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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).

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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 (*).

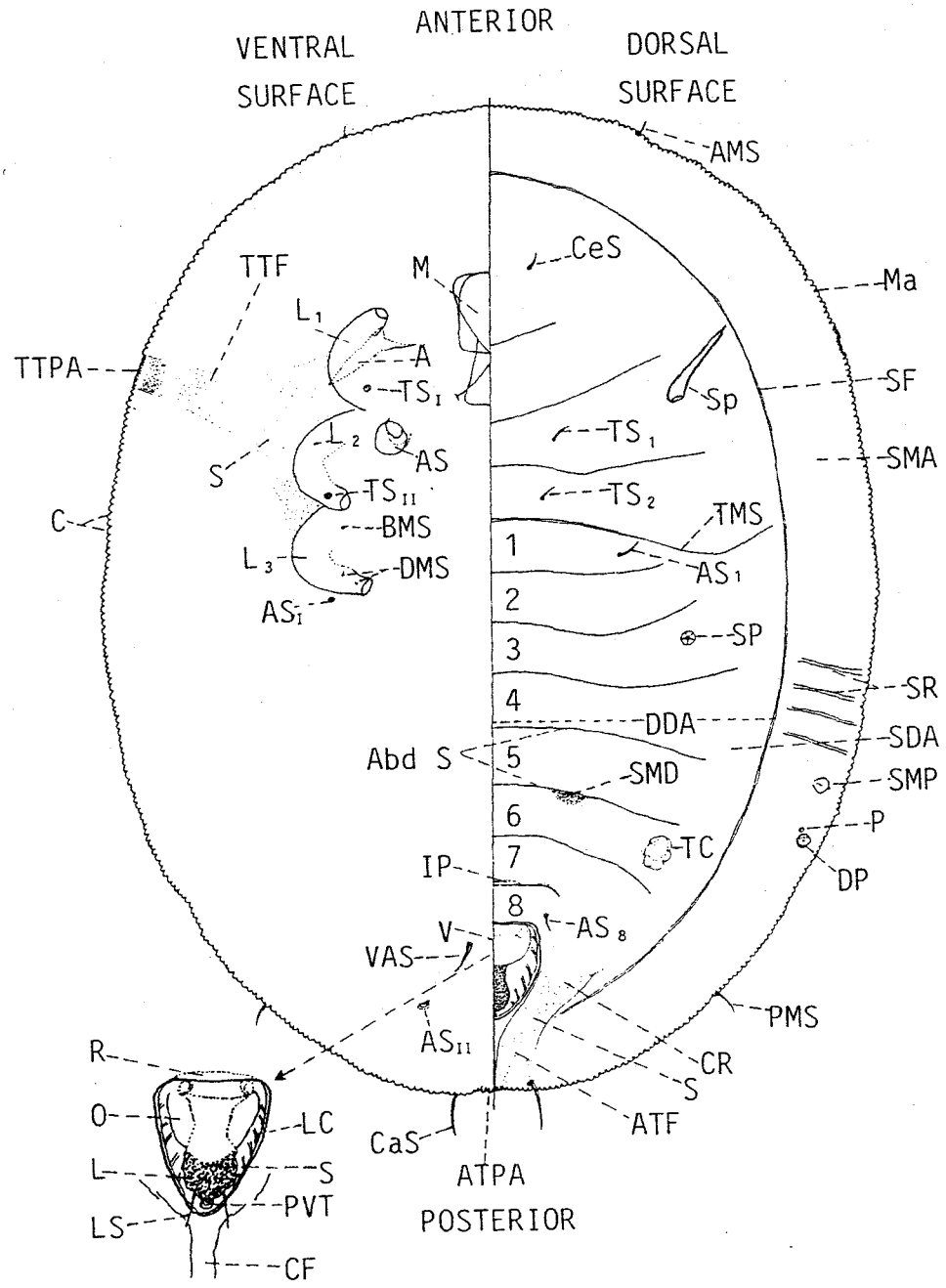

Fig.1 - General morphological characteristics of a whitefly puparium. A, antenna; Abd S, abdominal sutures; AMS, anterior marginal seta; $AS_{I,II}$, anterior, posterior abdominal spiracle; $AS_{1,8}$, 1st, 8th abdominal seta; 1-8 abdominal segments; AS, adhesive sac; ATF, abdominal tracheal fold; ATPA 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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THE SNAIL-KILLING FLY *PHERBELLIA CINERELLA* (FALLEN) IN MALTA.

M.J. Ebejer[1]

The Sciomyzidae is a family of flies whose larvae are predatory on terrestrial and aquatic molluscs. There are 142 species known from the Western Palaearctic and the Mediterranean region. *Pherbellia* Robineau-Desvoidy is the genus with the highest number of species and *P. cinerella* (Fallen) is the commonest and most widespread species in the Palaearctic. It is here recorded for the first time from Malta and so far it is the only representative of the family locally. Identification was based on Knutson et al (1965).

Pherbellia cinerella (Fallen 1820)

Material examined: 1 ♀, Siggiewi, Fawwara, 18.iii.1992, M.J. Ebejer; 1 ♂, Ghadira 17.iv.1992, M.J. Ebejer.

Bratt et al (1969) give a detailed account of the biology of the genus and the diverse ecological conditions under which the species occurs. Interestingly, the two records from Malta reflect this. Fawwara is relatively dry and the specimen was taken from vegetation on stony ground at the foot of the vertical rockface; Ghadira on the other hand may be described as dune with saltmarsh; here the specimen was taken behind the pool, from the low vegetation among the reeds. This species breeds continuously during the warmer months and up to seven generations in a year have been recorded.

