

Aphids (Hemiptera: Aphidoidea) associated with native trees in Malta (Central Mediterranean)

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ABSTRACT. In the present study 25 aphid species which are known to be associated with trees in the Maltese Islands are recorded. Of these, 18 species represent new records; these include *Aphis craccivora*, *Brachyunguis tamaricis*, *Cavariella aegopodii*, *Chaitophorus capreae*, *C. populialbae*, *Cinara cupressi*, *C. maghrebica*, *C. palaestinis*, *Essigella californica*, *Eulachnus rileyi*, *E. tuberculostemmatum*, *Hoplocallis picta*, *Lachnus roboris*, *Myzocallis schreiberi*, *Tetraneura nigriabdominalis*, *Thelaxes suberi*, *Tinocallis takachihoensis* and *Tuberolachnus salignus*. A number of the above mentioned species alternate hosts between the primary host, being the tree species, and secondary hosts being mainly roots of grasses. The record of *Tetraneura ulmi* could be incorrect and could possibly be referred to *T. nigriabdominalis*. Most of the aphid species recorded in the present study have restricted distribution in the Maltese Islands due to the rarity of their host trees. This is particularly so for those aphids associated with *Populus*, *Quercus*, *Salix* and *Ulmus* whose conservation should be addressed.

INTRODUCTION

Aphids belong to the suborder Sternorrhyncha within the order Hemiptera, along with scale insects, jumping plant-lice, or psylloids, and whiteflies. The Aphidoidea is predominantly a northern temperate group, richest in species in North America, Europe, and Central and Eastern Asia. A general feature of the life cycle of aphids is their parthenogenetic generations exploiting active growing plant parts and a sexual generation resulting in an overwintering diapause egg. The known world fauna of aphids consists of approximately 4400 described species placed in nearly 500 currently accepted genera. Of these, about 40% of species occur on trees (BLACKMAN & EASTOP, 1994).

Despite the economic importance of aphids, very few studies have been carried out on this insect group in the Maltese Islands. MIFSUD *et al.* (2009) summarised all available information with respect to aphid studies in Malta. Only fragmentary information is available on the aphidofauna associated with native trees in Malta. CARUANA GATTO (1926) included some aphid records which produce galls on trees in Malta. The lack of trees on the Maltese Islands make such studies even less attractive. Aphids associated with trees of economic and agricultural importance will not be included in the present study as these will be included in a later work on aphids of crop plants in Malta.

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The following is a very short account of tree communities to be found in Malta with special reference to those species which are known to harbour aphids. Before human colonisation, much of the Maltese Islands was probably occupied by large forest areas. Nowadays, such climax vegetation is almost inexistent and what remains are a few remnants of this original native forest all located on mainland Malta. Locations of these remnant forest with *Quercus ilex* as the only indigenous evergreen oak include Ballut tal-Wardija, L-Imgiebah, Il-Bosk and Ta' Baldu. In addition to these, there are also a few semi-natural woodlands, where oak and pine trees (represented by *Pinus halepensis* as the only native pine tree), originally planted by man, are now self-regenerating. Of these, only Buskett, located in the southwest of mainland Malta, can be adequately classified as a forest. Both *Quercus ilex* and more commonly *Pinus halepensis* are frequently encountered as planted in various localities, both in the wild and in non-rural areas such as roundabouts and along road-sides. *Cupressus sempervirens*, *Cercis siliquastrum* and *Nerium oleander* which may represent indigenous species are frequently cultivated and planted in non-rural locations. High maquis habitats are more frequent and often encountered in deep valley systems. Such habitats are mainly characterized by the following combination of trees and woody shrubs: *Pistacia lentiscus*, *Pistacia atlantica*, *Rhamnus alaternus* and *R. oleoides*, *Laurus nobilis*, *Fraxinus angustifolia*, *Olea europaea*, *Ceratonia siliqua*, *Myrtus communis* and *Crataegus* spp. Very few localities support freshwater all year round and in such locations one may find an assembly of very rare trees associated with this habitat type. These include *Populus alba*, *Salix pedicellata* and *S. alba* and *Ulmus canescens* all of which are known to host a wide range of aphids in continental Europe. Another important habitat type is that encountered close to sea side communities where a rather common tree, *Tamarix africana* is to be found. The most common habitat type in the Maltese Islands is the garigue, where a frequently encountered woody shrub is *Pistacia lentiscus*. A wide spectrum of non-indigenous trees used for reforestation projects and for general landscaping include *Acacia*, *Eucalyptus*, and *Ficus* spp. A whole range of trees known as hosting a diversity of aphid species and are common in Continental Europe and the Mediterranean, are completely lacking in Malta.

MATERIAL AND METHODS

Aphid samples were collected from tree species by either beating or by careful visual search for the aphid colonies, or by examination of aphid galls. Material was conserved in 75% ethanol for further studies and labelled accordingly. Material was then mounted using the current methods in aphidology (REMAUDIÈRE, 1992; BROWN, 1997). Aphid identification was carried out using a Zeiss Compound Microscope (Axioscope 2 plus), the work of BLACKMAN & EASTOP (1994) and in some cases through comparison with type material. All material examined and cited in the present study represent either slide mounted aphids or material in 75% ethanol. Unless otherwise stated all samples and photos were recorded and taken by the first author and mostly represent Maltese material (either aphids or galls). We follow the higher classification of aphids as found in REMAUDIÈRE & REMAUDIÈRE (1997) with modifications proposed by NIETO NAFRIA *et al.* (1998). Material was deposited in the private collections of Mifsud and in the aphidological collection of the University of León.

