex *B. tabaci* complex on *H. rosa-sinensis*, 4♀ 12.vii.94 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*. LANZAROTE: 2♂ Costa Teguise, 4.v.97 (E. Hdez.) ex *T. vaporariorum* on *S. oleraceus*; same data: 1♂ 8.iii.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*. GRAN CANARIA: 2♂ Vecindario, 18.iii.98 (E. Hdez.) ex *Aleyrodidae* on *Ruta* sp.; 2♂ San Agustín, 11.ii.96 ex *B. tabaci* complex on *H. rosa-sinensis*; 4♀ Arucas, 22.i.97 (E. Hdez.) on *P. pulcherrima*; same data: 1♂ i.97 (E. Hdez.) on *P. pulcherrima*. LA GOMERA: 2♂ San Sebastián, 15.vi.97 (E. Hdez.) ex *T. vaporariorum* on *L. serriola*; 2♀ 1♂ Jardín Tesina, 14.vi.97 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*, 3♀ 1♂ *L. camara*; 1♀ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *Aleyrodidae* on *L. serriola*; same data: 3♀ 3♂ on *L. sativa*, 2♀ 1♂ 1.v.96 (E. Hdez.) ex *B. tabaci* complex on *L. camara*, 1♀ 1.v.96 (E. Hdez.) ex *T. vaporariorum* on *H. annuus*, 1♀ 1.v.96 (E. Hdez.) ex *B. tabaci* complex on *H. annuus*. FUERTEVENTURA: 1♂ Nuevo Horizonte, 5.v.97 (E. Hdez.) ex *T. vaporariorum* on *L. camara*, 2♀ on

H. rosa-sinensis; 1♂ Cañada del Rio, 5.v.97 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*, 4♂ ex *B. tabaci* complex on *N. glauca*.

Encarsia tricolor (Förster)

