



## Psocids from Malta (Insecta: Psocodea: ‘Psocoptera’), with new synonymy for *Peripsocus stagnivagus* based on the discovery of its first Palaearctic male

CHARLES LIENHARD<sup>1</sup> & DAVID MIFSUD<sup>2,3</sup>

<sup>1</sup>Muséum d'histoire naturelle, c. p. 6434, CH-1211 Genève 6, Switzerland. E-mail: [charleslienhard@bluewin.ch](mailto:charleslienhard@bluewin.ch)

<sup>2</sup>Institute of Earth Systems, Division of Rural Sciences and Food Systems, University of Malta, Msida, Malta.

E-mail: [david.a.mifsud@um.edu.mt](mailto:david.a.mifsud@um.edu.mt)

<sup>3</sup>Corresponding author. E-mail: [david.a.mifsud@um.edu.mt](mailto:david.a.mifsud@um.edu.mt)

### Abstract

About 2,000 specimens of Psocoptera were collected in Malta recently. Examination of this material revealed 21 new records for the Maltese archipelago, augmenting the known psocid fauna of these islands from 6 to 27 species. One of the most abundant species is *Peripsocus stagnivagus* Chapman, 1930 (= *P. bivari* Baz, 1988 = *P. leleupi* Badonnel, 1976, new synonymies), formerly considered to be a predominantly Nearctic species. The discovery in Malta, of one male of this usually parthenogenetic species enabled comparison of this first Palaearctic male with the well-documented, rare Nearctic male. The lack of any morphological difference between these males, or between females from the Nearctic, the western Palaearctic and several Atlantic islands, supports the proposed synonymies.

**Key words:** Mediterranean, *Peripsocus bivari*, *Peripsocus leleupi*, new synonymies

### Introduction

The Order Psocodea, formerly considered as a Superorder, comprises the free-living (i.e. nonparasitic) paraphyletic ‘Psocoptera’ (former Order Psocoptera, booklice and barklice) and the possibly polyphyletic parasitic lice (former Order Phthiraptera, chewing and sucking lice or “true lice”). The latter are phylogenetically embedded in the Suborder Troctomorpha (see Johnson *et al.* 2004; Yoshizawa & Johnson 2006, 2010; Yoshizawa & Lienhard 2010). The species richness is similar in both these groups; about 5,100 species of parasitic lice and 5,700 species of psocids have been described so far (Zhang 2011). Psocids have a worldwide distribution (Lienhard & Smithers 2002) and usually live on vegetation, especially on the bark and foliage of trees and shrubs, where they feed on epiphytic microflora (algae, fungi and lichen) or organic detritus and pollen; some species are regularly found in ground litter, under stones, in caves or in birds’ nests, mammals’ nests or human dwellings (Lienhard 1998).

At the initiation of this study, the psocid fauna of the Maltese Islands was poorly known, with only six species recorded (Lienhard 1990, 1998, 2004; Mifsud 2000), namely: *Liposcelis bostrychophila*, *L. compacta*, *L. decolor*, *Bertkauia lucifuga*, *Ectopsocus meridionalis*, and *E. vachoni*. No specific surveys for psocids had ever been carried out in Malta and the above mentioned records were based on accidental captures collected by foreign entomologists who did field work there. The Maltese archipelago is a group of small, low-lying islands located in the Central Mediterranean basin, of which the islands of Malta, Gozo and Comino are inhabited. Malta and Gozo are the main islands, with a surface area of 245.7 km<sup>2</sup> and 67.1 km<sup>2</sup> respectively. With the overall population density currently at 1,317 people per km<sup>2</sup>, the archipelago is one of the most densely populated regions in the World, and human impact on the natural environment is quite severe; however, we are of the opinion that a considerably higher number of psocid species could potentially occur in these islands.

In the present work, 27 species of psocids are documented for the Maltese archipelago, of which 21 are here recorded for the first time. Moreover, *Peripsocus bivari* Baz, 1988 and *Peripsocus leleupi* Badonnel, 1976 are here synonymised with *Peripsocus stagnivagus* Chapman, 1930.

## Materials and methods

Most of the material upon which the present work is based was collected by one of us (DM) and all specimens were identified by the first author (CL). The largest part of the material was collected using a Malaise trap at the Verdala Palace (near Buskett) on Malta, between June and September 2014. This locality can be best defined as semi-natural woodland, which represents a unique and rare habitat type in the islands. The Malaise trap was located at N 35.86198°, E 14.401622°, in an area dominated by *Pinus halepensis*. The material upon which previous psocid records from Malta were based is also included in the present work for completeness. Some psocid samples were also collected by Bernhard Merz (BM), Daniel Burckhardt (DB), Desirée Falzon (DF) and Volker Mahner (VM). Most of the material mentioned below is deposited in the Muséum d'histoire naturelle of the City of Geneva (MHNG), but a small reference collection of all the species mentioned is deposited at the University of Malta too. The arrangement of the taxa follows Lienhard & Smithers (2002), without mentioning infraorders and subfamilies. Other abbreviations used in the annotated species list below include: IO/D = shortest distance between compound eyes divided by longitudinal diameter of compound eye in dorsal view of head; m3 = medial cell of forewing bounded anteriorly by medial branch M3; r5 = radial cell of forewing bounded anteriorly by radial branch R4+5.