ANNOTATED FAUNISTIC LIST

For convenience all aphid records included in this section are arranged in alphabetical order. For each species the higher classification, material examined, host plant and comments on biology and aphid morphology are included where appropriate. With “*” are marked the new aphid records for the Maltese Islands.

****Aphis craccivora* Koch, 1854**
(Aphidinae: Aphidini: Aphidina)

Material examined: MALTA: Msida (University grounds), 6.vi.1994, apterae; Zejtun, 14.vi.2008, apterae; Ta' Qali, 29.vi.2009, apterae and alatae. All records on *Ceratonia siliqua* L.

A. craccivora is known to colonise numerous plants, particularly Leguminosae and recorded as a major pest on crops belonging to this plant family (BLACKMAN & EASTOP, 2000, 2006). Apterae present a characteristic shining black coloration (Fig. 1). *A. craccivora* is a cosmopolitan species particularly common in warm temperate and tropical regions which is believed to be of Palaearctic origin.

***Aploneura lentisci* (Passerini, 1856)**
(Eriosomatinae: Fordini)

Material examined: MALTA: Żurrieq (near Wied Babù), 13.x.1994 (galls); Attard, San Anton gardens, 10.i.2009, alatae inside gall, leg. A. Tabone; Wardija, 2.i.2009, alatae inside gall; Bidnija, 17.vi.2009, apterae inside galls; Buskett, 18.vi.2009, apterae inside galls. All material was collected on *Pistacia lentiscus* L.

This species alternate between pocket-like galls (Fig. 2) on *Pistacia lentiscus* and roots of grasses. The species has a strong tendency to develop generations of parthenogenetic females on the roots of its secondary host plants. In Malta, galls appear in February-March and grow quickly to attain maximum size by April-May. Apterae on grass roots are pale yellow with dark coloured head, covered with fine white wax which is flocculent at posterior end. *A. lentisci* is known from West, Central and Southern Europe, the Middle East, Central Asia, Africa (Morocco, Kenya, Nigeria, and Zimbabwe), Australia, New Zealand, Argentina and California. The species is of Mediterranean origin. The species was previously reported for Malta by SOMMIER & CARUANA GATTO (1915), BORG (1922) and CARUANA GATTO (1926).

***Baizongia pistaciae* (Linnaeus, 1767)**
(Eriosomatinae: Fordini)

Material examined: MALTA: Attard, St. Anton gardens, 13.x.1994, alatae inside galls; Buskett, 28.x.1994, alatae inside galls, 20.viii.2009, apterae inside galls. All material was collected from *Pistacia terebinthus* L.

The species is known to produce characteristic elongate horn-like galls (Fig. 3, 4) on *Pistacia* spp. (its primary host) in the Mediterranean and northwest India and anholocyclic populations on numerous grass species. *B. pistaciae* is known throughout Europe, the Mediterranean Region, the Middle East, North Africa, Kenya, India, and Pakistan. The species is of Mediterranean origin. This species was previously reported from Malta by CARUANA GATTO (1926) from galls on *Pistacia terebinthus* and *P. vera*.

****Brachyunguis tamaricis* (Lichtenstein, 1885)**
(Aphidinae: Aphidini: Aphidina)

Material examined: MALTA: Birżebbuġa, 27.iii.1994, apterae and alate on *Tamarix africana* Poiret.

B. tamaricis produces small colonies of velvety-grey-green aphids on twigs of *Tamarix* spp. which are inconspicuous, resembling small leaves or leaf-scales of the host plant. The species is known from southern and Central Europe, North Africa, and southwest and Central Asia east to Pakistan. The species is most probably of Mediterranean origin.

****Cavariella aegopodii* (Scopoli, 1763)**
(Aphidinae: Macrosiphini)

Material examined: MALTA: Żabbar, 10.iii.1994, alatae vagrant, leg. G. Watson & D. Mifsud.

Most species of *Cavariella* host-alternate between *Salix* and Umbelliferae or the closely related Araliaceae. Apterae in spring colonies of *C. aegopodii* are to be found on young leaves and catkins of the primary hosts, *Salix* spp. Alatae produced from the second generation onwards mostly migrate to wild and cultivated Umbelliferae in May-June, but sometimes recolonize willows. The return migration from Umbelliferae to willows occurs in late September to early November. The species is known as a pest of cultivated Umbelliferae (BLACKMAN & EASTOP, 2000) and is known to transmit various viruses in carrots and other crops. Alatae have black head and thorax and a dark green dorsal abdominal patch. Apterae green to yellowish green in colour. *C. aegopodii* is widespread throughout the temperate and warm temperate regions of the world and is of Palaearctic origin.

****Chaitophorus capreae* (Mosley, 1841)**
(Chaitophorinae: Chaitophorini)

Material examined: MALTA: Wied tal-Isqof, 17.vii.2009, apterae (high infestations) on *Salix pedicellata* Desf.