Material examined: CANARY ISLANDS: FUERTEVENTURA: 1♂ Cañada del Rio, 3.i.96 (E. Hdez.) ex Aleyrodidae on *N. glauca*; same data: 1♂ 11.iii.97 (E. Hdez.). LA GOMERA: 35♀ 26♂ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*; same data: 14♂ ex *A. singularis* on *T. laciniata*; 1♀ 2♂ Hermigua, 15.vi.97 (E. Hdez.) ex *A. proletella* on *B. oleracea* 12♀ Ctra. Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*, 2♀ San Sebastian, 15.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*. GRAN CANARIA: 19♂ La Aldea, 12.viii.97 (E. Hdez.) ex *T. vaporariorum* on *P. pulcherrima* (BNHM); 12♀ 5♂ Vecindario, 18.iii.98 (E. Hdez.) ex *T. vaporariorum* on *N. glauca*. LA PALMA: 1♂ Los Llanos, 15.x.96 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*; 1♂ El Paso, 22.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*. TENERIFE: 2♀ Bco. de Badajoz, 25.i.98 (E. Hdez.) ex *A. singularis* on *C. canariensis*; same data: 1♀ 11.i.98; 1♂ Arafo, 31.iii.95 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*; 16♂ 2♀ La Guancha, 25.v.95 (E. Hdez.) ex *A. proletella* on *B. oleracea* var. *italica*; same data: 2♂ ex *B. oleracea*; 5♀ 3♂ Pajalillos, 4.xii.96 (E. Hdez.) ex *B. tabaci* complex on *B. oleracea*; same data: 3♀ 2♂ ex *A. proletella*, 12♀ 7♂ 22.x.96 (E. Hdez.) ex *A. proletella* on *B. oleracea*; 8♀ Cuevas Negras, 29.vi.97 (E. Hdez.) ex *A. singularis* on *cruciferae*; same data: 17♀ 1♂ ex *A. singularis* on *C. canariensis*; 21♀ 18♂ Buenavista, 12.vii.95 (E. Hdez.) ex *A. proletella* on *B. oleracea*; 3♀ Valle Guerra, 20.v.94 (E. Hdez.) ex *A. proletella* on *B. oleracea*; same data: 2♀ 1.iv.98 (E. Hdez.) ex *B. tabaci* complex; 7♀ Las Mercedes, 7.vi.97 (E. Hdez.) ex *A. singularis* on *C. canariensis*; 1♀ La Laguna, 17.v.95 (E. Hdez.) ex *T. vaporariorum* on *Sechium edule* (Jacq.) Sw. MADEIRA: 2♀ Lourencinhos, C^a. da Lobos (270 m) CB1615, 24.viii.93 (F. Aguiar) P134 ex *A. proletella* on *B. oleracea* (ICLAM); same data: 1♀ 1♂ (BMNH); 4♀ S^o. da Madalena, Funchal CB1914, 4.x.94 (F. Aguiar) P209a ex *T. vaporariorum* on *Ruta officinalis* (ICLAM); same data: 4♂ (BMNH); 9♀ S^o. da Igreja, Qt^a. Grande CB1115, 16.ii.95 (A. Felix) P277 ex *T. vaporariorum* on *P. vulgaris* (ICLAM); 1♀ S^o. da Igreja, Campanário CB1016, 6.x.94 (F. Aguiar) P212b ex *T. vaporariorum* on *B. pilosa* (BMNH); same data: 2♀ (ICLAM); 10♂ 5♀ S^o. do Amparo, São Martinho CB1713, 12.iv.95 (J. Jesus) P233 ex *A. proletella* on *Euphorbia helioscopic* (ICLAM); 2♀ Santana CB2330, 13.vi.95 (F. Aguiar) P256 ex *A. proletella* on *B. oleracea* (ICLAM); 3♂ Tranqual, Campanário CB1016, 19.vii.95 (F. Aguiar) P258 ex *T. vaporariorum* on *L. esculentum* (ICLAM); 5♂ Tranqual, Campanário CB1016, 18.viii.95 (A. Felix) P280 ex *T. vaporariorum* on *L. esculentum* (ICLAM); 3♀ Preces, C^a. da Lobos CB1414, 16.i.95 (A. Felix) P275a,d ex *T. vaporariorum* on *P. pulcherrima* (ICLAM); 7♂ 1♀ S^o. do Amparo, São Martinho CB1713, 1.iv.97 (J. Jesus) P348 ex *A. proletella* on *E. helioscopic* (ICLAM); same data: 2♀ 12.iv.95 (J. Jesus) P233 (BMNH); 1♂ São Pedro, Funchal CB2013, 30.v.93 (F. Aguiar) P121a ex *T. vaporariorum* on *E. uniflora* (BMNH); 1♂ S^o. do Saraiva, C^a. de Lobos CB1514, 13.x.93 (F. Aguiar) P140a ex *T. vapor-*

ariorum on *S. muricatum* (BMNH); 1♀ Fonte do Til, Arco da Calheta BB9820, 31.x.94 (A. Felix) P241 ex *T. vaporariorum* on *C. sativus* (BMNH); same data: ??♀ P242 (BMNH), 1♀ P237 (BMNH). AZORES: SÃO MIGUEL: 2♂ Serra da Tronqueira, 26.ix.98 (A. Polaszek and E. Hdez.) ex *A. proletella* on *Lysimachia nemorum*; 10♀ Ponta Delgada market, 25.ix.98 (A. Polaszek and E. Hdez.) ex *A. proletella* on *B. oleracea*. CAPE VERDE: 4♀ Serrado, 7–10.vii.1981 (G. Scheibelreiter) ex *Bemisia* sp. on *B. oleracea* (BMNH, CIE A14563.27); 9♀ Santa Cruz, 2.vii.1982 (A. van Harten) ex *A. proletella* on *B. oleracea* (BMNH).

Eretmocerus Haldeman

Eretmocerus eremicus Rose & Zolnerowich

Material examined: Paratypes: 6♀ 1♂ USA: ARIZONA: 5♀ 1♂ Phoenix, iii.91 (G. Butler) ex *Bemisia tabaci* on *Gossypium hirsutum*; 1♀ CALIFORNIA: Imperial Co., Brawley, 6.i.1994 (K. Hoelmer) ex *Bemisia tabaci* on okra (BMNH).