P. cinerella is known from most of the Mediterranean countries including Sicily and Tunisia, and in Israel (Knutson 1983) it has also been found in semidesert localities.

The mollusc fauna of Malta is comparatively rich and many snail populations are large. The mollusc genera from which this species has been reared are many but some at least do occur on Malta (*Helix, Helicella and Lymnaea*). The apparent scarcity of the Sciomyzidae therefore, cannot be explained. Among material reared from snails there were Phoridae and Sarcophagidae but no Sciomyzidae. It remains possible that other widespread species of this family of flies may yet turn up.

[1] "Tamarisk", Triq P. P. Castagna, Balzan, Malta.

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THE HOVERFLIES OF MALTA (DIPTERA: SYRPHIDAE), NEW RECORDS AND CORRECTIONS.

M.J. Ebejer[1]

ABSTRACT

Additional records of hoverflies from Malta are given; 9 species are recorded for the first time, 6 had been recorded by Rondani and one was discovered in the collections of the Natural History Museum of London. The nomenclature of Rondani's records is updated and the status of the species in Malta commented upon. The total number of species known from Malta is now 46.

INTRODUCTION

Since my previous article on Maltese Syrphidae (Ebejer 1988) I have been able to examine Dr.P. Gatt's collection of Diptera and some of the specimens upon which Mr.J. Cilia had based his own hoverfly records (Cilia 1973) and to whose work I had referred. I have had the opportunity to go through Rondani's Prodromus which includes species not recorded again from Malta as well as Antonio Schembri's descriptions of two hoverflies (Rondani 1856-1880). With the publication of the Catalogue of Palaearctic Diptera (Soos & Papp 1988) it has been possible to update the nomenclature. In addition, I have undertaken further collecting myself. As a result, there are several new records for the Islands and I have listed them below. Species about which there is a serious doubt as to their occurrence in Malta are in square brackets. Unless otherwise stated, the recorded material has been collected by me and is in my collection.

SPECIES LIST

SYRPHINAE

Bacchini

Xanthandrus Verrall 1901

Xanthandrus comtus (Harris 1782)

Material examined: 4♂♂, Wied il-Qlejgha, 8.xi.1992.

[1] "Tamarisk", Triq P. P. Castagna, Balzan, Malta.

Rondani had recorded this species and Schembri et al. (1991), recorded it again on the basis of a single headless specimen collected by Cilia at Hamrun. Until now it was thought to be rare. However, I observed several males hovering high beneath White Poplars (*Populus alba* Linnaeus) at Wied il- Qlejgha.

Syrphini

Eupeodes Osten-Sacken 1877

Eupeodes nuba (Wiedemann 1830)

Material examined: 1 ♂, Bahrija, 21.vi.1992.

This is the only specimen I have seen in spite of checking the genitalia of many *Eupeodes* males in Dr. Gatt's collection and my own. It is very similar to several other species in the genus including *E. corollae* (Fabricius) which is one of the commonest hoverflies on the Island.

Paragini

Paragus Latreille 1804

Paragus albifrons (Fallen 1817)

Material examined: 1 ♂, Mosta, 4.iv.1965, K.M. Guichard, Natural History Museum collections, London.

I had overlooked this species in my own notes when I had searched the collections at the Natural History Museum in London.

[***Paragus majoranae*** Rondani 1857]

This species was recorded by Rondani. It can be separated reliably from the above only by examination of the male hypopygium. There must therefore remain some doubt whether or not this species occurs in Malta and until its presence can be confirmed I do not consider it a member of the Maltese fauna.

Ceriana Rafinesque 1815

Ceriana conopsoides (Linnaeus 1758)

This was recorded by Rondani together with the similar species *C. vespiformis* (Latreille) which is still met with regularly but has not been found again.

MILESIINAE

Eristalini

Eristalinus Rondani 1845

Eristalinus megacephalus (Rossi 1794)

Material examined: 1♀, Wied Qannotta, 7.vii.1987; 1♂ and 2 ♀♀, Marsaxlokk, 27.ix.1992.

Eristalis Latreille 1804

Eristalis arbustorum (Linnaeus 1758)

Material examined: 1♀, Buskett, 25.viii.1991; 1♂, Fiddien, 8.iv.1992; 1♂, Gozo, Wied ir-Ramla, 23.iv.1992; 1 ♂, Gozo, Wied il-Lunzjata, 23.iv.1992.

Eristalis pratorum (Meigen 1822)

Recorded by Rondani but has not been collected again, although it could easily be overlooked.

Helophilus Meigen 1822

Helophilus trivittatus (Fabricius 1775)

Material examined: 1♀, Wied il-Ghasel, 29.iii.1979, S.P. Schembri; in the collection of Dr. P. Gatt.

Merodontini

Eumerus Meigen 1822

Eumerus emarginatus (Loew 1848)

Material examined: 1 ♂, Buskett, 14.iv.1977; 1♀, Salina, 16.iv.1977; 1♀, Fiddien 4.v.1988.

This species was inadvertently omitted from my previous article.

Eumerus nudus (Loew 1857)

Material examined: 1♀, Ghadira, 17.iv.1992.

Eumerus strigatus (Fallen 1817)

Material examined: 2 ♀, Rabat, Wied Ghomor, 31.iii.1992.

Platynochaetus Wiedemann 1830

Platynochaetus setosus (Fabricius 1794)

Rondani recorded this species which is fairly distinctive and not easily confused with ***P. rufus*** Macquart. It has not been found again.

Merodon Meigen 1803

[***Merodon albifrons*** (Meigen 1822)]

Rondani recorded the occurrence of *M. varius* in Malta. There are several closely related species in this group, including *M. geniculata* Strobi which is common in Malta and *M. albifrons* of which *varius* is a synonym. Without examining Rondani's specimen(s) from Malta, I cannot be sure which species Rondani was actually referring to. For the time being, therefore, the occurrence of *M. albifrons* in Malta remains doubtful.