C. capreae is found on broad-leaved *Salix* spp., scattered on the underside of leaves and, unlike other *Chaitophorus* spp., not attended by ants. Apterae are white to yellowish-white. The species is widespread in Europe and eastward to Central Asia from which areas the species is considered as native.

****Chaitophorus populiabae* (Boyer de Fonscolombe, 1841)**
(Chaitophorinae: Chaitophorini)

Material examined: MALTA: Fiddien, 3.vii.1994; Buskett, 17.vii.2008; Wied tal-Isqof, 17.vii.2009. All records of apterae on *Populus alba* L.

C. populiabae is found in small to medium sized colonies mainly on the underside of leaves of various *Populus* spp. Apterae oval, greenish to yellowish-white and are ant-attended. This species is known from throughout the Palaearctic Region, in northern, western and southern Africa, and introduced in North America (BLACKMAN & EASTOP, 1994). The species is likely of W-Palaearctic origin.

****Cinara cupressi* (Buckton, 1881)**

(Lachninae: Eulachnini)

Material examined: MALTA: Buskett, 17.vi.2009, alate found dead beating *Cupressus sempervirens*, leg. C. Favret & D. Mifsud.

C. cupressi is most common on *Cupressus* spp. but can be also found on other Cupressaceae, feeding on smaller twigs in the foliated parts of the crown. Aphids are orange-brown to yellowish-brown in colour, dorsum dusted with pale grey wax making a pattern of cross-bands. The species is known from Europe, southwest Asia, India, and North America and introduced in Africa, Colombia and South America. The species is of uncertain origin, but likely originated within the primary native area of *Cupressus sempervirens* (E Mediterranean and Middle East).

****Cinara maghrebica* Mimeur, 1934**

(Lachninae: Eulachnini)

Material examined: MALTA: Fawwara, 30.xii.1996; Buskett, 17.vi.2009, leg. C. Favret & D. Mifsud, same locality but 25.vii.2008, leg. D. Mifsud & A. Tabone. All records of apterae on *Pinus halepensis* Mill.

C. maghrebica is usually founds in dense colonies on young twigs of *Pinus* spp. Apterata are chocolate brown in colour with a dorsal pattern of white wax dust. The species is known from the Mediterranean Region and Middle East (from where it is likely native) and introduced in Argentina.

****Cinara palaestinensis* Hille Ris Lambers, 1948**

(Lachninae: Eulachnini)

Material examined: MALTA: Zejtun, 10.iv.2009, apterae, leg. D. Mifsud & D. Cuesta; Buskett, 17.vi.2009, alatae and apterae, leg. C. Favret & D. Mifsud. All records on *Pinus halepensis* Mill.

C. palaestinensis is generally found in large, dense, ant-tended colonies on *Pinus halepensis*. Apterata are chestnut-brown to yellowish-green in colour. The species is known from the Mediterranean Region and south-western Asia from where the species is considered as native.

***Eriosoma lanuginosum* (Hartig, 1839)**

(Eriosomatinae: Eriosomatini)

Material examined: MALTA: Girgenti, 25.v.2006, alate inside gall on *Ulmus canescens* Melville; Gnien il-kbir, 16.vii.2009 empty galls; Wied ir-Rum, 16.vii.2009 empty galls.

E. lanuginosum forms clusters of large, closed, bloated-leaf galls (Fig. 5) near ends of branches of various *Ulmus* spp. The gall is produced by extreme hypertrophy of the leaf parenchyma on one side of the mid-rib near its base; the hypertrophied tissue is light green at first and covered with fine white hairs, becoming brown as the gall matures and aphids emerge (Fig. 6) (MARCHAL, 1933). Alatae produced in the second and third generations on elms emerge from these galls in late June-July and migrate to form colonies on fibrous rootlets of *Pyrus communis* or *Cydonia*. *E. lanuginosum* is widely distributed throughout Europe, the Mediterranean Region, Middle East, Central Asia, and introduced in South Africa. The species is of Palaearctic origin. This species was previously reported from Malta by CARUANA GATTO (1926).

****Essigella californica* (Essig, 1909)**
(Lachninae: Eulachnini)

Material examined: MALTA: Buskett, 17.vi.2009, apterae on *Pinus halepensis* Mill., leg. C. Favret & D. Mifsud.

Essigella species are Nearctic in origin, and all live on *Pinus* needles except for one species living exclusively on *Pseudotsuga*. *E. californica* is known to feed singly on needles of *Pinus* spp. Alatae and apterae are spindle-shaped, with grey-green thorax and lime green abdomen, with or without brown dorsal spots. *E. californica* is known in western North America from southern British Columbia and Alberta, south to Mexico. The species was also introduced to Australia and to Europe (France, Italy, Spain and Madeira Archipelago) (BARBAGALLO *et al.*, 2005; NIETO NAFRÍA *et al.*, 2009).

****Eulachnus rileyi* (Williams, 1911)**
(Lachninae: Eulachnini)

Material examined: MALTA: Mosta, 12.iii.1994 and 17.iii.1994, apterae on *Pinus* sp. leg. M. Scicluna.