Eretmocerus mundus Mercet

Material examined: CANARY ISLANDS: LANZAROTE: 2♀ 1♂ Lanzarote, 20.iv.88 (M. Peña) CIEA 19715 ex Aleyrodidae (BNHM); 1♂ Arrecife, 21.iv.96 (E. Hdez.) ex *B. tabaci* complex on *Solanum muricatum*; 1♀ Cerro Teroso, 27.xii.94 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*; 1♀ 1♂ Costa Teguise, 4.v.97 (E. Hdez.) ex *B. tabaci* complex on *S. oleraceus*; 1♂ Famara, 15.viii.95 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*; 3♀ 1♂ Fariones, 5.i.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; same data: 2♂ 15.i.96; 1♂ Haría, 25.viii.95 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 2♂ Pto. del Carmen, 5.i.996 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 1♂ San Bartolomé, 25.ii.95 (E. Hdez.) ex *B. tabaci* complex on *I. batatas*. FUERTEVENTURA: 2♀ Cañada del Rio, 3.i.96 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*; same data: 1♀ on *P. pulcherrima*, 1♀ 22.viii.95 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*, 2♀ 11.iii.97 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*; 1♂ Gran Tarajal, 10.iii.97 (E. Hdez.) ex *B. tabaci* complex on *N. glauca*; 5♀ Nuevo Horizonte, 5.v.97 (E. Hdez.) ex *B. tabaci* complex on *L. camara*; same data: 5♀ 8♂ on *Sonchus* sp.; 1♀ Pájara, 21.xii.94 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; same data: 1♀ 28.xii.94 (BMNH), 2♀ 22.viii.95, 1♂ 22.viii.95 (BMNH), 5♀ 5♂ 3.i.96, 2♀ 2♂ 5.v.97, 1♀ 2♂ 10.iii.97 on *H. rosa-sinensis*. TENERIFE: 1♀ Agua Dulce, 5.xii.94 (E. Hdez.) ex *B. tabaci* complex on *H. rosa-sinensis*; same data: 1♂ 6.xii.94 (E. Hdez.), 2♀ 2♂ 22.ix.95 (E. Hdez.) on *N. glauca*; 13♀ 5♂ Arafo, 21.xii.95 (E. Hdez.) ex *B. tabaci* complex on *P. vulgaris*; same data: 1♂ (BMNH); 1♀ 2♂ Guamasa, 20.iii.96 (E. Hdez.) ex *B. tabaci* complex on *P. pulcherrima*; 2♀ 7♂ Güímar, 24.vi.96 (E. Hdez.) ex *B. tabaci* on *C. annuum*; same data: 2♀ 2.ii.97, 1♀ 1♂ 10.ii.97, 15♀ 7♂ 1.vii.97, 3♀ 2♂ 1.vii.96 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*, 19♀ 15♂ 1.xii.96, 1♂ 1.xii.96 (BMNH), 19♀ 19♂ 9.ii.97, 2♀ 3♂ 1.xii.96 (E. Hdez.) ex *B. tabaci* on *H. rosa-sinensis*; 1♀ 2♂ La Barranquera, 3.iii.97 (E. Hdez.) ex *B. tabaci* on *Gerbera* sp.; 1♀ La Laguna, 5.ii.96 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*; 1♂ Las Galletas, 1.ii.95 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*; same data: 1♂ 15.ii.95 (E. Hdez.) ex *B. tabaci* on *L. esculentum*; 1♀ 2♂

Pajalillos, 4.xii.96 (E. Hdez.) ex *B. tabaci* on *B. oleracea*; 27♀3♂ Valle Guerra, 9.ix.97 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*; same data: 1♀ 24.vii.96 (E. Hdez.) on *B. oleracea*, 1♀2♂ 27.ii.97 on *Gerbera* sp., 31♀17♂ 8.viii.97 (E. Hdez.) on *Rosa* sp. LA GOMERA: 1♂ San Sebastian, 14.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. berthelotii*. PALMA: 6♀3♂ Los Cancajos, 21.vi.97 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*. 7♀4♂ Pto. Nao, 22.vi.97 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*; 26♀18♂ Tazacorte, 22.vi.97 (E. Hdez.) ex *B. tabaci* on *P. pulcherrima*; same data: 1♂ on *N. glauca*. MADEIRA: 2♀ Preces, C^a. da Lobos CB1414, 4.ii.97 (A. Felix) P351 ex *T. vaporariorum* on *P. vulgaris* (ICLAM); same data: 1♀ (BMNH); 2♀ Levada da Serra, Bica da Cana, 16.v.97 (F. Aguiar) P367 ex *Bemisia afer* sens. lat. on *C. arborea* (ICLAM); 8♂3♀ Assomada, Caniço CB2914, 29.xii.97 (A. Felix) P438 ex *B. tabaci* on *P. pulcherrima*; same data: 1♂ 3.xii.97 (A. Felix) P450a (ICLAM); 1♀ Corujeira, Tabúa CB0618, 16.vii.97 (A. Felix) P469 ex *B. tabaci* on *C. sativus* (ICLAM).