Pipizini

Heringia Rondani 1856

Heringia heringi (Zetterstedt 1843)

Material examined: 1 ♂ and 1♀, Buskett, 25.viii.1981; 1♂, Bahrija, 3.xi.1991; 1♀, Buskett, 22.iv.1992; 1 ♂, Buskett, 1.v.1992; 1♂, Girgenti, 18.iv.1993.

Xylotini

Syritta Le Peletier & Serville 1828

Syritta flaviventris Macquart 1842

Material examined: 1♂, Marsaxlokk, 27.ix.1992, P. Gatt, in his collection; 1♂, Wied Liemu, 22.viii.1993.

This species is easily overlooked because in the field it looks so similar to the very common *S. pipiens* (Linnaeus).

DISCUSSION

The currently accepted name for the genus *Metasyrphus* Matsumura is *Eupeodes* Wiedemann and the previously recorded species *M. corollae* should now be included under the new name. Antonio Schembri described *Sphaerophoria oleandri* which is a synonym of *S. ruppellii* (Wiedemann) and *Eumerus delicatae* which is a synonym of *E. pulchellus* Loew (Soos & Papp 1988). I have two further species of *Eumerus* in my collection which I am unable to determine at present. Cilia's records for *Chrysotoxum festivum* (Linnaeus) and *Platycheirus albimanus* (Fabricius) may not be based on correct identifications (Cilia pers. comm.). He had given his collection to Dr. P. Gatt and a search has not revealed any specimens labelled as the above species. For the time being therefore, they cannot be considered as part of our fauna.

The number of Syrphidae known from Malta is 46, including Rondani's five records which have not been found again. There is no doubt that more species will be recorded, considering the several possibilities of North African migrants.

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NOTES AND NEW RECORDS OF THE LARGER BRACHYCERA (DIPTERA) OF MALTA.

M.J.Ebejer[1]

ABSTRACT

The list of species of the larger Brachycera known from Malta is updated according to current classification and nomenclature. All species, including new records, are included except for the Bombyliidae previously recorded by the present author. Here are listed 7 spp of Stratiomyidae, 1 of Vermileonidae, 1 of Rhagionidae, 3 of Tabanidae, 3 of Therevidae, 7 of Asilidae, 6 of Bombyliidae and 2 each of Scenopinidae and Acroceridae. For species recorded here for the first time, all data are given. Each Family is followed by comments on what is known about it locally.

INTRODUCTION

No comprehensive list of species exists for the dipterous fauna of the Maltese Islands. Some authors have reported on species belonging to the group of their interest and Schembri et al have published some records of Diptera which include a few Brachycera (Schembri 1991). As there are several additional species and corrections, an up-to-date list of the larger Brachycera may be appropriate.

The list of species which follows includes all those known to me. Unless otherwise stated, all material examined is in my collection. Where species are not recorded for the first time, reference is made only to the first published records. The classification follows that adopted for the Brachycera in the Catalogue of Palaearctic Diptera (Soos & Papp 1984-1991).

SPECIES LIST

RHAGIONIDAE

Chrysopilinae

Chrysopilus Macquart 1826.

Chrysopilus aureus (Meigen 1804).
Material examined: 1♂, Bahrija, 21.vii.1977; 1♂ and 1♀, Bahrija, 7.vii.1981; 1♂ and 1♀, Bahrija, 21.vi.1992; 1♀, Bahrija, 13.vi.1993.

[1] "Tamarisk", Triq P. P. Castagna, Balzan, Malta.

Like Stratiomyidae, most species of Rhagionidae have developmental stages in a wet environment. The adults are usually swept from waterside vegetation. It is not likely therefore that many more species will be discovered in Malta, but a search in late summer on the vegetation at the streams in Bahrija, Wied il-Luq, Fiddien and Xlendi may be rewarding.

VERMILEONIDAE

Vermileo Macquart 1834.

Vermileo vermileo (Linnaeus 1758).

Material examined: 1♂, Balzan, 15.v.1977; 1♀, Balzan, 20.v.1977; 1♂ Guardamangia, 22.v.1992; 1♂, Guardamangia, 29.v.1992; 1♂ and 1♀, Guardamangia, 2.vi.1992.

This species was recorded for the first time in its larval stage (Zammit-Maempel 1985). Gatt (pers. comm.) reared the larva successfully on various small diptera, placing these in the pit which the larva created in a manner very similar to Antlions (Neuroptera: Myrmeleontidae). The adults often fly indoors.

STRATIOMYIDAE

Beridinae

Chorisops Rondani 1856.

Chorisops tibialis (Meigen 1820).

Material examined: 1♀, Buskett, 16.ix.1976; 1♀, Gzira, 20.x.1978, P. Gatt; 1♀, Bingemma, 30.x.1978, P. Gatt; 2♂♂ and 1♀, Wied Has-Sabtan, 25.x.1980, J.L. Schembri; 1♂ and 3 ♀♀, Pieta, 22.x.1992, P. Gatt, in Dr.P. Gatt's collection.

Hermetiinae

Hermetia Latreille 1804.

Hermetia illucens (Linnaeus 1758).

Lindner (1936) recorded this species from Malta but this appears to have been an isolated finding. This species, originally from South America, has become widespread in the tropics and sub-tropics.

Stratiomyinae

Stratiomys Geoffroy 1762.

Stratiomys longicornis (Scopoli 1763).

Recorded by Rozkosny (1983).

Clitellariinae

Nemotelus Geoffroy 1762.

Nemotelus anchora Loew 1846.

Recorded by Rozkosny (1983).