Eulachnus species are cryptic when feeding but very active when disturbed. *E. rileyi* occurs on needles of a wide range of *Pinus* spp. Heavily attacked needles turn yellow and are lost prematurely. Apterae are spindle-shaped, varying in colour from dark olive green to orange-brown or grey, with a dusting of bluish-grey wax. *E. rileyi* is known from Europe, the Mediterranean Region, south-western Asia, and introduced in Africa south of the equator and North, South and Central America. The species is native to the Palaearctic.

****Eulachnus tuberculostemmatus* (Theobald, 1915)**
(Lachninae: Eulachnini)

Material examined: MALTA: Ta' Qali, 16.v.1994, 4 exs. (alatae and apterae) on *Pinus* sp., leg. M. Scicluna; Żejtun, 10.iv.2009, apterae on *Pinus halepensis* Mill, leg. D. Mifsud & D. Cuesta.

E. tuberculostemmatus is to be found on needles of *Pinus* spp. especially *P. halepensis*. Apterae are narrowly spindle-shaped, pale green to greenish-yellow, with small brown dorsal spots. The species is known from southern Europe, the Mediterranean Region, and south-western Asia and is probably of Mediterranean origin.

***Forda riccobonii* (De Stefani Perez, 1899)**
(Eriosomatinae: Fordini)

Material examined: MALTA: 9.x.1972, alatae and apterae (BMNH); Valletta, 5.vi.1994, alatae in galls of *Pistacia atlantica* Desf., leg. S. Navaratnam; Attard (St. Anton Gardens), alatae in galls of *Pistacia atlantica*, 13.x.1994; Marsa (Ghammieri), 19.iii.1994; Migra Ferha, 20.xii.1996. The latter two samples are apterae taken from roots of grasses.

The fundatrix of this species initially forms a small temporary gall, usually near the leaf apex, from where the fundatrigeniae emerge to induce the definitive leaf-edge galls (Fig. 7). Emigrant alatae emerge in September–November and found colonies on roots of grasses. *F. riccobonii* is native to the Mediterranean Region (Morocco, Italy, Spain and Malta) and it is widely distributed

in southwestern Asia. This species was originally recorded for Malta by BLACKMAN & EASTOP (1994) on the basis of the above mentioned material housed at the Natural History Museum in London (BMNH). The species was later also recorded (galls) by ORTIZ-RIVAS *et al.* (2009) from Valletta.

****Hoplocallis picta* (Ferrari, 1872)**
(Calaphidinae: Panaphidini)

Material examined: MALTA: Buskett, 24.iii.1994, alatae and alatoid nymphs on *Quercus ilex*.

The females of this species are always alatae and live on the underside of leaves of *Quercus* spp. Apteræ and alatae are pale yellow-green in life, with banded antennae and a series of dark abdominal markings (Fig. 8). *H. picta* is a species of Mediterranean origin, now widely distributed in Europe, in southwest Asia, and introduced into South Africa and South America (Argentina and Chile) (BLACKMAN & EASTOP, 1994).

****Lachnus roboris* (Linnaeus, 1758)**
(Lachninae: Lachnini)

Material examined: MALTA: Valletta, 15.v.1998, apterae on *Quercus ilex* L.

L. roboris are aphids of medium to large size with apterae shining blackish-brown in colour, and with alatae having pigmented wings (Fig. 9). The species is found on twigs and small branches of Fagaceae (*Quercus* spp. and *Castanea* spp.). It is present in Europe east to the Ukraine, the Mediterranean Region and Lebanon. The species is of Palaearctic origin. The above cited material from Malta is only provisionally identified as *L. roboris* as there are a number of morphological differences which differ from type material of this species. BLACKMAN & EASTOP (1994) suggested that *L. roboris* is likely to be a complex of species with different host plant associations and karyotypes.

****Myzocallis schreiberi* Hille Ris Lambers & Stroyan, 1959**
(Calaphidinae: Panaphidini)

Material examined: MALTA: Rabat, 12.iii.1994, alatae and alatoid nymphs on *Quercus ilex* L., leg. G. Watson & D. Mifsud.

The colonies of this species (alatae and alatoid nymphs) are on the underside of leaves of *Quercus ilex*. Individuals are pale yellow in colour, with head and thorax slightly darker; the prothorax often has short lateral streaks of dark pigment, and the dorsal abdomen with small transversely oval, often dusky to dark, spinal spots and lighter marginal sclerites. *M. schreiberi* is a typical European species, with recorded from England, France, Italy, Greece and ex-Yugoslavia. It is likely of Mediterranean origin.

***Paraclotus cimiciformis* von Heyden, 1837**
(Eriosomatinae: Fordini)

Material examined: MALTA: Marsa (Ghammieri), 26.iii.1994, apterae on roots of *Hordeum* (?) *leporinum* (Link) Arcang.; Buskett, 25.vii.2009, apterae in galls on *Pistacia terebinthus* L.

P. cimiciformis produces flat, folded, leaf edge galls (Fig. 10) on *Pistacia* spp. Alatae emerge from galls in September-October to found colonies on roots of various grasses. Apteræ on roots are yellowish white with the body dorsoventrally flattened, especially at lateral margins. *P. cimiciformis* is of Mediterranean origin widely distributed also in North Africa, the Middle East, Central Asia, Korea, China and Japan. This species was previously recorded from Malta by CARUANA GATTO (1926) from galls on *Pistacia vera*.