Fretocerus near rajasthanicus Hayat

Material examined: CANARY ISLANDS: LA PALMA: 1♀ 2♂ Pto. Nao, 22.vi.97 (E. Hdez.) ex *A. rachipora* on *E. balsamifera*; same data: 1♀ 1♂ ex *Bemisia* sp. (afer-group); Los Cancajos, 21.vi.97 (E. Hdez.) on *E. obtusifolia*. TENERIFE: 1♂ s.l., 23.v.97 (A. Aguiar) ex *A. rachipora*. LA GOMERA: Ctra. San Sebastian, 14.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. berthelotii*.

Eretmocerus roseni Gerling

Material examined: CANARY ISLANDS: LA PALMA: 1♂ Bco. de las Angustias, 22.viii.97 (E. Hdez.) ex *A. rachipora* on *E. obtusifolia*; 3♀ Pto. Nao, 22.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. balsamifera*. 1♀ 1♂ Los Cancajos, 21.vi.97 (E. Hdez.) ex *A. rachipora* on *E. obtusifolia*. GRAN CANARIA: 1♀ La Aldea, 12.viii.97 (E. Hdez.) ex *Aleyrodidae* on *P. pulcherrima*. TENERIFE: 1♀ Cuevas Negras, 29.vi.97 (E. Hdez.) ex *A. rachipora* on *E. atropurpurea*. LA GOMERA: 1♀ San Sebastian, 14.vi.97 (E. Hdez.) ex *Bemisia* sp. (afer-group) on *E. berthelotii*.

Incertae sedis

Cales Howard

Cales noacki Howard

Material examined: CANARY ISLANDS: FUERTEVENTURA: 2♀ Antigua, 14.xii.89 (E. Hdez.) ex *A. floccosus*. LA GOMERA: 1♂ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. floccosus* on *C. limon*; 10♀7♂ San Sebastian, 15.vi.97 (E. Hdez.) ex *A. floccosus* on *C. sinensis*; 5♀5♂ Valle Hermoso, 4.iii.95 (E. Hdez.) ex *A. floccosus* on *C. limon*. LA PALMA: S/C de la Palma, 28.v.96 (E. Hdez.) ex *A. floccosus* on *C. limon*. TENERIFE: 11♀7♂ Bahía del Duque, 3.ii.95 (E. Hdez.) ex *A. floccosus* on *C. sinensis*; same data: on *C. limon*; 2♂ Los Realejos, 7.ii.95 (E. Hdez.) ex *A. floccosus* on *C. limon*; 1♀ Tejina, 5.ii.95 (E. Hdez.) ex *A. floccosus* on *C. sinensis*, 3♀ Playa San Juan, 4.vii.97 (E. Hdez.) ex *A. floccosus* on *C. aurantium*; 1♂ Santa Cruz, 21.i.98 (A. Polaszek *et al.*) ex *Aleurotrachelus atratus* on *Syagrus romanzoffiana* (Cham.).