## Annotated species list

### Suborder Trogiomorpha

#### Family Trogiidae

##### *Cerobasis annulata* (Hagen, 1865)

**Material examined.** Malta, Fomm ir-Riĥ, 29.x.2014, 1 ♀, beating vegetation, DM.

**Notes.** A new record for the Maltese Islands. This is a widespread but mainly West-Palaeartic species (Lienhard & Smithers 2002). In central and northern territories it is almost exclusively found in association with human habitation (Lienhard 1998) whereas in the South it is associated with the bark of trees and leaf litter.

##### *Cerobasis guestfalica* (Kolbe, 1880)

**Material examined.** Malta, Buskett Gardens, 2 km S of Rabat, 15.vii.1997, 1 ♀, DB; Buskett, 27.x.2014, 1 ♀, under bark of *Pinus halepensis*, DM; Fomm ir-Riĥ, 29.x.2014, 1 ♀, beating vegetation, DM; Verdala Palace, 12–24.vi.2014, 83 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 45 ♀; 11.vii.–1.viii.2014, 30 ♀; 1–15.viii.2014, 235 ♀; 15–30.viii.2014, 164 ♀; and 1–30.ix.2014, 363 ♀.

**Notes.** A new record for the Maltese Islands. Only females of this almost cosmopolitan parthenogenetic (thelytokous) species have been collected in Malta; males are extremely rare (Lienhard 1998). The species is often abundant on the bark of various trees and woody shrubs, in herbaceous leaf litter and sometimes in human habitation (Lienhard 1998).

##### *Lepinotus reticulatus* Enderlein, 1905

**Material examined.** Malta, Verdala Palace, 15–30.viii.2014, 2 ♀, Malaise trap, DM.

**Notes.** A new record for the Maltese Islands. It is a cosmopolitan parthenogenetic species, common in nature in the Mediterranean Region but rare in Central and Northern Europe. The species is often found in human habitation and in warehouses where foodstuffs are stored, whereas in nature it is generally found in leaf litter and tufts of dry grass (Lienhard 1998).

## Suborder Troctomorpha

### Family Liposcelididae

#### *Liposcelis bostrychophila* Badonnel, 1931

**Material examined.** Malta, Buskett, 17.v.1974, 1 ♀, in soil sample, VM; Zejtun, 20.x.2014, 8 ♀, in private residence, DM.

**Notes.** This species was previously reported from Malta by Lienhard (1990). It is a cosmopolitan species with obligate thelytokous parthenogenesis and is the most common domestic species of Psocoptera, often being a serious pest in the food industry, households, herbaria, medical mycotheca and similar commodities (Lienhard 1990, 1998).

#### *Liposcelis compacta* Lienhard, 1990

**Material examined.** Malta, Buskett, 17.v.1974, 4 ♀ (paratypes), in soil sample, VM.

**Notes.** This species was previously reported from Malta by Lienhard (1990). It is a Mediterranean species (so far recorded from Algeria, France, Greece, Malta and Spain) associated with soil, ground litter and under-stone habitats (Lienhard 1990, 1998).

#### *Liposcelis decolor* (Pearman, 1925)

**Material examined.** Malta, Buskett, 17.v.1974, 4 ♀, in soil sample, VM.

**Notes.** This species was previously reported from Malta by Lienhard (1990). It is a cosmopolitan species mostly associated with ground litter and tussocks of dead grasses, also found in birds' nests, mammals' nests, bat guano, and under bark. It is also often found in warehouses and dwellings, herbaria, insect collections and similar commodities (Lienhard 1990, 1998).

#### *Liposcelis pearmani* Lienhard, 1990

**Material examined.** Malta, Zejtun, 20.x.2014, 1 ♀, in private residence, DM.

**Notes.** A new record for the Maltese Islands. This is a mainly European species but has been recorded also from Japan and U.S.A. It is mainly found in houses, insect collections, stored products, sometimes in birds' nests and, in the Mediterranean Region, occasionally under bark (Lienhard 1990, 1998).

