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WHITEFLIES OF THE MALTESE ISLANDS (HOMOPTERA, ALEYRODIDAE)

David Mifsud[1]

ABSTRACT

Whitefly species collected by the author from the Maltese Islands during 1992-94 are recorded.

Prior to this study only two whitefly species were definitely recorded from the Maltese archipelago.During this study thirteen species were found. These were *Aleurolobus niloticus* Priesner & Hosny; *Aleurolobus* sp., *Aleurothrixus floccosus* (Maskell); *Aleurotrachelus rhamnicola*(Goux), *Aleyrodes proletella* (Linnaeus); *Bemisia afer* (Priesner & Hosny); *Bemisia tabaci* (Gennadius); *Dialeurodes citri* (Ashmead); *Siphoninus phillyrea* (Haliday); *Tetraleurodes hederae* Goux; *Tetralicia ericae* Harrison; *Trialeurodes lauri* Signoret and *Trialeurodes vaporariorum* (Westwood).

A key based on pupal characters is given. For each species, complete collection data, host plant range, global distribution and additional notes are given where appropriate.

Attention is drawn to the possible occurrence of other whitefly species with suitable biogeographical distribution and ecology. These include: *Aleurolobus olivinus* (Silvestri), *Aleurotuba jelinekii* (Frauenfeld), *Aleuroviggianus adrianae* Iaccarino, *Aleyrodes elevatus* Silvestri and *Aleyrodes lonicerae* Walker.

INTRODUCTION

Several floristic and faunistic studies have been carried out in the Maltese Islands. Due to the critical geographical position of the Islands in the Central Mediterranean Basin, such studies throw light on important aspects of biogeography.

Lack of information on the Maltese Sternorrhynchous fauna encouraged the present author to carry out a study of the Aleyrodidae of the Maltese Islands, as the subject of his B.Sc. dissertation (Mifsud, 1993).

[1] Department of Agriculture, Research and Development Centre, Ghammieri - Marsa, Malta.

Faunistic and ecological studies on whiteflies have been conducted in several Mediterranean countries including Egypt, Israel and Italy, the latter being thoroughly investigated by Italian entomologists in the past twenty years (Mineo & Viggiani, 1975; Iaccarino, 1976; 1981; 1982; 1985; Iaccarino & Tremblay, 1977; Genduso & Liotta, 1980; Patti & Rapisarda, 1981; Rapisarda, 1982; 1985; 1990; Rapisarda & Patti, 1983; Barbagallo *et al.*, 1986).

Published work on Maltese whitefly species is limited and only species of agricultural importance have been reported. Borg (1922) pointed out that the citrus whitefly *Dialeurodes citri* (Ashmead) had never been observed on citrus groves in the Maltese Islands. The earliest Maltese whitefly record was due to Borg (1935) citing the cabbage whitefly *Aleurodes brassicae* [= *Aleyrodes proletella* (Linnaeus)] as a pest on cabbages.

An article (Anon., 1985) contributed by David Dandria (pers. comm.) mentioned the newly introduced woolly whitefly pest *Aleurothrixus floccosus* (Maskell). In another publication (Vella, 1993) problems caused by this pest in local citrus groves were described.

The occurrence of a plant virus new to Malta, the tomato yellow leaf curl virus (TYLCV), mainly transmitted by the sweet potato whitefly *Bemisia tabaci* (Gennadius) was recently highlighted (Anon., 1993a; 1993b; 1993c). Problems caused by this virus were also recorded by Saliba (1993).

METHODS

Field investigations and collection in several habitats of the Maltese Islands were conducted by the author during the years 1992/94. All identifications were based on the pseudopupal stage. Fig.1 shows a diagramatic representation of a whitefly pupal case.

Species not covered in author's dissertation (Mifsud, 1993) are indicated by an asterisk (*).