Glassman. **MADEIRA**: 2♀3♂ Preces, C^a. de Lobos CB1414, 13.vi.89 (F. Aguiar) P2 ex *A. floccosus* on *Citrus* sp.; same data: 2♀1♂ 15.v.97 (A. Polaszek) ex *A. floccosus* on *Citrus* sp. (BNHM), 1♂ Arieiro, São Martinho CB1613, 15.ii.90 (F. Aguiar) P17 ex *A. floccosus* on *C. sinensis* (ICLAM); 1♂ Lugar de Baixo, Ponta do Sol CB0417, 24.i.91 (F. Aguiar) P59 ex *A. floccosus* on *Coffea arabica* (ICLAM); same data: 3♀8♂ 9.iv.91 (F. Aguiar) P62 ex *A. floccosus* on *C. arabica* (ICLAM); 7♀1♂ Cmº. da Ajuda, Funchal CB1812, (F. Aguiar) P60 ex *A. floccosus* on *Citrus reticulata* (ICLAM); 2♂ Funchal CB2013, 11.iii.92 (F. Aguiar) P93 ex *A. floccosus* on *C. sinensis* (ICLAM); same data: 1♀1♂ 3.ii.91 (F. Aguiar) P112 ex *A. floccosus* on *C. reticulata* (ICLAM); 2♀4♂ Sº. da Caldeira, C^a. de Lobos (380 m) CB1215, 8.vi.92 (F. Aguiar) P101 ex *A. floccosus* on *C. sinensis* (ICLAM); 1♀ Santa Luzia, Funchal (100 m) CB2114 30.iv.93 (F. Aguiar) P116 ex *A. floccosus* on *P. americana* (ICLAM); same data: 8♂28♀ 27.i.94 (F. Aguiar) P146 ex *A. floccosus* on *Citrus sinensis* (ICLAM); 9♂38♀ Sº. do Amparo, São Martinho CB1813, 15.vii.93 (F. Aguiar) P125 ex *A. floccosus* on *C. reticulata* (ICLAM); 4♂3♀ Fonte do Til, Arco da Calheta BB9820, 24.ii.94 (F. Aguiar) P157 ex *A. floccosus* on *C. reticulata* (ICLAM); 1♂ Sº. da Madalena, Santo António CB1914, 8.xi.94 (F. Aguiar) P219 ex *A. floccosus* on *E. uniflora* (ICLAM); same data: 1♂1♀ (BMNH); 1♀ Campo da Barca, Funchal CB2113, 20.xi.94 (F. Aguiar) P226 ex *A. floccosus* on *Plumeria rubra* (ICLAM). **AZORES**: SÃO MIGUEL: 6♀6♂ Furnas, B.G. Terra Nostra botanical gardens, 26.ix.98 (A. Polaszek and E. Hdez.) ex *A. floccosus* on *C. aurantium* (BMNH); 2♂ road to Sete Cidades (590 m.s.m.), 27.ix.98 (A. Polaszek and E. Hdez.) ex *Bemisia afer* sens. lat. on *Ilex perado azorica* (BMNH); same data: 2♀ ex *Aleurotulus neph-relepidis* on *Blechnum spicans*.

Family Eulophidae
Subfamily Entedoninae

Euderomphale Girault

Euderomphale cortinae Graham

examined: MADEIRA: 2♀ Fajã

Material examined. ICLAM
 (600 m) CB2223, 19.iv.93 (F. Aguiar) P117 ex *Bemisia afer* sens. lat. on *M. faya* (ICLAM); same data: 1♀1♂ (BMNH), 2♀2♂ 15.xii.93 (F. Aguiar) P119a (ICLAM), 3♂1♀ 15.xii.93 (F. Aguiar) P119a (BMNH); 4♀3♂ Chao da Ribeira near Seixal, 14.v.97 (A. Polaszek) on *Cedronella* sp. with *Bemisia afer* sens. lat.; 1♀1♂ Vale do Paraíso, 13.v.97 (A. Polaszek) ex *Bemisia afer* sens. lat. on *Clethra* sp.

Euderomphale gomer LaSalle & Hernández sp. nov.