Nemotelus brachystomus Loew 1846

Material examined: 4♂♂ and 5♀♀, Marsaxlokk marsh, 26.vii.1992; 3♂♂, Marsaxlokk marsh, 24.iv.1993; 4♂♂, Marsaxlokk marsh, 9.vii.1993.

Nemotelus nigrifrons Loew 1846

Material examined: 4♂♂ and 5♀♀, Ghadira; 29.vi.1992; 2♂♂, Comino, 22.vi.1986, S.P. Schembri, in Dr.P. Gatt's collection.

Pachygastrinae

Eupachygaster Kertesz 1911.

Eupachygaster tarsalis (Zetterstedt 1842).

Material examined: 1♀, Wied il-Qlejgha, 5.vi.1983, P.Gatt, in his collection.

Another specimen was seen at Buskett in June 1992, close to the poplar trees where it is known to breed under the bark.

Stratiomys longicornis is still common on the island and its larvae are frequently encountered in late winter in muddy pools after rain, and in more permanent water bodies both fresh as in reservoirs as well as brackish as at Salina and Ghadira, for the greater part of the year. On 11.iv.1976, at Salina, males of *N. anchora* were observed swarming. When the swarm was approached or swept at with a hand net it seemed to disappear. This was because the insects suddenly dropped onto the vegetation about a metre below. This behaviour is in contrast to

what one sees in most other dipterous swarms. All three *Nemotelus* species must be considered endangered on the island not only because of their very restricted saltmarsh habitats but also because of marked human interference in such places. *C. tibialis* and *E. tarsalis* are too poorly known to allow comment on their status in Malta.

TABANIDAE

Atylotus Osten-Sacken 1876.

Atylotus loewianus (Villeneuve 1920).

Material examined: 1♀, Mistra, 22.vi.1971; 1♀, Comino, 12.vii.1976; 1♀, Comino, 13.vii.1976; 1♂ and 1♀, Ghallis, 7.vii.1987; 1♀, Mgiebah, 29.vii.1993.

Schembri et al (1991) recorded the following five species:

Tabanus Linnaeus 1758.

Tabanus autumnalis 1761.

Tabanus regularis Jaennicke 1866.

Atylotus latistriatus (Brauer 1880), misidentification.

Atylotus fulvus (Meigen 1820), misidentification.

Atylotus quadrifarius (Loew 1874), misidentification.

I have had the opportunity to examine all the specimens of *Atylotus* upon which Schembri et al based their records. The specimens were generally in poor condition and in the light of further better preserved specimens I concluded that in fact they all belong to one species namely *A. loewianus* (Villeneuve), an opinion shared by Mr J. Chainey of the Natural History Museum in London, who had originally identified Schembri's limited material. Leclerq (1967) reviewed the distribution of this family in the Mediterranean Islands but made no reference to Malta, presumably because of lack of data. Both *T. autumnalis* and *T. regularis* are represented in Malta by their brown forms *brunescens* and *rufus* respectively which, according to Leclerq is the norm for most of the islands except Cyprus and Sicily where both forms are found. All Tabanids recorded to date were common in Malta especially *Atylotus* which is exclusively coastal and attacks humans persistently. I collected four final instar larvae of *T. autumnalis* on 6.vii.1985 from mud at the edge of the stream at Bahrija. Two survived to the

adult stage; one pupated on 9.iv.1985 and a male emerged on 3.vii.1985; the other pupated on 3.vii.1985 and a female emerged on 16.vii.1985.

ASILIDAE

Laphriinae

Pogonosoma Rondani 1856.

Pogonosoma maroccanum (Fabricius 1794).

Material examined: 1♀, Mistra, 19.vi.1971; 1♂, Hal-Ghaxaq, ix.1973; 1 ♀, Tal-Qroqq, 16.viii.1975; 1♂, Wied Qannotta, 23.vi.1977; 1♀, Kalkara, 8.vii.1993, S. Mifsud.

Stenopogoninae

Habropogon Loew 1847.

Habropogon striatus (Fabricius 1794).

Material examined: 1♂, Bahrija, 9.vii.1976; 1♂, Wied Qannotta, 18.vi.1977; 1♀, Wied Qannotta, 23.vi.1977; 1♀, Marfa Ridge, 10.vii.1987; 2 ♂♂, Bahrija, 13.vi.1993.

Stichopogon Loew 1847.

Stichopogon elegantulus Wiedemann 1820.

Material examined: 1♂, Gozo, Ramla dunes, 20.ix.1983, S.P. Schembri, in the collection of Dr.P. Gatt; 1♂, Ghadira, 4.viii.1993.

Laphystiinae

Laphystia Loew 1847.

Laphystia erberi (Schiner 1865).

Material examined: 7♀♀, Ghadira, 21.vi.1977, J.L. Schembri, in the collection of Dr.P. Gatt.

Asilinae

Antiphrisson Loew 1849.

Antiphrisson trifarius (Loew 1849).

Material examined: 1♀, Wied Is-Sewda, 1.v.1974; 1♂, Wied Qannotta, 6.iv.1977; 2♂♂, Wied Il-Ghasel, 9.iv.1985; 1♂ and 2♀♀, Buskett, 1.v.1992.

Cerdistus Loew 1849.

Cerdistus erythruroides Theodor 1980.

Material examined: 1♂, Balzan, 25.vii.1976; 1♀, Buskett, 28.vii.1976; 1♂ and 1♀, Wied Qirda, 6.vii.1977; 1♂ and 2♀♀, Bahar Ic-Caghaq, 29.vii.1977; 1♀, Wied Qirda, 2.vii.1987; 1♂, Fiddien, 6.vii.1987; 1♂, Marfa Ridge, 10.vii.1987; 1♂, Salina, 31.v.1992; 1♂, Buskett, 5.vii.1992; 1♂, Salina, 13.vii.1992; 2♂♂ and 1♀, Marsaxlokk, 26.vii.1992; 1♂, Mgiebah, 26.v.1993.