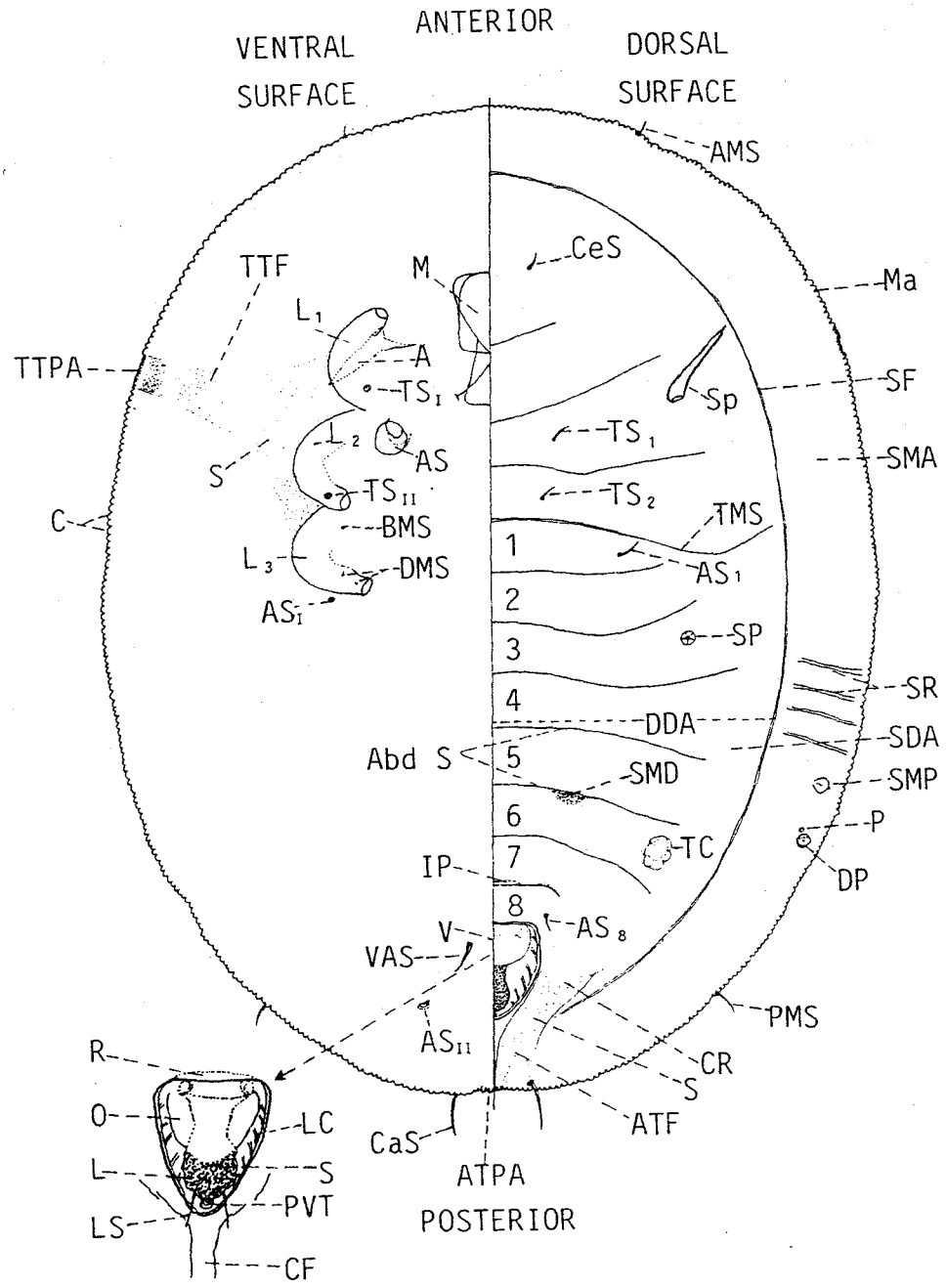

Fig.1 - General morphological characteristics of a whitefly puparium. A, antenna; Abd S, abdominal sutures; AMS, anterior marginal seta; $AS_{I,II}$, anterior, posterior abdominal spiracle; $AS_{1,8}$, 1st, 8th abdominal seta; 1-8 abdominal segments; AS, adhesive sac; ATF, abdominal tracheal fold; ATPA abdominal tracheal pore area; BMS, basal minute seta; C, crenations; CaS, caudal seta; CeS, cephalic seta; CF, caudal furrow; CR, caudal ridge; DDA, dorsal disc area; DMS, distal minute seta; DP, disc pore; IP, internal pocket; L, ligula; $L_{1,2,3}$ pro-, meso-, metathoracic legs; LC, lateral carinae of vasiform orifice wall; LS, ligular seta; M, mouth parts; Ma, margin; O, operculum; P, porette; PMS, posterior marginal seta; PVT, posterior vasiform tubercle; R, rim; S, spinules; SDA, subdorsal area; SF, submarginal fold; SMA, submarginal area; SMD, submedian depressions; SMP, submaginal papilla; Sp, spine; SP, simple pore; SR, submarginal ridges; TC, tubercle cluster; TMS, transverse moulting suture; $TS_{1,2}$, meso-, metathoracic setae; $TS_{I,II}$, anterior, posterior thoracic spiracle; TTF, thoracic tracheal fold; TTPA, thoracic tracheal pore area; V, vasiform orifice; VAS, ventral abdominal seta.