Material examined: HOLOTYPE ♀: CANARY ISLANDS: LA GOMERA: El Cedro, 15.vi.97 (E. Hdez.) ex *Bemisia afer* sens. lat. on *Gesnouinia arborea* (BMNH). PARATYPE ♂: same data as holotype (BMNH); TENERIFE: 41♀2♂ Cuevas Negras, 29.vi.97 (E. Hdez.) ex *Aleyrodes singularis* on *Canarina canariensis* (BMNH); 1♂ same data but ex *Bemisia afer* sens. lat. on *Bystropogon odoratissimus* (BMNH); 1♀, 1♂ same data but ex *B. medinae* on *H. grandifolium* (BMNH); 1♀ same data but ex *A. singularis*

on Cruciferae (BMNH). 1♀ Bco. de las Moradas, 18.v.97 (E. Hdez.) ex *Bemisia afer* sens. lat. on *E. virescens* (BMNH); 2♀2♂ same data but ex *A. singularis* on *C. canariensis* (BMNH); 2♀1♂ same data but ex *B. medinae* on *H. grandifolium* (BMNH) 3♀3♂ same data but ex *B. medinae* on *H. grandifolium* (BMNH); 1♀ Valle Guerra, 12.vi.97 (E. Hdez.) ex *Bemisia afer* sens. lat. on *Pterocephalus* sp. (BNHM); 1♂ Las Cañadas, Bco. de Erque (1925m.s.m.), 15.x.95 (A. Camacho) 17W/HI37740; 5♀2♂ Las Mercedes, 7.vi.97 (E. Hdez.) ex *A. singularis* on *C. canariensis* (BMNH); 1♂ same data but ex *B. medinae* on *H. grandifolium*. LA GOMERA: 34♀6♂ El Cedro, 15.vi.97 (E. Hdez.) ex *B. medinae* on *H. grandifolium* (BMNH); 1♀1♂ San Sebastian, 15.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola* (BMNH); 2♀ same data but ex *Bemisia* sp. (*afer*-group) on *E. berthelotii* (ICIA). LA PALMA: 1♀9♂ Los Tilos, 21.vi.97 (E. Hdez.) ex *A. singularis* on *C. canariensis* (ICIA), 1♀1♂ (BMNH).

Euderomphale insularis LaSalle & Hernández sp. nov.

Material examined: HOLOTYPE ♀: CANARY ISLANDS: LA GOMERA: San Sebastian, 15.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*. PARATYPES 2♀2♂; same data as holotype (BMNH). Other material (all BMNH): LA GOMERA: 2♀1♂ Bco. Santiago, 14.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*; 1♀1♂ San Sebastian, 15.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*; LANZAROTE: 1♂ Femés, 3.v.97 (E. Hdez.) ex *A. proletella* on *B. oleracea*; LA PALMA: 1♀ El Paso, 22.vi.97 (E. Hdez.) ex *A. proletella* on *L. serriola*; AZORES: SÃO MIGUEL: 3♀1♂ Serra da Tronqueira (700 m), 26.ix.98 (A. Polaszek and E. Hdez.) ex *Aleyrodes proletella* on *Lysimachia nemorum*.

Family Platygastridae

Amitus Haldeman

Amitus fuscipennis MacGown & Nebeker

Material examined: CANARY ISLANDS: TENERIFE: 23♀ La Laguna, 21.i.97 (E. Hdez. et al.) ex *T. vaporariorum* (West.) on *P. pulcherrima*; same data: 1♀ 16.xi.94. MADEIRA: 2♀ Sº. da Igreja, Campanário CB1016, 9.ii.94 (F. Aguiar) P150 ex *T. vaporariorum* on *Urtica dioica* (ICLAM); same data: 1♀ (BMNH), 2♀ 6.x.94 (F. Aguiar) P213 on *B. pilosa* (ICLAM); 1♀ Preces, Cº. de Lobos CB1414, 6.vii.94 (F. Aguiar) P193 ex *T. vaporariorum* on *B. pilosa* (ICLAM); same data: 323♀ 16.i.95 (A. Felix) P271 ex *T. vaporariorum* on *P. pulcherrima* (ICLAM), 2♂ (BMNH), 15♀ 4.vi.95 (A. Felix) P272 (ICLAM), 13♀ 15.v.97 (A. Polaszek) ex *T. vaporariorum* on *Erigeron* sp.; 12♀ Sº. da Madalena, Funchal CB1815, 8.xi.94 (F. Aguiar) P222 ex *T. vaporariorum* on *Conyza* sp. (BMNH); 1♀ Fonte do Til, Arco da Calheta BB9820, 31.x.94 (A. Felix) P239 ex *T. vaporariorum* on *L. esculentum* (ICLAM); 3♀ Serrado, Porto da Cruz CB2925, 26.i.95 (A. Felix) P266 ex *T. vaporariorum* on *L. esculentum* (ICLAM); 1♀ Sº. da Corujeira, Tabúa CB0618, 19.iv.95 (A. Felix) P267 ex *T. vaporariorum* on *C. sativus* (ICLAM); 2♀ Rib. Real, Estreito de Cº. de Lobos CB1515, 8.iii.95 (A. Felix) P268 ex *T. vaporariorum* on *P. pulcherrima* (ICLAM); 3♀ Sº. dos Barreiros, Caniço CB2814, 7.i.95 (A. Felix) P269 ex *T. vaporariorum* on *C. sativus* (ICLAM); 4♀ Sº. da Igreja, Quinta Grande CB1115,