## Suborder Psocomorpha

### Family Epipsocidae

#### *Bertkauia lucifuga* (Rambur, 1842)

**Material examined.** Malta, Buskett, 17.v.1974, 16 nymphs, in soil sample, VM.

**Notes.** This species was previously reported from Malta by Lienhard (1998) under the name *Epipsocus lucifugus*. It is a parthenogenetic species confined to the western Palaearctic Region and is associated with forest leaf litter, sometimes under stones, on rotten wood and at the entrances of caves (Lienhard 1998).

## Family Caeciliusidae

### *Stenoecilius caboverdensis* (Meinander, 1966)

**Material examined.** Malta, Ghadira beach, 15.vi.1999, 1 ♀, BM; Marsaxlokk beach, 4.v.2001, 1 ♂, BM; Mnajdra, 3 km E. Zurrieq, 12.vii.1997, 1 ♂ 2 ♀, DB; Fomm ir-Rih, 29.x.2014, 1 ♂, beating vegetation, DM; Verdala Palace, 11.vii.–1.viii.2014, 1 ♂, Malaise trap, DM; same data but 1–30.ix.2014, 1 ♀.

**Notes.** A new record for the Maltese Islands. This coastal Atlanto-Mediterranean species is generally associated with foliage of the giant reed (*Arundo donax*) but also of acacias and herbaceous plants such as *Artemisia*, *Juncus*, and others (Lienhard 1998).

### *Valenzuela burmeisteri* (Brauer, 1876)

**Material examined.** Malta, Buskett, 3.v.2001, 1 ♀, BM; Verdala Palace, 12–24.vi.2014, 3 ♂ and 1 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 1 ♂ and 3 ♀; 11.vii.–1.viii.2014, 2 ♂ and 1 ♀.

**Notes.** A new record for the Maltese Islands. This is a Holarctic species mainly associated with conifers (Lienhard 1998).

### *Valenzuela corsicus* (Kolbe, 1882)

**Material examined.** Malta, Delimara, Peter's Pool, 3 km SE Zejtun, 12.vii.1997, 1 ♀, DB; Bahrija Valley, 6 km W of Rabat, 16.vii.1997, 1 ♂, DB; Salina bay, 4.vi.1999, 2 ♂ and 1 ♀, BM; Fomm ir-Rih bay, 14.vi.1999, 1 ♀, BM; Salina bay, 2.v.2001, 2 ♂ and 2 ♀, BM; Buskett, 3.v.2001, 1 ♂, BM; Marsaxlokk beach, 4.v.2001, 3 ♂ and 9 ♀, BM; Verdala Palace, 12–24.vi.2014, 22 ♂ and 25 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 25 ♂ and 28 ♀; 11.vii.–1.viii.2014, 38 ♂ and 33 ♀; 1–15.viii.2014, 4 ♂ and 2 ♀; 15–30.viii.2014, 6 ♂ and 2 ♀; and 1–30.ix.2014, 38 ♂ and 12 ♀.

**Notes.** A new record for the Maltese Islands. It is a West Palaearctic species, common in the Mediterranean Region, which was known for a long time under the junior synonym *V. rhenamus* (listed under this name by Lienhard & Smithers 2002). However, for several years *V. corsicus* has been considered as its valid name (Lienhard 2002). This foliiclc species lives on different kinds of trees and shrubs, occasionally also on herbaceous plants (Lienhard 1998).

## Family Lachesillidae

### *Lachesilla bernardi* Badonnel, 1938

**Material examined.** Malta, Ghadira beach, 15.vi.1999, 1 ♂, BM; Fomm ir-Rih, 29.x.2014, 1 ♂, beating vegetation, DM; Verdala Palace, 11.vii.–1.viii.2014, 1 ♂, Malaise trap, DM.

**Notes.** A new record for the Maltese Islands. This is a circum-Mediterranean species, mainly associated with dead branches of different trees and shrubs, occasionally found also on dead leaves of herbaceous plants or in leaf litter (Lienhard 1998).

### *Lachesilla dimorpha* Lienhard, 1981

**Material examined.** Malta, Verdala Palace, 11.vii.–1.viii.2014, 4 ♂ and 1 ♀, Malaise trap, DM; same data but 1–15.viii.2014, 1 ♂; 15–30.viii.2014, 4 ♂ and 2 ♀; and 1–30.ix.2014, 2 ♂ and 1 ♀.

**Notes.** A new record for the Maltese Islands. This is an apparently rather rare circum-Mediterranean species, mainly associated with dried twigs and branches of different shrubs and herbaceous plants (Lienhard 1998).