Tolmerus Loew 1849.

Tolmerus pyragra (Zeller 1840).

Material examined: 2♂♂ and 2♀♀, Mtahleb, 20.x.1991; 3♂♂, Bahrija, 3.xi.1991.

This species was recorded by Cilia (1973) but no data were given.

A. trifarius and *T. pyragra* are not seen as frequently as *C. erythruroides*, which flies in summer in between the peak flight periods of the other two species. Furthermore, *erythruroides* occurs more commonly in coastal areas and on open ground where low vegetation is the commonest perch from which it hunts. *A. trifarius* and *T. pyragra* hunt from the ground frequently from paths or stones and rocks adjacent to them, but the preferred habitat seems to be Maquis. *P. maroccanum* is usually seen basking on the lower branches of carob trees (*Ceratonia siliqua* L.) from where it conducts its predaceous habits. The insect is very alert with a noisy and rapid flight but the fly frequently returns to the same spot. Nothing is known of the habits of *H. striatus*, *S. elegantulus* or *L. erberi* on Malta.

THEREVIDAE

Schembri et al (1991) recorded the following species:

Thereva Latreille 1802.

Thereva binotata Loew 1847.

Thereva spiloptera Wiedemann 1824.

Thereva tuberculata Loew 1847.

All the Therevid species known to date appear to be quite common. *T. spiloptera* occasionally comes to light indoors and of the three species it seems to be the only one which occurs regularly in marshy habitats.

BOMBYLIIDAE

Schembri et al (1991) recorded *Usia forcipata* Brulle. The following are new records and should be taken in conjunction with my previous article (Ebejer, 1988) wherein I listed 21 species of Bombyliidae with full data and field observations.

Cyrtosiinae

Cyrtosia Perris 1839

Cyrtosia meridionalis Rondani 1863.

Rondani (1856-80), in his Prodromus (Vol.IV page 111), described *Schembria (= Cyrtosia) meridionalis*, indicating it was common. However, it has not been seen again.

Empidideicus Becker 1907

Empidideicus hungaricus Thalhammer 1911.

Material examined: 3♂♂, Salina, 23.viii.1992.

Gerontinae

Geron Meigen 1820.

Geron sp.

Material examined: 2♂♂ and 1♀, Wied Babu, 7.vii.1979, J.L. and S.P. Schembri; in the collection of P. Gatt.

This species has the male hypopygium distinct from those already described from the Mediterranean. It is the second species of *Geron* known from Malta. Further identification is not possible until the genus in the Mediterranean is revised.

Bombyliinae

Bombylius Linnaeus 1758.

Bombylius vulpinus Wiedemann 1820.

Material examined: 2♂ ♂, Gozo, Dwejra, 17.iii.1984, in the collection of Dr.P. Gatt.

Phthiriinae

Phthiria Meigen 1803.

Phthiria umbripennis Loew 1846.

Material examined: 7♀ ♀, Gozo, Ramla dunes, 4.vii.1992.

These were collected when it was almost dark. They were still active, feeding in the large white flowers of *Pancratium maritimum* Linnaeus.

Anthracinae

Exhyalanthrax Becker 1916.

Exhyalanthrax vagans (Loew 1862).

Material examined: 9♀ ♀, Marfa Ridge, 11.vii.1987; 1♀, Marfa Ridge, 12.vii.1992.

SCENOPINIDAE

Scenopinus Latreille 1802.

Scenopinus albicinctus (Rossi 1794).

Material examined: 1♂, 10.vii.1987, Marfa Ridge; 1♀, Guardamangia, 4.vi.1992; 1♀ Balzan, 30.vi.1992; 1♀, Marsaxlokk, 27.ix.1992; 1♀ Balzan, 7.viii.1993.

Scenopinus glabrifrons Meigen 1824.

Material examined: 1♀, Balzan, 31.v.1977; 1♀, Malta, 1977; 1♀, Marsa, 14.ix.1989, S. Mifsud; 1♀, Balzan, 2.viii.1983.

S. glabrifrons is cosmopolitan. Most Scenopinidae are found in arid habitats, often associated with birds' nests and some are parasites of beetle larvae (Dermestidae). It would not be surprising if more species were found on Malta.

ACROCERIDAE

Ogcodes Latreille 1796.

Ogcodes schembrii Chvala 1980.

This species was described from material collected in Malta.

Ogcodes sp.

Material examined: 1♀, Victoria, Gozo, 4.vii.1992.

I was unable to determine this species using the key by Chvala (1980) and direct comparison with nearly all known European species including a series of *O. schembrii* proved equally unsuccessful. It may represent a further new species.

DISCUSSION

The Rhagionidae, Stratiomyidae (the majority) and Tabanidae are largely dependent on aquatic or semi-aquatic habitats during their early stages of development whereas the Vermilionidae, Asilidae, Therevidae, Bombyliidae, Scenopinidae and Acroceridae are either adapted to a drier environment or pass their immature stages as parasites of other arthropods. It comes as no surprise therefore that species in the first three families are few and scarce while the remainder are comparatively much better represented and when encountered are seen in greater numbers.