KEY TO THE WHITEFLY SPECIES OF THE MALTESE ISLANDS - BASED ON PUPAL CASES

(species not in bold type have not yet been found in the Maltese Islands, but have been included since their occurence or possible introduction is highly probable)

1. Pupal cases evenly brown or lack.....2
   Pupal cases wholly or partly with pale to dusky cuticle.....6

2. Wide submargin separated from dorsal disc by a distinct furrow (dorsal surface).....3
   Submargin not physically separated from dorsal disc.....5

3. Outline subcircular, little longer than wide. Larger species, female puparia up to 1.70mm.....*Aleurolobus olivinus* (Silvestri)
   Outline oval, conspicuously longer than wide. Smaller species, female puparia up to 1.30mm.....4

4. Operculum acute posteriorly. Margin at thoracic tracheal openings with three modified teeth; remainder of margin with regular, shallow crenulation.....
   .....***Aleurolobus niloticus* Priesner & Hosny**
   Operculum rounded posteriorly. Margin at thoracic tracheal openings unmodified; remainder of margin irregularly but coarsely crenulate.....
   .....***Aleurolobus* sp.**

5. Pupal case with margin deflexed ventrally, rendering edge of puparium a "false margin" which is smooth. Outline rather irregular, much longer than wide.....***Tetralicia ericae* Harrison**
   Margin not deflexed, with regular fine teeth. Outline suboval, widest at abdominal segment III. Inner subdorsum with a pair of folds, concentric with margin, from thorax to abdominal segment II.....
   .....***Aleurotrachelus rhamnicola* (Goux)**

6. Wide submargin separated from dorsal disc by a distinct furrow.....7
   Submargin not physically separated from dorsal disc.....8

7. Submarginal furrow interrupted posteriorly, not present behind vasiform orifice. Cephalic, meso- and metathoracic, eighth abdominal and caudal setae present,short and stout. .....***Tetraleurodes hederae* Goux**
   Submarginal furrow continuous behind vasiform orifice. Metathoracic, eighth abdominal and caudal setae only present, long and hair-like, wavy.....
   .....***Aleurothrixus floccosus* (Maskell)**

8. Outer submargin with an even row of 14 pairs of fine setae up to 45 µm long. Head of lingula with a pair of lateral processes basally.....
   .....*Parabemisia myricae* (Kuwana)
   If submargin with setae, then these minute. Head of lingula without lateral processes at base.....9

9. Operculum filling vasiform orifice, concealing lingula. Thoracic and caudal tracheal openings at margin marked by distinct invaginated "pores"..... .....***Dialeurodes citri*** **(Ashmead)**
Operculum not entirely filling vasiform orifice. Lingula tip exposed to varying degrees, or at least visible through operculum.....10

10. A row of submarginal papillae present. Lingula lobulate.....11
Without a row of submarginal papillae. Lingula not lobulate.....12

11. Shape, position and number of submarginal papillae very variable, but their bases not contiguous. Lingula with only basal lobes covered by operculum. Cephalic setae present.....***Trialeurodes vaporariorum*** **(Westwood)**
Submarginal papillae in a regular row, their bases contiguous. Lingula almost completely covered by operculum. Cephalic setae absent..... .....***Trialeurodes lauri*** **(Signoret)**

12. Dorsum bearing many long tubular spines. Cuticle often pigmented along median line.....***Siphoninus phillireae*** **(Haliday)**
Dorsum often bearing conspicuous setae, but never tubular spines.....13