### ***Lachesilla pedicularia* (Linnaeus, 1758)**

**Material examined.** Malta, Bahrija Valley, 6 km W of Rabat, 16.vii.1997, 4 ♀, DB; Mnajdra, 3 km E of Zurrieq, 12.vii.1997, 1 ♀, DB; Salina bay, 4.vi.1999, 1 ♀, BM; Fomm ir-Rih bay, 14.vi.1999, 1 ♀, BM; Marsaxlokk beach, 4.v.2001, 2 ♂ and 5 ♀, BM; Fomm ir-Rih, 29.x.2014, 1 ♂, beating vegetation, DM; Verdala Palace, 12–24.vi.2014, 11 ♂ and 1 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 4 ♂ and 3 ♀; 11.vii.–1.viii.2014, 1 ♂ and 2 ♀; 1–15.viii.2014, 6 ♂ and 3 ♀; and 15–30.viii.2014, 1 ♀.

**Notes.** A new record for the Maltese Islands. It is an almost cosmopolitan species, mainly associated with dried twigs and branches of different shrubs and herbaceous plants, occasionally found also in leaf litter, in birds' nests or in human dwellings (Lienhard 1998).

### **Family Ectopsocidae**

#### ***Ectopsocus briggsi* McLachlan, 1899**

**Material examined.** Malta, Buskett, 2 km S of Rabat, 15.vii.1997, 2 ♀, DB; Buskett, 14.vi.1999, 1 ♂, BM; Verdala Palace, 12–24.vi.2014, 2 ♂ and 5 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 1 ♂ and 1 ♀; and 11.vii.–1.viii.2014, 1 ♂ and 1 ♀.

**Notes.** A new record for the Maltese Islands. This is an almost cosmopolitan species associated with numerous trees and shrubs, especially on dead leaves still attached to the living plant. It is sometimes also found in human habitation or on cultivated plants (Lienhard 1998).

#### ***Ectopsocus meridionalis* Ribaga, 1904**

**Material examined.** Malta, Buskett, 17.v.1974, 2 ♀, in soil sample, VM.

**Notes.** This species was previously reported from Malta by Lienhard (1998). It is an obligatory parthenogenetic species, almost cosmopolitan in distribution and with similar ecology to *E. briggsi* (Lienhard 1998).

#### ***Ectopsocus strauschi* Enderlein, 1906**

**Material examined.** Malta, Għadira beach, 15.vi.1999, 1 ♀, BM; Buskett, 27.x.2014, 1 ♂, under bark of *Pinus halepensis*, DM; Fomm ir-Rih, 29.x.2014, 1 ♀, beating vegetation, DM; Verdala Palace, 25.vi.–10.vii.2014, 2 ♂, Malaise trap, DM; same data but 11.vii.–1.viii.2014, 4 ♂ and 4 ♀; 1–15.viii.2014, 3 ♂; 15–30.viii.2014, 2 ♂ and 5 ♀; and 1–30.ix.2014, 23 ♂ and 9 ♀.

**Notes.** A new record for the Maltese Islands. It is a South-Atlantic species, particularly common on the Macaronesian archipelagos, found in association with numerous trees and shrubs, especially on dead branches and leaves still attached to the living plant (Lienhard 1998).

#### ***Ectopsocus vachoni* Badonnel, 1945**

**Material examined.** Malta, Buskett, 17.v.1974, 1 ♂, in soil sample, VM; Verdala Palace, 25.vi.–10.vii.2014, 1 ♀, Malaise trap, DM; same data but 11.vii.–1.viii.2014, 3 ♀. Macropterous females and a micropterous male.

**Notes.** This species was previously reported from Malta by Lienhard (1998). It is a typical circum-Mediterranean species, with adults occurring throughout the year and mainly found in leaf litter of deciduous trees or conifers. The species is also known from the Canary Islands and from several regions with a Mediterranean or subtropical climate in the New World, including Chile, Argentina, Guatemala, Mexico, and U.S.A.; one record from Western Australia is also known (Lienhard 1998; Lienhard & Smithers 2002).