***Smynthuroides betae* Westwood, 1849**

(Eriosomatinae: Fordini)

Material examined: MALTA: Żebbug (Tal-Hlas), 6.i.1995, 2 exs. (apteræ) on roots of cauliflower (*Brassica oleracea* L.), leg. C. Farrugia; Attard, St. Anton gardens, 19.vii.2009, apteræ in galls of *Pistacia atlantica* Desf.

S. betae produces galls on *Pistacia* spp. which are yellow-green or red, spindle-shaped, and formed by rolling of the edge of the leaflet near its base (Fig. 11). These are secondary galls, produced by the progeny of the fundatrix, which lives in a small red mid-rib gall. Alatae emerge in September-November and migrate to the roots of numerous, mostly dicotyledonous plants. *S. betae* is virtually cosmopolitan in distribution and it is of Mediterranean origin. Host plant alternation takes place throughout the range of the primary hosts, *Pistacia* (Algeria, Morocco, Israel, Syria, Iran, southern Crimea and Transcaucasia), whereas anholocyclic populations occurring on secondary hosts are recorded from throughout the world. This species was recorded by FARRUGIA (1997) from a field in the island of Gozo. However, two original slide mounted specimens (bearing same date of collection by Farrugia himself) were available for the present study and these were clearly labelled as collected from Malta and not Gozo.

****Tetraneura nigriabdominalis* (Sasaki, 1899)**

(Eriosomatinae: Eriosomatini)

Material examined: MALTA: Girgenti, 25.v.2006; Gnien il-kbir, 16.vii.2009; Wied ir-Rum, 16.vii.2009; Buskett, 27.viii.2009. Most of the material was represented by empty galls. Samples collected from Girgenti were only photographed. All galls on *Ulmus canescens*.

At least seven species of *Tetraneura* are known to migrate from galls on *Ulmus* to roots of grasses, but most species are either known from *Ulmus* or from grass roots. *T. nigriabdominalis* forms characteristic stalked, hairy, elongate, spindle-shaped galls, usually bicoloured green and rose-red when mature, with a pointed apex (Fig. 12, 13). Alatae leave the galls through lateral slits in May-July to form colonies on roots of grasses. This species is also known as a pest of rice (BLACKMAN & EASTOP, 2000). *T. nigriabdominalis* is known from south and eastern Europe, south-western Asia, Japan, China, Korea and USA. The species is believed to be of E-Palaearctic origin.

***Tetraneura ulmi* (Linnaeus, 1758)**

(Eriosomatinae: Eriosomatini)

T. ulmi produces characteristic bean-shaped galls smooth and shiny, green and/or yellow on *Ulmus* spp. (Fig. 14). Life-cycle similar to preceding species. *T. ulmi*, a species of Palaearctic origin, is known from Europe, Central Asia, Middle East (Iran, Iraq, Syria, Turkey), Eastern Siberia, Northern Japan, and introduced in North America. This species was recorded from the Maltese Islands by CARUANA GATTO (1926) presumably based on plant gall morphology. All gall material available during this study including examination of available photos taken by Maltese botanists is to be referred to the preceding species. It is thus possible that the record of *T. ulmi* from Malta is incorrect. However, more studies should be carried out on both gall-morphology and aphid morphology before any definite conclusion is taken.

****Thelaxes suberi* (Del Guercio, 1911)**

(Thelaxinae)

Material examined: MALTA: Valletta, 15.v.1998, 19.vi.2008, 20.iv.2009; Lija, 30.vi.2008. All records are of apterae on *Quercus ilex* L.

Large colonies of *T. suberi* are often encountered on young shoots, suckers, and developing acorns of numerous *Quercus* spp. In Sicily, the species was also reported on *Castanea sativa* (BARBAGALLO & STROYAN, 1982). The apterous morphs vary greatly in coloration from pale green to yellow-white to dark brown. The species is likely of Mediterranean origin and is present in England, southern Europe, the Mediterranean Region and south-western Asia.

****Tinocallis takachihoensis* Higuchi, 1972**

(Calaphidinae; Panaphidini)

Material examined: MALTA: Gnien iż-Żghir, 17.vii.2009, alatae on underside of leaves of *Ulmus canescens* Melv.

Alatae of this species are pale yellow-green with shiny black head and thorax, black distal section of hind femur and base of hind tibia and with some blackish fuscous veins on forewings (Fig. 15). The species is recorded from *Ulmus* spp. and is native to Eastern Asia with records from Japan, China and eastern Siberia. In 1988 the species was recorded in France (QUEDNAU & SHAPOSHNIKOV, 1988) and seems to be rapidly extending its range in the Mediterranean basin and Central Europe (DÖRING, 2007).

****Tuberolachnus salignus* (Gmelin, 1790)**

(Lachninae: Lachnini)

Material examined: MALTA: Mtahleb, 3.vii.1994; Naxxar, Ix-Xwieki (private garden), 21.iv.2007. All records include apterae on *Salix pedicellata* Desf.