13. Caudal furrow little marked. 8 subequal segments clearly visible on median line, between moulting suture and vasiform orifice. Caudal setae very short, hardly extending beyond margin of puparium; cephalic, first and eighth abdominal setae similar. Vasiform orifice normally smoothly rounded posteriorly.....***Aleyrodes protella*** **(Linnaeus)**
Caudal furrow pronounced. Median length of abdominal segment VII reduced often only 7 segments visible between moulting suture and vasiform orifice..... 14

14. Vasiform orifice longer than caudal furrow, its sides almost straight. Caudal setae always long (usually at least as long as vasiform orifice), irrespective of lengths of other dorsal setae..... ***Bemisia tabaci*** **(Gennadius)**

Caudal furrow at least as long as vasiform orifice, whose sides are somewhat concave. Caudal setae usually less than half length of vasiform orifice..... .....***Bemisia afer*** **(Priesner & Hosny)**

Aleurolobus niloticus Priesner & Hosny

Aleurolobus niloticus Priesner & Hosny, 1934

Material examined: Malta: Ghar Lapsi 14/II/93; Valletta, 20/IX/93; Wardija 3/X/93. Pupal cases collected on upper and lower leaf surfaces of *Capparis* spp.

Host plants: *A. niloticus* is polyphagous, known to develop on twenty-four different plant genera (Mound & Halsey, 1978). In Israel it has been recorded only on *Zizyphus spina-christi* (Bink-Moenen & Gerling, 1990) whereas in Sicily it was collected on *Capparis spinosa* (Rapisarda, 1985).

Distribution: *A. niloticus* is known to occur in Central and Eastern Africa (Cameroon, Chad, Congo, Nigeria, Egypt, Sudan, Ethiopia, Kenya) diffusing eastwards through Saudi Arabia, Iran, Pakistan and India (Mound & Halsey, 1978; Bink-Moenen, 1983; Martin J.H. pers. comm.). Its presence in Sicily (Rapisarda, 1985) and the Maltese Islands further extends its geographical range towards the Central Mediterranean Basin. Further investigations on typical host plants of this whitefly, may reveal its diffused presence along the southern coasts of the Mediterranean Basin.

Notes: Whenever present, *A. niloticus* was always found in high population densities. Heavily infested caper bushes showed leaf chlorosis, similar to observations made in Sicily (Rapisarda, 1985). So far, in Sicily, this species has only been observed on isolated caper plants. No caper industry is present in the Maltese Islands, so that this whitefly does not represent any economic problem.

Aleurolobus sp. *

The identity of this possibly new whitefly species is still under investigation. It represents a very interesting biogeographical entity showing affinities to North African material. Further information on host plants and ecology will be published in the near future.

Aleurothrixus floccosus (Maskell)

Aleyrodes floccosa Maskell,1895
Aleurothrixus floccosus; Quaintance & Baker, 1914

Material examined: Malta: B'Kara 20/VII/92 on *Citrus aurantium & C. limon*; St. Andrews 11/VIII/92 on *C. sinensis*; Birzebbugia 15/VIII/92 on *C. sinensis*; St. Lucia 16/VIII/92 on *C. nobilis*; Siggiewi, Rabat, Buskett 18/VIII/92 on *C. aurantium*; Zejtun 16/VIII/92 on *C. sinensis, C. aurantium, & C. nobilis*; St. Thomas Bay 20/VIII/92 on *C. sinensis* Girgenti 8/IX/92 on *C. sinensis*; Kappara 9/IX/92 on *C. sinensis*; Lija 11/X/92 on *C. limon*.
Gozo: Ghajnsielem, Victoria 3/X/92 on *C. sinensis*; Zebbug 4/X/92 on *C. sinensis & C. limon*.

Host plants: *A. floccosus* occurs on about twenty different plant genera, having a preference for *Citrus* spp., at least in newly colonized environments such as the Mediterranean Basin (Patti & Rapisarda, 1981; Barbagallo *et al.*, 1992).

Distribution: *A. floccosus* is probably of neotropical origin, having diffused over North Africa, several other African countries, the Canary Islands, Réunion, the western and southern Mediterranean Basin, and the Middle East (Mound and Halsey, 1978; Liotta & Maniglia, 1983; Barbagallo *et al.*, 1986).