## Family Peripsocidae

### *Peripsocus stagnivagus* Chapman, 1930

*Peripsocus bivari* Baz, 1988: 6. **syn. nov.**

*Peripsocus leleupi* Badonnel, 1976: 218. **syn. nov.**

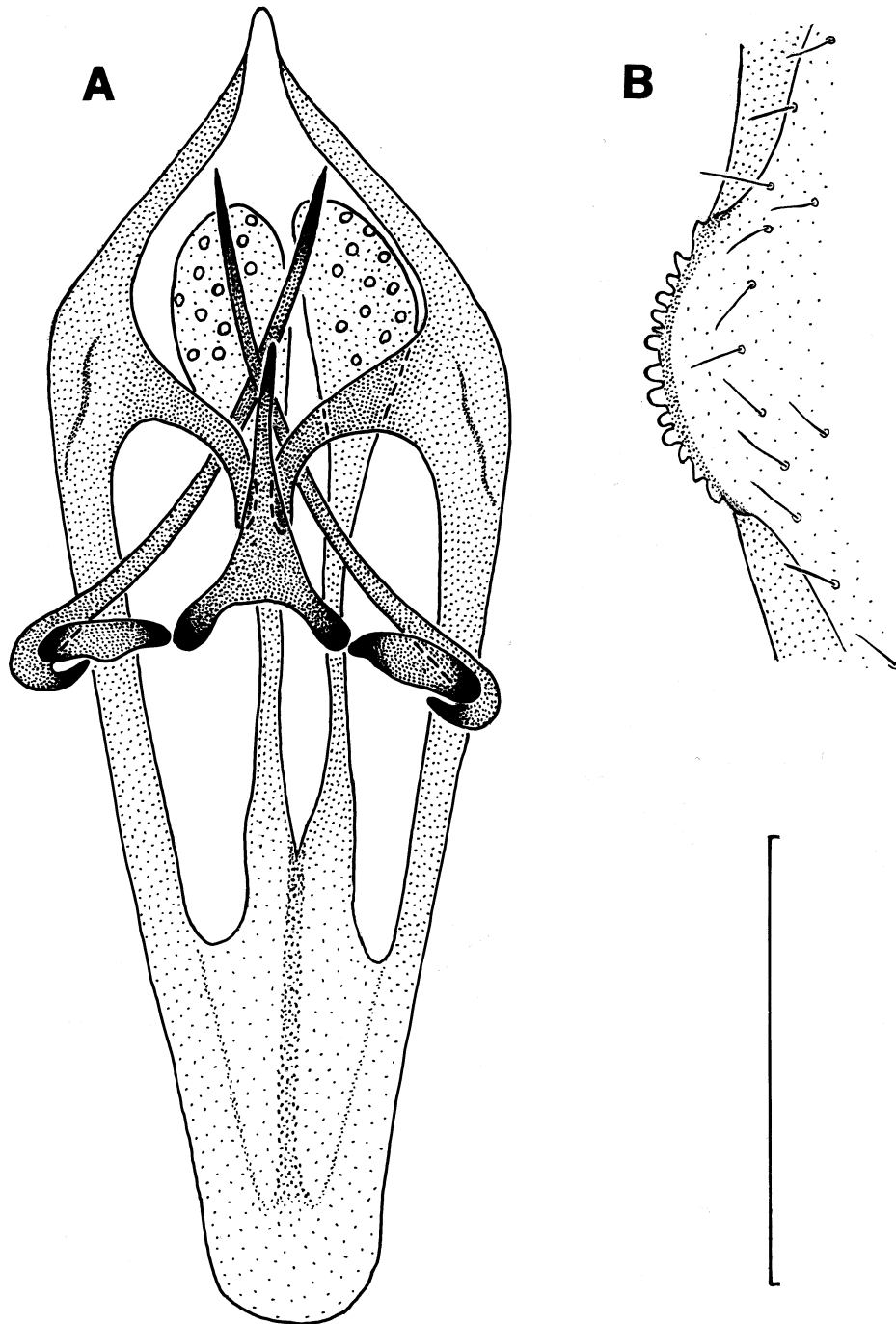
**Material examined.** Malta, Verdala Palace, 12–24.vi.2014, 2 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 3 ♀; 11.vii.–1.viii.2014, 37 ♀; 1–15.viii.2014, 6 ♀; 15–30.viii.2014, 1 ♂ and 246 ♀; and 1–30.ix.2014, 298 ♀.

**Notes.** A new record for the Maltese Islands. The Maltese population of this species apparently reproduces by thelytokous parthenogenesis, as do most Nearctic populations of *P. stagnivagus* (Mockford 1971). By chance, one male was found among the almost 600 females collected from Malta, as occasionally happens in obligatorily thelytokous psocids (see Lienhard 1998: 45). No morphological differences were found between the Maltese male and the Nearctic male of *P. stagnivagus*; the latter was well described and illustrated by Mockford (1993). Lienhard (1998: 262) stated that the females of *P. bivari*, described by Baz (1988) and redescribed by Lienhard (1998), and *P. leleupi*, described by Badonnel (1976), cannot be distinguished either from each other or from the North American *P. stagnivagus*; the female of the latter was described by Chapman (1930) and redescribed by Mockford (1993). Based on the discovery of the first Palaearctic male of *P. stagnivagus*, the synonymy of these names is here formally proposed.

*Peripsocus stagnivagus* in the narrow sense is a predominantly Nearctic species considered by Mockford (2012) as a native element of deciduous forests in the eastern United States. However, it has been recorded also from Central America (Cuba, Mexico, Panama), the Galapagos Islands and from Bermuda (see Lienhard & Smithers 2002). According to Mockford (1993: 215), some of the Mexican populations represent two undescribed species: “the three [species] are readily separated on male characters, but females appear to be indistinguishable morphologically” (Mockford *loc. cit.*). Following the proposed synonymy, the distributional range of *P. stagnivagus* is widened to include Macaronesia (Azores, Canary Islands, and Madeira), western North Africa (Morocco) and western France (i.e. range of *P. bivari*, see Lienhard 1998 and Lienhard & Smithers 2002), and also the South Atlantic islands of St. Helena and Ascension (i.e. range of *P. leleupi*, see Badonnel 1976 and Lienhard & Ashmole 2011). The easternmost Palaearctic record is the present one from Malta.