The islands are small and relatively arid, aquatic habitats are very limited and frequently disturbed by man. In summer, reliable freshwater is very scarce though it can be found as small streams flowing at Bahrija and Xlendi, Gozo. Until a few years ago a stream flowed relatively undisturbed at Wied Il-Luq. At Gnejna, San Martin, Fiddien and Wied il-Qlejgha, water lasts well into the summer but the valleys are usually dry beyond June. The recent bird conservation projects at Ghadira have increased the presence of surface water which now lasts throughout the year but the natural cycle of the marsh has been largely disrupted. The effects that this may have had on this group of Diptera may never be known since no studies were undertaken before the projects began. Ghadira and the saltmarshes at Salina and Marsascala are very small but appear to offer the final foothold for our three *Nemotelus* species. A cursory look at the above records shows an obvious discrepancy between the numbers of

Bombyliidae (27 species) and the numbers of Asilidae (7 species). Both families are the most numerous of the larger Brachycera in the Mediterranean and both are well adapted to dry habitats. One would have expected at least double this number of Asilidae to occur on Malta. Reasons for this discrepancy are unclear.

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OTANTHUS MARITIMUS (L.) HOFFMANNSEGG ET LINK (FAM. ASTERACEAE) AND *CRYPSIS SCHOENOIDES* (L.) LAMARCK (FAM. POACEAE), TWO NEW ADDITIONS TO THE FLORA OF THE MALTESE ISLANDS

J. Timothy Tabone[1]

ABSTRACT

The occurrence of *Otanthus maritimus* (L.) Hoffmannsegg et Link and *Crypsis schoenoides* (L.) Lamarck in the Maltese islands is reported for the first time. Information on habitat, distribution and status is also given.

Othantus maritimus (L.) Hoffmannsegg et Link

During August 1992 the author found a small population of *Otanthus maritimus* on the sand dune at Ramla tat-Torri, Marfa peninsula, Northern Malta. About four plants were seen at the time.

The low mound of sand on the foreshore at Ramla tat-Torri coincides with the *Agropyretum mediterranei* association as described by Bartolo *et al.*, (1982) that has resulted from the degradation of an old established *Ammophiletum arundinaceae* dune. The main species was *Elymus farctus* (Viviani) Runemark ex Melderis with *Eryngium maritimum* L. as sub-dominant. *Cutandia maritima* (L.) W.Barbey, *Sporobolus arenarius* (Gouan)Duv-Jouve, *Erodium laciniatum* (Cavanilles)Willdenow, *Euphorbia peplis* L., *Lotus* cf. *halophilus* Boissier et Spruner and *Cakile maritima* (Willdenow)Nyman were other important accompanying species. *Euphorbia terracina* L., *Pancratium maritimum* L. and *Polygonum maritimum* L. were present in small numbers. Species not exclusive to sand dune habitats, particularly ruderals, were frequent, especially under a row of trees at the back of the sandy beach, examples being *Lagurus ovatus* L., *Cynodon dactylon* (L.) Persoon, *Salsola kali* L., *Scabiosa maritima* L., *Plantago coronopus* L., *Diplotaxis erucoides* (L.)DC., *Atriplex prostrata* DC., *Conyza bonariensis* (L.) Cronquist, *Lavatera arborea* L., *Sonchus oleraceus* L., *Echium arenarium* Gussone, *Malva sylvestris* L. and *Ononis natrix* L.

The stunted size and sporadicity of the *Otanthus maritimus* plants found give the impression of an old population on the way to extinction. Throughout the past two decades the sand dune at Ramla tat-Torri has undergone much disturbance

[1] "High Croft", Triq il-Verdun, Kappara, Malta.

due to bulldozing, trampling, camping, parking of vehicles and boathouse construction. Several species that used to be associated with it such as *Euphorbia paralias* L. and *Ammophila littoralis* (Beauvos) Rothmaler have disappeared. Hence *Otanthus maritimus* is critically endangerd in the Maltese islands.

DISTRIBUTION: *Otanthus maritimus* grows on maritime sands in the Canary islands, around the Mediterranean and along the coast of Western Europe, northwards to South East Ireland (Tutin, 1976; Fiori, 1969).

Crypsis schoenoides (L.) Lamarck

In July, 1993 the author discovered a population of *Crypsis schoenoides* (L.) Lamarck on the valleybed between the 'Inland sea' and 'Il-Qattara' pool in Dwejra, western Gozo. About one thousand clumps were counted at the time. The only other *Crypsis* that occurs in the Maltese islands is the very rare *Crypsis aculeata* (L.) Aiton, which is now confined to saltmarsh pockets at Ghadira s-Safra (Ghallis) and Il-Qaliet (Paceville) in the island of Malta (Lanfranco, 1989).

The valleybed vegetation is transitional between a saltmarsh community and disturbed waste land overrun with weeds. The halophilic *Inula crithmoides* L. is the dominant shrub; the weedy perennial *Dittrichia viscosa* (L.) Greuter is sub-dominant. Halophilic species present, most of which occur in the greatest population density towards the 'Inland Sea', are: *Arthrocnenum glaucum* (Delile) Ungern - Sternberg (only at the valleybed end), *Atriplex prostrata* DC., *Spergularia bocconei* (Scheele) Graebner, *Melilotus messanensis* (L.) Allioni, *Lotus cytisoides* L. (only on rocky ground), *Frankenia* spp., *Crithmum maritimum* L., *Daucus* cf. *gingidium* L., *Centaurium spicatum* (L.) Fritsch, *Senecio leucanthemifolius* Poiret, *Hordeum marinum* Hudson. A watercourse flows through the valleybed during the winter rains, some clayey parts retaining enough humidity to support populations of *Medicago ciliaris* (L.) Allioni, *Trifolium fragiferum* L., *Polypogon monspeliensis* (L.) Desfontaine, *Agrostis stolonifera* L., *Phalaris paradoxa* L. and *Lythrum hyssopifolium* L. . However the soil is very dry during the Summer, as is evidenced by the large number of the spiny xerophilic *Cichorium spinosum* L. Also, species requiring a permanent water supply that is present very close to the site do not occur in the valleybed e.g. *Cyperus longus* L., of which a large stand grows around the permanent pool (Il-Qattara), and *Apium nodiflorum* (L.) Lagasca growing on the dripping shaded rocks above the pool. The most frequent weeds include *Lobularia maritima* (L.) Desvaux, *Lotus edulis* L., *Oxalis pes-caprae* L., *Malva silvestris* L., *Foeniculum vulgare* Miller, *Daucus carota* L., *Mentha pulegium* L., *Aster squamatus* (Sprengel) Hieronymus, *Galactites tomentosa* Moench,