Notes: *A. floccosus* is a serious pest of citrus, being considered a highly injurious species around the Mediterranean basin (Barbagallo *et al.*, 1986). It is present wherever citrus is grown in the Maltese Islands; however it is effectively controlled in certain citrus orchards by the introduced parasitoid *Cales noacki* (Howard) (Mifsud *et al.*, 1995). Besides the fact that populations can reach very high densities on leaf undersides, it secretes copious sugary honeydew, on which fungal growth developes. The whole leaf can be covered by a sooty mould, impairing the photosynthetic process.

Aleurotrachelus rhamnicola (Goux) *

Aleyrodes rhamnicola Goux,1940
Aleurotrachelus rhamnicola; Martin *et al.*,1995
Aleurotrachelus espunae Gomez-Menor,1945; Martin *et al.*,1995

Material examined: Malta: Wardija 3/X/93. Pupal cases on leaf underside of *Rhamnus alaternus* (L.).

Host plants: In Spain, *A. rhamnicola* was reported to occur on *Berberis* sp. and *Quercus* sp. (Gomez-Menor, 1945). In Sicily, specimens were collected on *Rubus* spp. (Iaccarino, 1985), while in Malta the species was found on *Rhamnus alaternus*, this being a new host record. In Italy an *Aleurotrachelus* sp. was collected on *Rubus* spp. and *Clematis vitalba* L., while mounted material (coll. Silvestri) was found on *Rhamnus* sp. (Iaccarino, 1985). Further study may indicate that *A. rhamnicola* is more polyphagous than is presently known (Rapisarda & Patti, 1983).

Distribution: *A. rhamnicola* has a South European distribution, being hitherto known only from Spain and Sicily (Gomez-Menor, 1945; Rapisarda & Patti, 1983). The identity of *Aleurotrachelus* sp. collected in Italy (Iaccarino, 1985) is still under investigation (F. Iaccarino, personal communication). Further research may indicate a more widespread distribution and a wider range of host plants.

Aleyrodes proletella (Linnaeus)

Phalaena (Tinea) proletella Linnaeus, 1758
Aleyrodes proletella; Latreille,1801-2

Material examined: Malta: Bahrija 4/IX/92 on *Brassica capitata*; Girgenti 8/IX/92 on *B. botrytis*; Manikata 22/IX/92 on *B. capitata & B. rupestris*; Marsaskala 18/XI/93 on *Brassica* sp.
Gozo: Ghajnsielem 3/X/92 on *B. rupestris*; Marsalforn 4/X/92 on *B. capitata.*

Host plants: *A. proletella* is known to occur on various host plants, with a marked preference for Compositae and Cruciferae (Mound & Halsey, 1978). In Sicily, *A. proletella* was collected on *Brassica oleracea* L., *Cichorium intybus* L., *Sonchus oleraceus* L., *Acanthus mollis* L. and *Hypochaeris glabra* L., while in the Maltese Islands it was observed on several *Brassica* crops.

Distribution: *A. proletella* is probably of Palaearctic origin, being present throughout Europe and North Africa; it is also present in Eastern Africa, Brazil and New Zealand (Mound & Halsey, 1978).

Notes: *A. proletella* is commonly regarded as a pest of *Brassica* crops (Martin, 1987). *Aleyrodes proletella* is considered to be a pest of *Brassica* crops in Europe (Martin, 1987). In the Maltese Islands it was only found in low population densities, being apparently effectively controlled by its natural enemies (Mifsud *et al.*, 1995).

Bemisia afer (Priesner & Hosny) *

Dialeurodes afer Priesner & Hosny,1934
Bemisia afer; Gameel,1968
Bemisia hancocki Corbett, 1936; Bink-Moenen,1983

Material examined: Malta: Buskett 4/X1/93; Msida 8/XI/93; Qrendi (Maqluba) 10/XI/93, all on leaf undersides of *Ceratonia siliqua* L.

Host plants: *B. afer* is known to be highly polyphagous (Mound & Halsey, 1978). In Italy *B. afer* was first observed on *Citrus* spp. (Mineo & Viggiani, 1975; Patti & Rapisarda, 1981); in Sicily it was also found on *Laurus nobilis* L., *Clematis vitalba* L. and *Rhamnus alaternus* L. (Iaccarino & Viggiani, 1988; Rapisarda, 1985-89).In Malta *B.afer* was only found on *Ceratonia siliqua,* this being a new host plant.