T. salignus is to be found on stems and branches of *Salix* spp. and also very occasionally recorded from *Populus*. Apteratae are very big aphids with mid-brown to dark brown in colour and a large dark brown tubercle in the centre of the dorsum (Fig. 16). The alatae have forewing membranes unpigmented. *T. salignus* is a species of unknown origin, but most likely native to the E-Palaearctic. It is virtually cosmopolitan in distribution, absent only in Australasia.

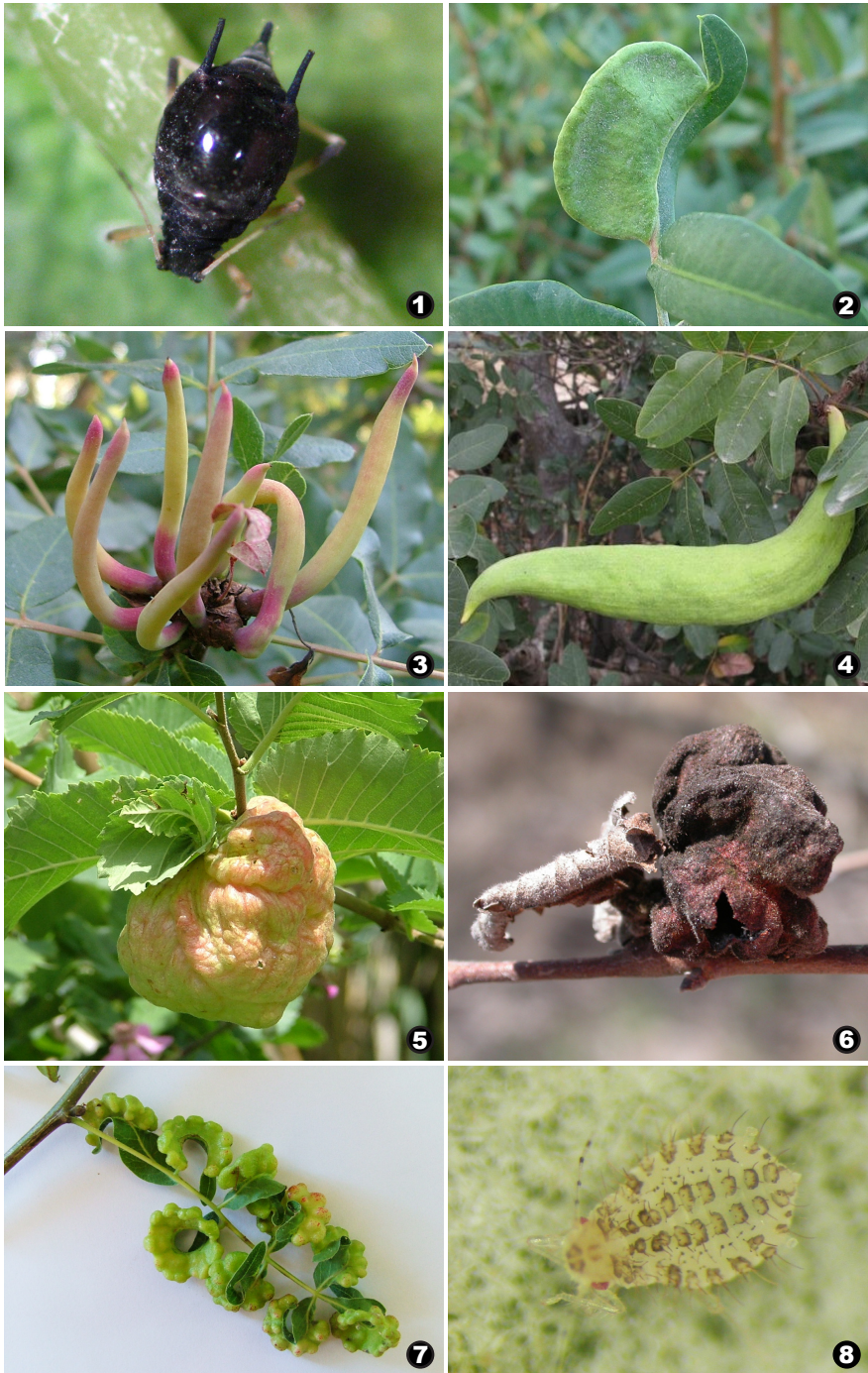


Figure 1: *Aphis craccivora* (aptera); 2: gall of *Aploneura lentisci* on *Pistacia lentiscus*; 3-4: galls of *Baizongia pistaciae* on *Pistacia terebinthus*; 5-6: gall of *Eriosoma lanuginosum* on *Ulmus canescens* (young 5, old 6); 7: galls of *Forda riccobonii* on *Pistacia atlantica*; 8: *Hoplocallis picta* (nymph).