Reichardia picroides (L.). Rothmaler, *Sonchus oleraceus* L., *Carlina involucrata* Poiret, *Hedypnois cretica* (L.) Dum., *Dactylis glomerata* L., *Bromus* spp., *Hordeum* spp., *Lagurus ovatus* L., *Avena* spp., *Cynodon dactylon* (L.) Persoon.

The *Crypsis schoenoides* population found in Gozo occurs on bare stable clay in five soil depressions in the valleybed that are flooded during winter rains and parched dry in Summer. The largest subpopulation (>900 clumps), occurs in the depression closest to the 'Inland Sea' (approx. 210m away). In this particular trough, *C. schoenoides* is the only plant species present, but its clumps abruptly give way to the valleybed vegetation at the trough border. This is perhaps due to minimum soil disturbance as well as tolerance by *Crypsis schoenoides* of extreme conditions in the troughs, especially the high salinity (at least during the Summer drought), that keep out other competitive species. In fact, *C. schoenoides* clumps are comparitively few in other weed infested troughs, e.g. only three clumps in a depression overrun with *Cynodon dactylon* (L.) Persoon.

This fragmentary community of *C. schoenoides* gives the impression of a dwindling old established population. The valleybed is being severely degraded by goats' grazing, refuse and rubble dumping, trampling and boathouse building. Consequently, saltmarsh vegetation is succumbing to ubiquitous weeds e.g. only one clump of the halophilic *Juncus acutus* L. remains. Thus *C. schoenoides* is a highly vulnerable species in the Maltese islands.

Crypsis schoenoides occurs in damp places, such as riverbank mud and brackish saline areas.

DISTRIBUTION: Sudan and Mediterranean region, northwards to North West France, Slovakia and central European Russia, eastwards to North India, with isolated records from Senegal, Malawi, Mozambique and Madacascar (Tutin, 1980; Clayton *et al.*, 1974).

The plants of both species found are presumably indigenous since they occur within their typical phytocoenosis and the Maltese islands are well within the species' distribution.

Specimens of both species have been deposited in the private herbaria of the author and that of Edwin Lanfranco inMalta.

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WHITEFLY PARASITOIDS FROM THE MALTESE ISLANDS.

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ABSTRACT

Nine whitefly parasitoids in three different families (Aphelinidae, Eulophidae and Platygasteridae) are recorded from the Maltese Islands. An *Amitus* sp. and a *Euderomphale* sp. are recorded for the first time as occuring on *Tetralicia ericae* Harrison. Notes on introduced species for biological control of whitefly pests are also included.

INTRODUCTION

Information on local whitefly parasitoids is very limited and very few local works have been published on the group. Borg (1935) mentioned *Prospaltella coniugata* [probably referring to *Encarsia tricolor* Foerster (= *Prospalta conjugata* Masi)], as an effective parasitoid of the European Cabbage Whitefly, *Aleyrodes proletella* (Linnaeus). However, no direct evidence is cited as to whether such material was actually collected from the Maltese Islands. One of us (D.D.) contributed an article in Il-Biedja Llum (Anon., 1985) documenting the introduction of *Cales noacki* (Howard), for the biological control of the newly introduced pest, *Aleurothrixus floccosus* (Maskell). A recent work (Mifsud, 1993, unpublished), mainly dealing with the taxonomy of whiteflies and their parasitoids in the Maltese Islands, mentions seven hymenopteran parasitoids.

The present work updates our current knowledge of whitefly parasitoids. Where possible, information on local biological control of whitefly pests is also given.

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SPECIES LIST

Aphelenidae

Cales noacki Howard, 1907

Material examined: Malta: Zejtun 12/X/92 14♂♂ ; 5♀♀; Buskett 20/XI/92 2♀♀; B'Kara 28/XI/92 6 ♂♂, 4♀♀; all from *Aleurothrixus floccosus* (Maskell) on *Citrus aurantium*.

Distribution: *C. noacki* is Neotropical in origin, but has been successfully introduced into the Nearctic and Palaearctic Regions as a biological control agent against *Aleurothrixus floccosus* (Maskell) (Viggiani & Carver, 1988).

Notes: *C. noacki* was purposely introduced in the Maltese Islands in 1986 (Anon., 1986) to control the newly introduced citrus whitefly *A. floccosus* (Maskell). It was released in the following localities in Malta: Sliema, Birkirkara, St. Venera, Gwardamangia and Balzan.

Encarsia formosa Gahan, 1924

Material examined: Reared material from introduced *Encarsia formosa* (Msida: University; Marsa: Department of Agriculture).

Distribution: *E. formosa* is a native of the Americas (Speyer, 1927) but has been introduced throughout the world for the biological control of the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood).

Notes: *E. formosa* was not found naturally occurring in the Maltese Islands. It has been introduced in 1990 as a biological control agent against *T. vaporariorum* (Westwood) in greenhouses, in the following localities: Ghammieri, Pwales, Dingli, Birkirkara, Buskett and Burmarrad in Malta and in Xewkija and Nadur in Gozo.