Distribution: *B. afer* is a widely diffused species, being reported from several African countries, Madagascar, Great Britain, South Europe (Italy, Spain), India, Pakistan and China (Mound & Halsey, 1978; Halstead, 1981; Bink-Moenen, 1983; Yan, 1988).

Notes: *B. afer* occurs in very low population densities on citrus in Southern Italy (Campania, Liguria and Sicily), being of no economic importance (Mineo & Viggiani, 1975; Patti & Rapisarda, 1981; Barbagallo *et al.*, 1992). In Italy, although previously recorded as a possibly introduced species on citrus groves (Mineo & Viggiani, 1975; Patti & Rapisarda, 1981), recent evidence points to its indigenous occurrence (Rapisarda, 1990). This hypothesis was put forward because of the effective natural control of this whitefly: a study of the parasitoids associated with *B. afer* revealed the presence of at least three species, two of which (*Euderomphale bemisiae* Viggiani and *Encarsia silvestri* Viggiani & Mazzone). were new to science (Viggiani, 1977; Viggiani & Mazzone, 1979). Other evidence for the indigenous occurrence of *B. afer* in Southern Europe is its higher incidence on indigenous host plants, such as *Laurus nobilis* (Iaccarino & Viggiani, 1988), *Clematis vitalba, Rhamnus alaternus* (Rapisarda, 1990) and *Ceratonia siliqua*, as opposed to cultivated citrus.

Bemisia tabaci (Gennadius)

Aleurodes tabaci Gennadius,1889
Bemisia tabaci; Takahashi,1936

Material examined: Malta: Bahrija 4/IX/92 on *Helianthus tuberosus*; Girgenti 8/IX/92 on *Solanum tuberosum*; Zabbar 17/IX/92 on *Brassica capitata*; Zejtun 17/IX/92 on *Ocimum basilicum*; B'Kara 20/IX/92 on *Solanum melongena*; Manikata 22/IX/92 on *B. capitata*; St. Thomas Bay 24/IX/92 on *B. capitata*; Ghajn Rihana 26/IX/92 on *B. capitata*; Marsaskala 24/IX/92 on *S. tuberosum*; B'Kara 8/X/92 on *Jaccobina pohliana*; Msida 22/X/92 on *Lantana camara.*

Gozo: Dwejra 3/X/92 on *S. nigrum*; Tal-Lunzjata 4/X/92 on *Helianthus tuberosus*; Sara Valley, Zebbug, Marsalforn 4/X/92 on *Brassica sp.*

Comino: 1/X/92 on *Euphorbia pinea.*

Host plants: *B. tabaci* is extremely polyphagous, reported to occur on more than five hundred different plant species, often herbaceous (Russell, 1975; Mound & Halsey, 1978; Greathead, 1986). Recent evidence points to the occurrence of different biotypes (strains or races) of *B. tabaci* and it has been suggested that it is one or more of these biotypes which is responsible for the recent escalation of crop losses (Costa & Brown, 1990; Perring *et al.*, 1991).

Distribution: Cosmopolitan.

Notes: *B. tabaci* is regarded as a serious pest of vegetable crops in greenhouses and open fields and of other crops (e.g. cotton) throughout the world (Onillon, 1990). High population densities on leaf undersides can considerably reduce productivity by directly consuming phloem material, but *B. tabaci* is also known to transmit at least 19 plant viruses (Brunt, 1986); some important ones are the cotton leaf crumple virus(CLCV), the cotton leaf curl virus(CLCV), the tobacco leaf curl virus(TLCV) and the tomato yellow leaf curl virus (TYLCV). The latter is known to occur in the Maltese Islands and is causing considerable losses in tomato crops (Saliba, 1993; Anon., 1993c).

Dialeurodes citri (Ashmead)

Aleyrodes citri Ashmead, 1885
Dialeurodes citri; Quaintance & Baker,1916

Material examined: Malta: Zejtun 26/VIII/92; on *Citrus nobilis* and *C. aurantium*; Birzebbuga 28/X/92 on *C. sinensis*; Zebbug 19/X/93 on *C. nobilis*; Buskett 11/XI/93 on *Fraxinus angustifolia.*

Gozo: Ghajnsielem 3/X/92 on *Citrus aurantium.*

Host plants: *D. citri* is known to live on numerous plants of different families (Mound & Halsey, 1978) though it shows a marked preference for *Citrus* spp., at least where it has been introduced (Patti & Rapisarda, 1981).