16.ii.95 (A. Felix) P270 ex *T. vaporariorum* on *P. vulgaris* (ICLAM); 2♀ Tranqual, Campanário CB1016, 22.viii.95 (A. Felix) P273 ex *T. vaporariorum* on *L. esculentum* (ICLAM); 1♀ Sº. do Saraiva, Cº. de Lobos CB1514, 13.x.93 (F. Aguiar) P140b ex *T. vaporariorum* on *S. muricatum* (BMNH); 2♀ Torrinha, Funchal CB2114, 23.iv.94 (F. Aguiar) P181 ex *T. vaporariorum* on *Hibiscus* sp. (BMNH); 1♀ Sº. do Saraiva, Cº. de Lobos CB1514, 13.x.93 (F. Aguiar) P140b ex *T. vaporariorum* on *S. muricatum* (BMNH); 2♀ Torrinha, Funchal CB2114, 23.iv.94 (F. Aguiar) P181 ex *T. vaporariorum* on *Hibiscus* sp. (BMNH).

Appendix 2. Summary of distribution

Parasitoid species	Canary Islands	Madeira	Azores
<i>Encarsia acaudaleyrodis</i>	+	—	—
<i>E. atlantica</i>	+	—	—
<i>E. azimi</i>	+	—	—
<i>E. davidi</i>	+	—	—
<i>E. dichroa</i>	+	—	—
<i>E. estrellae</i>	—	—	+
<i>E. formosa</i>	+	+	+
<i>E. guadeloupae</i>	+	—	—
<i>E. hispida</i>	+	+	—
<i>E. inaron</i>	+	+	—
<i>E. levadicola</i>	+	+	—
<i>E. lutea</i>	+	+	—
<i>E. melanostoma</i>	+	—	—
<i>E. noahi</i>	+	+	+
<i>E. pergandiella</i>	+	+	+
<i>E. sophia</i>	+	—	—
<i>E. tricolor</i>	+	+	+
<i>Eretmocerus eremicus</i>	+	—	—
<i>E. mundus</i>	+	+	—
<i>E. nr rajasthanicus</i>	+	—	—
<i>E. roseni</i>	+	—	—
<i>Cales noacki</i>	+	+	+
<i>Euderomphale cortinae</i>	—	+	—
<i>E. gomer</i>	+	—	—
<i>E. insularis</i>	+	—	+
<i>Amitus fuscipennis</i>	+	+	—

Total number of species: 26

Number of species in the Canary Islands: 24

Number of species in Madeira: 12

Number of species in Azores: 7

Here described: 6

Introduced in biological control programmes: 4

Number of species in all three archipelagos: 5 (*Encarsia noahi*, *E. formosa*, *E. pergandiella*, *E. tricolor*, *Cales noacki*) of which *E. noahi* could be a Macaronesian endemic, *E. tricolor* is widespread in the Old World and the remainder are cosmopolitan.

Number of species only in Canary Islands and Madeira: 6 (*Encarsia hispida*, *E. inaron*, *E. levadicola*, *E. lutea*, *Eretmocerus mundus*, *Amitus fuscipennis*) of which *E. inaron*, *E. lutea* and *E. mundus* could be expected to occur as yet undiscovered in the Azores, and *E. hispida* either already occurs there or can be expected to invade in the near future.