Encarsia lutea (Masi, 1909)

Material examined: Malta: Sliema 26/XI/92 2♂♂; 1♀ from *T. vaporariorum* on *Mentha spicata*. Gozo: Dwejra 6/X/92 2♂♂ ; 1♀ from *B. tabaci* on *Solanum nigrum*.

Distribution: Originally described as a parasite of Aleyrodidae in South Western Europe (Masi, 1909), *E. lutea* is now known to be a cosmopolitan species (Polaszek *et al.*, 1992).

Notes: *E. lutea* is not host-specific, having been recorded on more than 16 whitefly species throughout the world (Lopez-Avilla, 1986; Viggiani, 1987; Yasnosh, 1989; Polaszek *et al.*, 1992).

Encarsia tricolor Foerster, 1878

Material examined: Malta: Marsaskala 23/XI/93 6♀♀ from *Aleyrodes proletella* on *Brassica* sp.

Distribution: Palaearctic.

Notes: The commonest and best-known host of *E. tricolor* is the cabbage whitefly *Aleyrodes proletella* (Linnaeus); however, it is known to occur on various other whitefly species (Mazzone, 1976; Viggiani & Laudonia, 1985).

***Encarsia* sp.**

Material examined: Malta: Zejtun 11/X/92 1♀; Zejtun 14/X/92 1♂. Gozo: Ghajnsielem 6/X/92 2♂♂. All from *Dialeurodes citri* (Ashmead) on *Citrus aurantium*.

Notes: An important parasitoid which was introduced in various parts of Italy for the biological control of *Dialeurodes citri* is *Encarsia lahorensis* How. So far, this parasitoid has not been found in the Maltese Islands.

Eretmocerus mundus Mercet, 1931

Material examined: Malta: Bahrija 4/IX/92 2♀♀ from *Bemisia tabaci* (Gennadius) on *Helianthus tuberosus*. Gozo: Ghajnsielem, Dwejra, Victoria 3/X/92 and Marsalforn, Sara Valley 6/X/92 (several specimens collected on *Brassica* sp. infested with *B. tabaci)*.

Distribution: *E. mundus* was originally described on material obtained from Spain and Italy (Viggiani, 1965). It is known to occur throughout the Palaearctic region, having been introduced into various countries as a biological control agent of the tobacco whitefly *Bemisia tabaci*.

Notes: *E. mundus* probably entered the Maltese Islands with the introduction of its host species, *Bemisia tabaci,* since no information is available on artificial introductions. From observations made, *E. mundus* seems to be a well established species, especially on the Island of Gozo.

Eretmocerus sp.

Material examined: Malta: Buskett 3/X/93 2♀♀ from *Bemisia afer* (Priesner & Hosny) on *Ceratonia siliqua* (Linnaeus).

Notes: So far, in Italy the only *Eretmocerus* parasitoid obtained from *B. afer* is *E. roseni* (Viggiani & Battaglia, 1983).

Eulophidae

Euderomphale sp.
Material examined: Malta: Selmun, 1♂; 1♀. In *Tetralicia ericae* Harrison on *Erica multiflora.*

Notes: No species of *Euderomphale* has been recorded from *Tetralicia ericae* Harrison. Since the material available for study had not yet emerged from its host, certain characteristics could not be clearly observed. The genus is represented in the Italian fauna by two species: *E. bemisae* Viggiani a parasitoid obtained from *Bemisia citricola* Gomez- Menor [= *B. afer* (Priesner & Hosny)] (Viggiani, 1977), and *E. chelidonii* Erdos reared from *Aleyrodes lonicerae* Walker (Mazzone, 1988).

Platygasteridae

Amitus sp.

Material examined: Malta: Ghajn Hadid (Selmun) 26/XI/92 1♀; 23/XI/93 2♀♀; all from *Tetralicia ericae* Harrison on *Erica multiflora.*

Notes: No species of *Amitus* had been previously recorded on *T. ericae.*

DISCUSSION

During the present work nine hymenopteran parasitoids (eight of which new to the Maltese entomofauna) were reared from seven whitefly species. The Maltese whitefly parasitoid complex is rather similar to that of the Italian and Sicilian fauna, although some differences are encountered. Whitefly parasitoids which have reached the Maltese Islands due to the accidental introduction of the host species are represented by *Encarsia lutea* (Masi) introduced with its host species *Bemisia tabaci* (Gennadius) and *Trialeurodes vaporariorum* (Westwood); and *Eretmocerus mundus* Mercet introduced with *Bemisia tabaci.*

Cales noacki Howard was deliberately introduced in the Maltese Islands to control the newly introduced whitefly pest - *Aleurothrixus floccosus* (Maskell)

(Anon., 1985). Whether the prior introduction of *C. noacki* had occurred naturally with the introduction of its host species is not known; however it seems to be a well established species in the Maltese Islands.

Encarsia formosa Gahan was introduced on several occasions to control the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood). During this study, *E. formosa* was not found occurring naturally outside greenhouses.Interesting whitefly parasitoids were reared from *Tetralicia ericae* Harrison and *Bemisia afer* (Priesner & Hosny). The only hymenopteran parasitoid previously recorded from *T. ericae* was an *Encarsia* sp. of the *lutea* (Masi) group (Iaccarino & Viggiani, 1988). In the present study, two hymenopterous parasitoids were reared from *T. ericae*: *Euderomphale* sp. (Chalcidoidea, Eulophidae) and *Amitus* sp. (Proctotrupoidea, Platygasteridae).

An *Eretmocerus* sp., possibly indigenous, (Mifsud, 1994) emerged from *Bemisia afer*.

This present note highlights the need for further study to be undertaken on the Maltese whitefly parasitoid complex. At present several investigations are in progress to evaluate the exact identification of poorly represented material.

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