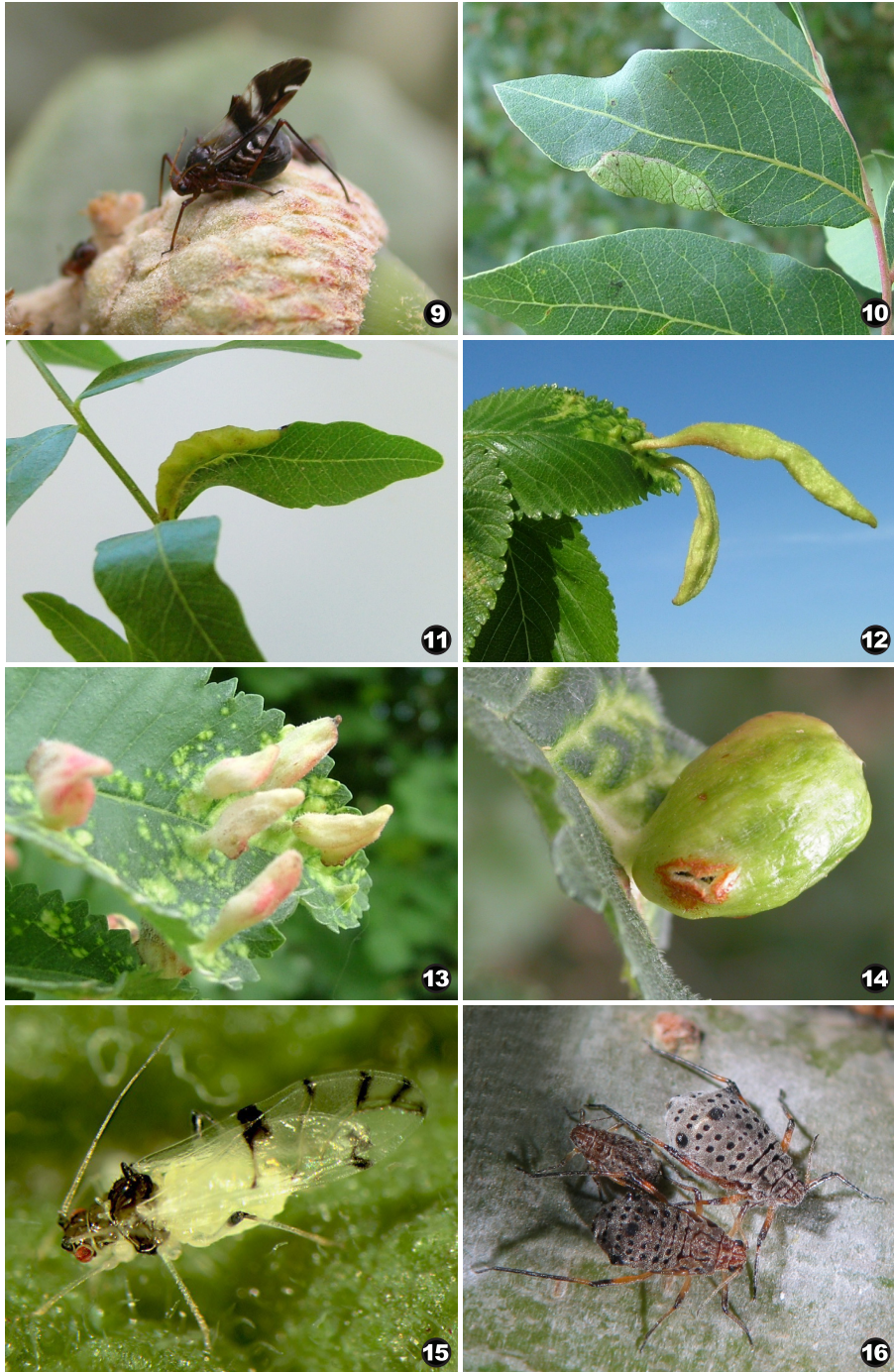


Figure 9: *Lachnus roboris* (alate); **10:** gall of *Paracletus cimiciformis* on *Pistacia terebinthus*; **11:** galls of *Smynthuroides betae* on *Pistacia atlantica*; **12-13:** galls of *Tetraneura nigriabdominalis* on *Ulmus canescens*; **14:** gall of *Tetraneura ulmi* on *Ulmus minor* (from Spain) **15:** *Tinocallis takachihoensis*, alate; **16:** *Tuberolachnus salignus* (apterae).

DISCUSSION

In the present work 25 aphid species associated with native trees in Malta are recorded. Of these, 18 species represent aphids which were not previously recorded for this territory. Only the record of *Tetraneura ulmi* by CARUNAN GATTO (1926) was not sustained by recently collected material and most likely this record must have been confused with *T. nigriabdominalis*. A total of eight aphid species are gall-formers on their primary host-tree whereas all the others form free-living colonies on their host-plants. Two species reported in the present study are definitely alien to the Maltese fauna. These include *Tinocallis takachihoensis*, an Asian species in origin and *Essigella californica*, native to the Nearctic Region, but introduced in the Palaearctic and now sub-cosmopolitan in distribution. Another alien aphid recently reported for Malta (MIFSUD, 2008) is *Greenidea ficicola* Takahashi, 1921 for which high population densities were reported on *Ficus* spp.