Among the European psocids, *P. bivari* has been considered as an alien element of unknown origin by Schneider (2010). In fact, the distribution range of *P. stagnivagus* resulting from the proposed synonymy suggests an introduction of this psocid from the Nearctic. The high potential for dispersal of this species is probably largely due to its predominantly parthenogenetic reproduction. Another example of an extremely widespread parthenogenetic psocid is *Trichadenotecnum cicularoides* Badonnel (thelytoky demonstrated by Mockford 1974), which has been recorded from all zoogeographical regions (see Lienhard & Smithers 2002 and Yoshizawa & Smithers 2006).

*Peripsocus stagnivagus* is the smallest of the European *Peripsocus* species (body length of females 1.6–1.8 mm, of the Maltese male 1.4 mm; forewing length of females 1.5–1.7 mm, of the Maltese male 1.6 mm). The compound eyes are distinctly larger in the male (IO/D = 1.25) than in the females (IO/D about 2.4). This sexual dimorphism was crucial for rapid detection of the single male among the almost 250 females collected in a single Malaise trap sample. The colouration of the forewing is variable; its membrane is faintly tinged with brown and usually some darker patches are clearly visible, especially in cells r5 to m3 (see Baz 1988: fig. 9; Lienhard 1998: fig. 84d); but these patches are often weakly developed or even absent, as is the case in the male and in many females from Malta. In the identification key proposed by Lienhard (1998), the male of *P. stagnivagus* keys out with *P. parvulus*. However, the latter is much larger (male forewing length 2.1–2.3 mm). The phallosome of *P. parvulus* is somewhat similar in shape to that of *P. stagnivagus* and has also a pair of anteromedially curved appendages arising at the base of the aedeagal arch (see Lienhard 1998: fig. 83q). However, the males of these species are easy to distinguish by the characteristic shape of the endophallic sclerites (compare Fig. 1A with Lienhard 1998: fig. 83p). The clunial comb is similar in both species, with about a dozen of well-developed rounded teeth in *P. stagnivagus* (Fig. 1B) and a somewhat higher number of such teeth in *P. parvulus* (see Lienhard 1998: fig. 83t). The male of *P. stagnivagus* is clearly not identical with the holotype of the enigmatic *P. yuleki* Galil, 1983 described from Israel (Galil & Halperin 1983); the latter remains a “species inquirenda” (see discussion in Lienhard 1998: 256).



**FIGURE 1.** *Peripsocus stagnivagus* Chapman. Male from Malta: A, Phallosome, dorsal view. B, Clunial comb, dorsal view. Scale (A, B) 0.1 mm.

### Family Trichopsocidae

#### *Trichopsocus clarus* (Banks, 1908)

**Material examined.** Malta, Buskett Gardens, 2 km S of Rabat, 15.vii.1997, 8 ♂ and 5 ♀, DB; Fomm ir-Riħ, 29.x.2014, 1 ♀, beating vegetation, DM; Verdala Palace, 25.vi.–10.vii.2014, 1 ♂ and 1 ♀, Malaise trap, DM.

**Notes.** A new record for the Maltese Islands. In nature, this species is predominantly found in the Atlanto-Mediterranean Region but it is often imported with subtropical plants into greenhouses in other parts of the World

(Lienhard 1998). In fact, *T. clarus* is established in coastal California, as noted by Mockford (1993) under the junior synonym *T. acuminatus* Badonnel.

### ***Trichopsocus dalii* (McLachlan, 1867)**

**Material examined.** Malta, Verdala Palace, 12–24.vi.2014, 8 ♂ and 12 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 6 ♂ and 9 ♀; 11.vii.–1.viii.2014, 3 ♂ and 7 ♀; 1–15.viii.2014, 2 ♂ and 8 ♀; 15–30.viii.2014, 1 ♀; and 1–30.ix.2014, 5 ♂ and 3 ♀.

**Notes.** A new record for the Maltese Islands. This is a predominantly Mediterranean species but is occasionally found also in the Nearctic Region. It is associated with the foliage of different trees and shrubs but is rarely found on conifers (Lienhard 1998).

## **Family Elipsocidae**

### ***Cuneopalpus cyanops* (Rostock, 1876)**

**Material examined.** Malta, Verdala Palace, 12–24.vi.2014, 1 ♂ and 5 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 2 ♂ and 1 ♀; and 1–15.viii.2014, 1 ♀.