Distribution: *D. citri* is probably a native of the Indian Region, having spread throughout the whole temperate zone, with a geographical distribution comprising, in addition to the Oriental and Palaearctic Regions, also North and South American countries (Mound & Halsey, 1978). It is widely present in the Mediterranean Basin (Barbagallo *et al.*, 1986).

Notes: *D. citri* is another injurious pest of citrus around the Mediterranean basin (Barbagallo *et al.*, 1986) although it is of secondary economic importance due to the effectiveness of its introduced natural enemies in Italy (Barbagallo *et al.*, 1986; 1992). High population densities in citrus groves were recorded in Italy during the period of its introduction (Priore, 1969). In the Maltese Islands ,no serious infestations have been observed.

Siphoninus phillyreae (Haliday) *

Aleyrodes phillyreae Haliday,1835
Siphoninus phillyreae; Silvestri,1915

Material examined: Malta: Buskett 11/XI/93 on *Fraxinus angustifolia.*

Host plants: *S. phillyrea* is a polyphagous species having a marked preference for several plant genera including *Pyrus, Fraxinus, Olea* and *Phillyrea* (Mound & Halsey, 1978).

Distribution: *S. phillyreae* occurs almost throughout continental Europe. It is present also in several parts of North and East Africa, extending to Saudi Arabia, Syria, Iran, Pakistan and India (Mound & Halsey, 1978).

Notes: *S. phillyreae* is considered a pest of pear trees (Tremblay, 1969; Patti & Rapisarda, 1981). So far, *S. phillyreae* has not been observed on pear trees in the Maltese Islands, however, it should be considered as a potential pest of this crop.

Tetraleurodes hederae Goux

Tetraleurodes hederae Goux, 1939

Material examined: Malta: Buskett 10/II/93 on *Hedera helix.*

Host plants: *T. hederae* seems to be monophagous on *Hedera helix* although a record exists on *H. taurica* (Mound & Halsey, 1978).

Distribution: The geographical distribution of *T. hederae* is poorly known, the species being found so far in France, Russia, Italy and Sicily (Mound & Halsey, 1978; Iaccarino, 1981; Rapisarda, 1982).

Tetralicia ericae Harrison

Tetralicia ericae Harrison,1917

Material examined: Malta: Mosta 4/X/92; Selmun (Ghajn Hadid) 8/XI/92; Manikata 10/XI/92; Ghar Lapsi 14/II/93; Birzebbuga 17/II/93 all on *Erica multiflora*,
Gozo: Wied tal-Lunzjata 3/X/92 on *Erica multiflora.*

Host plants: *T. ericae* seems to develop only on *Erica* spp. Both in Sicily and the Maltese Islands, it was only collected on *E. multiflora* (this being the only wild *Erica* species in the Maltese Islands) but it is also known to occur on *E. carnea, E. tetralix, E. australis, E. arborea, E. manipuliflora* and *E. umbellata* (Rapisarda, 1982; Bink-Moenen, 1989).

Distribution: *T. ericae* occurs throughout most of Continental Europe, diffusing into the Eastern Mediterranean Basin (Mound & Halsey, 1978; Patti & Rapisarda, 1981; Bink-Moenen, 1989).

Trialeurodes lauri Signoret

Trialeurodes lauri Signoret, 1882

Material examined: Malta: Buskett 10/II/92 on *Laurus nobilis*

Host plants: *T. lauri* is known to occur primarily on *Laurus nobilis*, having been also recorded on *Arbutus* spp. (Mound & Halsey, 1978) such as *A. andrachne* (Bink-Moenen & Gerling, 1990).

Distribution: The geographical distribution of *T. lauri* coincides with that of its host plant (*Laurus nobilis*) thus being present in most parts of the Mediterranean Basin (Mound & Halsey, 1978; Rapisarda, 1982).