Number of species only in the Canaries and Azores: 1 (*Euderomphale insularis*)

Number of species only in Madeira and Azores: 0

Appendix 3. Summary of *Encarsia* species groups

inaron: 7 (*E. atlantica*, *E. levadicola*, *E. melanostoma*, *E. azimi*, *E. dichroa*, *E. estrellae*, *E. inaron*).
lutea: 2 (*E. davidi*, *E. lutea*)
luteola: 3 (*E. formosa*, *E. hispida*, *E. guadeloupae*)
parvella: 2 (*E. acaudaleyrodes*, *E. pergandiella*)
strenua: 2 (*E. noahi*, *E. sophia*)
tricolor: 1 (*E. tricolor*)

Appendix 4. Summary of origin

Nearctic/Neotropical: 7 (*Cales noacki*, *Encarsia formosa*, *E. guadeloupae*, *E. hispida*, *E. pergandiella*, *Eremocerus eremicus*, *Amitus fuscipennis*) = 27%
 Palaearctic: 10 (*Encarsia acaudaleyrodis*, *E. azimi*, *E. davidi*, *E. dichroa*, *E. inaron*, *E. lutea*, *E. tricolor*, *Eremocerus mundus*, *E. roseni*, *E. nr rajasthanicus*) = 38%
 Oriental: 1 (*E. sophia*) = 4%
 Macaronesia: 8 (*Euderomphale gomer*, *E. insularis*, *E. cortinae*, *Encarsia atlantica*, *E. estrellae*, *E. levadicola*, *E. melanostoma*, *E. noahi*) = 31%

Appendix 5. Summary of whitefly hosts

Whitefly parasitoid species	<i>Acaudaleyrodes rachipora</i>	<i>Aleurothrixus flaccosus</i>	<i>Aleurotrachelus atratus</i>	<i>A. rhamnicola</i>	<i>Aleurotulus nephrolepidis</i>	<i>Aleyrodes</i> sp. nov.	<i>A. proletella</i>	<i>A. singularis</i>	<i>Bemisia</i> after sens. Lat.	<i>B. lauracea</i>	<i>B. medinae</i>	<i>B. tabaci</i> complex	<i>Bemisia</i> sp.(afer-group)	<i>Bemisia</i> sp.	<i>Crenidorsum aroidephagus</i>	<i>Lipaleyrodes</i> sp. A	<i>Lipaleyrodes</i> sp. B	<i>Peleius azaleae</i>	<i>P. maderensis</i>	<i>Siphoninus phillyreae</i>	<i>Triauleyrodes ricini</i>	<i>T. vaporariorum</i>	<i>Aleurodites dispersus</i>	<i>Lecanoideus floccissimus</i>	Total
<i>Encarsia acaudaleyrodis</i>	+																								2
<i>E. atlantica</i>									+																1
<i>E. azimi</i>																									2
<i>E. davidi</i>	+																								2
<i>E. dichroa</i>																									2
<i>E. estrellae</i>																									4
<i>E. formosa</i>																									2
<i>E. guadeloupae</i>																									10
<i>E. hispida</i>						+		+																	4
<i>E. inaron</i>										+															3
<i>E. levadicola</i>																									5
<i>E. lutea</i>	+																								6
<i>E. melanostoma</i>																									8
<i>E. noahi</i>		+																							4
<i>E. pergandiella</i>																									4
<i>E. sophia</i>																									5
<i>E. tricolor</i>																									2
<i>Eremocerus. eremicus</i>																									4
<i>E. mundus</i>																									2
<i>E. nr rajasthanicus</i>	+																								2
<i>E. roseni</i>	+																								1
<i>Euderomphale cortinae</i>																									5
<i>E. gomer</i>																									1
<i>E. insularis</i>																									5
<i>Cales noacki</i>	+	+	1	1	1	1	1	10	7	9	1	2	12	9	1	2	1	1	2	1	2	1	12	2	2
<i>Amitus. fuscipennis</i>																									89
Total	5	3	1	1	1	1	1	10	7	9	1	2	12	9	1	2	1	1	2	1	2	1	12	2	2