**Notes.** A new record for the Maltese Islands. It is a predominantly foliicole European species associated with conifers but is occasionally found also on broad-leaved trees. It is known also from North America, where it was most likely accidentally introduced (Lienhard 1998).

### ***Elipsocus abdominalis* Reuter, 1904**

**Material examined.** Malta, Verdala Palace, 25.vi.–10.vii.2014, 1 ♂, Malaise trap, DM.

**Notes.** A new record for the Maltese Islands. This is a predominantly West-Palaeartic species, found also on the Pacific coasts of North America. Generally it is associated with the dead branches of conifers, but is occasionally found also on other trees and shrubs (Lienhard 1998).

### ***Elipsocus hyalinus* (Stephens, 1836)**

**Material examined.** Malta, Marsaxlokk beach, 4.v.2001, 1 ♀, BM; Wardija, 22.ii.2000, 3 ♀, on *Lycium intricatum*, DM; Verdala Palace, 12–24.vi.2014, 1 ♀, Malaise trap, DM.

**Notes.** A new record for the Maltese Islands. This is a Holarctic, parthenogenetic species mainly associated with dead branches of conifers, but is also regularly collected on other trees and shrubs (Lienhard 1998).

## **Family Mesopsocidae**

### ***Mesopsocus fuscifrons* Meinander, 1966**

**Material examined.** Malta, Birkirkara, Mriehel, 1.i.2015, 1 ♀, on bark of *Ceratonia siliqua*, DF; same data but 11.i.2015, 1 male nymph (last instar), DM.

**Notes.** A new record for the Maltese Islands. This is a rather uncommon species but is widely distributed in the West Palaeartic Region, with records from Morocco, Algeria, Italy, Macedonia and France (Lienhard 1998); it was recently found also in Sweden (Svensson & Hall 2010). It is a cortical species that lives on various trees and shrubs, especially on those having deciduous leaves. The variability of colouration in *M. fuscifrons* has been discussed by Lienhard (1998). The Maltese female shows the typical dark frontal pigmentation and the dark brown sub-basal transversal ring on the tibiae; and the V-shaped patches on the eyes are very distinct, as figured by



Lienhard (1998: fig. 113c) and Svensson & Hall (2010: figs on pp. 148-149). The colouration of the eyes is identical in the male nymph but the dark frontal pigmentation and the sub-basal tibial rings are less distinct than in the female.

## Family Psocidae

### *Loensia variegata* (Latreille, 1799)

**Material examined.** Malta, Verdala Palace, 12–24.vi.2014, 1 ♀, Malaise trap, DM; same data but 25.vi.–10.vii.2014, 1 ♂ and 2 ♀; and 11.vii.–1.viii.2014, 1 ♂ and 2 ♀.

**Notes.** A new record for the Maltese Islands. It is a West Palaearctic species associated with bark of various trees and shrubs and occasionally found in piles of stones. The intensity of forewing colouration of the Maltese specimens is somewhat variable, corresponding to the medium- or relatively weakly-coloured forms described by Lienhard (1998: fig. 137b, c). However, a certain number of small patches are always present all over the membrane, in addition to the basic wing pattern consisting of a few larger pigment patches. The pale form described by Lienhard (1998: fig. 137d) from Greece, almost completely lacking the small patches, was not observed in the Maltese material.

## Family Myopsocidae

### *Myopsocus eatoni* McLachlan, 1880

**Material examined.** Malta, Zejtun, 20.vii.2014, 13 ♂ and 4 ♀ and 2 nymphs, associated with dead wood of *Ailanthus altissima* in storage, DM.

**Notes.** A new record for the Maltese Islands. This is a circum-Mediterranean species known also from several Atlantic Islands (Azores, Canaries, Madeira and St. Helena). It is associated with bark of different trees and shrubs (Lienhard 1998).

## Discussion

The present work brings the number of psocids recorded from the Maltese Islands to a total of 27 species. All the records come from the island of Malta, as so far no investigations for psocids have been carried out on the other islands of the Maltese archipelago. From the data gathered from the Malaise traps at Verdala Palace, *Cerobasis guestfalica*, *Peripsocus stagnivagus* and *Valenzuela corsicus* appear to be the commonest species. However, more extensive studies in other habitats need to be carried out and will probably reveal that other species may dominate and that the psocid fauna of Malta may be more diverse. The psocopteran fauna of Malta is characterized by the presence of several Atlanto-Mediterranean elements having a high potential for dispersal, namely: *Stenocaecilius caboverdensis*, *Ectopsocus strauschi*, *Peripsocus stagnivagus*, and *Trichopsocus clarus*; all of them are known also from the Macaronesian archipelagos and from western North Africa (Lienhard 1998). Most of the remaining species are widely distributed in the western Palaearctic, especially in the Mediterranean Region. The following species can be considered as typical and common Mediterranean elements: *Valenzuela corsicus*, *Lachesilla bernardi*, *Ectopsocus vachoni*, *Trichopsocus dali* and *Myopsocus eatoni*. Three less common predominantly Mediterranean species found in Malta are *Liposcelis compacta*, *Lachesilla dimorpha* and *Mesopsocus fuscifrons* (see Lienhard 1998 and Lienhard & Smithers 2002).