Trialeurodes vaporariorum (Westwood)

Aleyrodes vaporariorum Westwood, 1856
Trialeurodes vaporariorum; Quantance & Baker,1914

Material examined: Malta: Zejtun 23/VII/92 on *Lycopersicon esculentum*; Birkirkara 11/VIII/92 on *Fuchsia sp.*; Birkirkara 20/VIII/92 on *Brassica sp.*; Birkirkara 20/VIII/92 on *Mentha spicata*; Birkirkara 15/IX/92 on *Solanum melongena*; Gnien il-Kbir 17/IX/92 on *Ulmus canescens*; Zebbiegh 22/IX/92 on *Phaseolus cf. vulgaris*; Sliema 24/IX/92 on *Pelargonium regale*; Sliema 15/XI/92 on *Mentha spicata.*

Host plants: *T. vaporariorum* is an extremely polyphagous species. More than 250 plant genera are known as hosts for *T. vaporariorum* (Russell, 1977; Mound & Halsey, 1978). *Ulmus canescens* does not appear to have been previously recorded as a host plant for *T. vaporariorum.*

Distribution: Cosmopolitan, although records from the Oriental, Austro-oriental and Australasian Regions are sparse (Mound and Halsey, 1978; Martin 1987).

Notes: *T. vaporariorum* is another serious pest of vegetable crops through the world (Onillon, 1990). In the Maltese Islands, appreciable damage was observed on egg plants and tomatoes due to high population densities on leaf undersides. *T. vaporariorum* is also known to transmit viral diseases in plants (Costa, 1969).

DISCUSSION

The present study, extends the faunistic knowledge of the Maltese whiteflies to a total of thirteen species. In fact, 60% of the whitefly species known from Sicily have now been recorded also from Malta.

Unlike psyllids (Homoptera, Psylloidea), most whitefly species are either polyphagous (i.e. occurring on a wide variety of host plants) or oligophagous (i.e. occurring on a limited selection of often related host plants). Only very few species are strictly monophagous (i.e. occurring on just one host plant).

Four whitefly species have been accidentally introduced to the Maltese Islands through human activity. These polyphagous species are *Aleurothrixus floccosus, Bemisia tabaci, Dialeurodes citri* and *Trialeurodes vaporariorum*.

A citrus-feeding whitefly of primary economic importance is the Japanese Bayberry Whitefly, *Parabemisia myricae* (Kuwana). This whitefly, which in the past ten years has spread rapidly throughout the southern Mediterranean Basin (Barbagallo *et al.*, 1992) was recently found in citrus-growing areas of Sicily (Rapisarda *et al.*, 1990a; 1990b). Although, this pest has not so far been encountered in the Maltese Islands its eventual introduction seems likely.

The remaining whitefly species covered in this paper are probably indigenous to Malta. Of these, two species namely *Aleyrodes proletella* and *Siphoninus phillyreae* are often considered as agricultural pests, while *Aleurolobus niloticus* may potentially threaten caper cultivations in Sicily (Rapisarda, 1985; Martin, 1987).

Repeated investigations of typical host plants of other whiteflies with a Mediterranean distribution were also conducted. However, none of the species *Aleurolobus olivinus* (Silvestri) (feeding on *Olea europea), Aleyrodes elevatus* Silvestri (occurring primarily on *Ficus carica)* and *Aleuroviggianus adrianae* Iaccarino (developing on *Quercus ilex)* have yet been recorded from the Maltese Islands.

Viburnum tinus is the typical host plant of another whitefly species, *Aleurotuba jelinekii* (Frauen.). In the Maltese Islands, *Viburnum tinus* used to be cultivated (Haslam *et al.*, 1977), although nowadays this plant occurs only in small numbers. In Sicily, *A. jelinekii* was also found on *Teucrium flavum* (Rapisarda, 1982) which forms part of the Maltese flora (Halsam *et al.*, 1977) and on which further investigations will be carried out.

An extremely polyphagous whitefly species recorded from Sicily (Rapisarda, 1982) is *Aleyrodes lonicerae* Walker. It is known to occur on hosts belonging to several plant families including: Campunulaceae, Caprifoliaceae, Compositae, Grossulariaceae, Labiatae, Oxalidaceae, Papaveraceae, Ranunculaceae, Rosaceae, Umbelliferae and others (Mound & Halsey, 1978). Further research may reveal the presence of this species in the Maltese Islands.

Two other whitefly species represented in the Sicilian fauna, *Aleurochiton acerinus* Haupt. and *A. pseudoplatani* Visyna, live exclusively on species of *Acer*. (Rapisarda, 1982). Due to the absence of these host plants from the Maltese flora, their occurrence in Malta is highly improbable.

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