Currently, a total of 50 species of aphids are reported for the Maltese Islands (MIFSUD *et al.*, 2009). This number reflects the lack of aphid studies in Malta and surely represents a very small percentage of the actual number of aphid species that inhabit the archipelago. On the nearby Italian islands of Pantelleria and Lampedusa (much smaller islands than the Maltese archipelago and much less diverse in terms of flora), located south of Sicily, 55 and 27 species of aphids respectively were recorded by BARBAGALLO (1995). Sicily is considered as very well investigated in terms of aphid species and no less than 436 taxa are known. On the basis of the floristic composition of the Maltese Islands, the aphid fauna is expected to be much more numerous than is presently known.

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REFERENCES

- BARBAGALLO, S. (1995) Homoptera Aphidoidea di Pantelleria e Lampedusa. *Naturalista sicil.*, **19** (Suppl.): 321-339.
- BARBAGALLO, S. & STROYAN, H.L.G. (1982) Osservazioni biologiche, ecologiche e tassonomiche sull'Afidofauna della Sicilia, *Frustula Entomologica*, N.S. (1980), **3** (XVI): 1-182.
- BARBAGALLO, S., BINAZZI, A. & ORTU, S. (2005) On the presence in Italy of the nearctic aphid *Essigella californica* (Essig) living on American pines. *Redia*, **88**: 79-84.
- BLACKMAN, R.L. & EASTOP, V.F. (1994) *Aphids on the World's Trees - An identification and information guide*. CAB International in association with The Natural History Museum. viii + 987 pgs + 16 pls.
- BLACKMAN, R.L. & EASTOP, V.F. (2000) *Aphids on the World's Crops - An identification and information guide*. The Natural History Museum. John Wiley & Sons Ltd., Second edition, vi + 466 pgs incl. 51 pls.
- BLACKMAN, R.L. & EASTOP, V.F. (2006) *Aphids on the World's Herbaceous Plants and Shrubs*. Volume 1 - Host Lists and Keys; Volume 2 - The aphids. J. Wiley & Sons. Chichester. viii + 1439 pp.

- BORG, J. (1922) *Cultivation and diseases of fruit trees in the Maltese Islands*. Malta Government Printing Office, vii + 622 pp.
- BROWN, P.A. (1997) A review of Techniques used in the preparation, curation and conservation of microscope slides at the Natural History Museum, London. *The Biology Curator, Supplement* **10**: 1-36.
- CARUANA GATTO, A. (1926) Primo Contributo alla conoscenza dei Zoocecidi delle Isole Maltesi. *Archivum Melitensis*, **7** (3): 105-124 + 2 pgs. index.
- DÖRING, T.F. (2007) Colonies of the Asian elm aphid *Tinocallis takachihoensis* Higuchi (Hem.: Aphididae) in Britain. *Entomologist's Record*, **119**: 226-227.
- FARRUGIA, C. (1997) Insect pests on cauliflower (*Brassica oleracea* var. *botrytis*) in Gozo (Maltese Islands, Central Mediterranean). *The Central Mediterranean Naturalist*, **2** (4): 152-165.
- MARCHAL, P. (1933) Les aphides de l'orme et leurs migrations. *Annales des Épiphytes*, **19**: 207-329.
- MIFSUD, D. (2008) A new tree dwelling aphid, *Greenidea ficicola* Takahashi, 1921 for Malta (Hemiptera: Aphidoidea: Greenideidae). *Bulletin of the Entomological Society of Malta*, **1**: 39-41.
- MIFSUD, D., PEREZ HIDALGO, N. & BARBAGALLO, S. (2009) Present status of aphid studies in Malta (Central Mediterranean) with special reference to tree dwelling species. *Redia* (in press).
- NIETO NAFRÍA, J.M., MIER DURANTE, M.P. & REMAUDIÈRE, G. (1998) Les noms des taxa du group-famille chez les Aphididae (Hemiptera). *Revue Française d'Entomologie* (N.S.), **19** (3-4): 77-92.
- NIETO NAFRÍA, J.M., ANDREEV, A.V., BINAZZI, A., MIER DURANTE, M.P., PÉREZ HIDALGO, N., RAKAUSKAS, R. & STEKOLSHCHIKOV, A.V. (2009) Aphidoidea. Fauna Europaea version 1.3. <http://www.faunaeu.org>
- ORTIZ-RIVAS, B., MARTÍNEZ-TORRES D. & PÉREZ HIDALGO, N. (2009) Molecular phylogeny of Iberian Fordini (Aphididae: Eriosomatinae): implications for the taxonomy of genera *Forda* and *Paracletus*. *Systematic Entomology*, **34**: 293-306.
- REMAUDIÈRE, G. (1992) Une méthode simplifiée de montage des aphides et autres petits insectes dans le baume du Canada. *Revue Française d'Entomologie*, (N.S.), **14** (4): 185-186.
- REMAUDIÈRE, G. & REMAUDIÈRE, M. (1997) *Catalogue des Aphididae du monde / Catalogue of the world's Aphididae. Homoptera Aphidoidea*. INRA Editions. Versailles. 478 pp.
- SOMMIER, S. & CARUANA GATTO, A. (1915) *Flora Melitensis Nova*. Firenze: Stab. Pellas., viii + 502 pp.
- QUEDNAU, F.W. & SHAPOSHNIKOV, G.Ch. (1988) Drepanosiphinae of Soviet Far East, with description of new species (Homoptera: Aphidoidea). *Can. Ent.*, **120**: 1017-1032.

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