## Acknowledgements

We thank Bernhard Merz (MHNG), Daniel Burckhardt (Museum of Natural History, Basle, Switzerland), Desirée Falzon (BirdLife, Malta) and Volker Mahnert (MHNG), for depositing psocids that they collected from Malta in

the MHNG. Special thanks go to Giulio Marianacci (University of Bologna, Italy) who persuaded one of us (DM) to set up a Malaise trap in Malta for a long period of time. We also thank Edward Mockford (Illinois State University, Normal, USA) and Gillian W. Watson (California Department of Food and Agriculture, Sacramento, USA) for all their constructive help during the preparation of this manuscript.

## References

- Badonnel, A. (1976) La faune terrestre de l'île de Sainte-Hélène. Psocoptera. *Annales du Musée Royal de l'Afrique centrale, Sciences zoologiques*, 215, 206–232.
- Baz, A. (1988) Psocópteros de Azores: nuevas citas, descripciones y sinonimias. *Boletim da Sociedade Portuguesa de Entomologia*, 93, 1–15.
- Chapman, P.J. (1930) Corrodentia of the United States of America. I. Suborder Isotecnomera. *Journal of the New York Entomological Society*, 38, 219–290, 319–403.
- Galil, B. & Halperin, J. (1983) Psocoptera of Israel II. *Israel Journal of Entomology*, 17, 59–66.
- Johnson, K.P., Yoshizawa, K. & Smith, V.S. (2004) Multiple origins of parasitism in lice. *Proceedings of the Royal Society of London, Series B*, 271, 1771–1776.  
<http://dx.doi.org/10.1098/rspb.2004.2798>
- Lienhard, C. (1990) Revision of the Western Palaearctic species of *Liposcelis* Motschulsky (Psocoptera: Liposcelididae). *Zoologische Jahrbücher (Abteilung Systematik)*, 117, 117–174.
- Lienhard, C. (1998) Psocoptères euro-méditerranéens. *Faune de France*, 83, xx + 517 pp.
- Lienhard, C. (2002) Deux psocoptes intéressants de Corse (Psocoptera: Caeciliusidae) avec une liste des espèces ouest-paléarctiques de la famille. *Revue suisse de Zoologie*, 109 (4), 687–694.
- Lienhard, C. (2004) Worldwide country checklists of Psocoptera species [based on the World Catalogue by Lienhard & Smithers, 2002]. Available from: <http://www.ville-ge.ch/mhng/psocoptera/page/ps-coun.htm> (accessed 20 November 2014)
- Lienhard, C. & Ashmole, N.P. (2011) The Psocoptera (Insecta: Psocodea) of St Helena and Ascension Island (South Atlantic) with a new record from South Africa. *Revue suisse de Zoologie*, 118 (3), 423–449.
- Lienhard, C. & Smithers, C.N. (2002) Psocoptera (Insecta): World Catalogue and Bibliography. *Instrumenta Biodiversitatis*, 5, 1–xli + 1–745. [Muséum d'histoire naturelle, Genève]
- Mifsud, D. (2000) Present knowledge of the entomofauna of the Maltese Islands. *Entomologica Basiliensia*, 22, 75–86.
- Mockford, E.L. (1971) Parthenogenesis in psocids (Insecta: Psocoptera). *American Zoologist*, 11, 327–339.
- Mockford, E.L. (1974) *Trichadenotecnum circularoides* (Psocoptera: Psocidae) in southeastern United States, with notes on its reproduction and immature stages. *Florida Entomologist*, 57 (4), 369–370.  
<http://dx.doi.org/10.2307/3493496>
- Mockford, E.L. (1993) *North American Psocoptera (Insecta)*. Flora and Fauna Handbook, Sandhill Crane Press, Gainesville, Florida, 10, xviii + 455 pp.
- Mockford, E.L. (2012) Aspects of the biogeography of North American Psocoptera (Insecta). pp. 307–328. In: Stevens, L. (Ed.), *Global Advances in Biogeography*. InTech, Rijeka & Shanghai, 360 pp. Available from: <http://www.intechopen.com/books/global-advances-in-biogeography/aspects-of-the-biogeography-of-northamerican-psocoptera> (accessed 20 November 2014)
- Schneider, N. (2010) Psocids (Psocoptera). In: Roques, A., Kenis, M., Lees, D., Lopez-Vaamonde, C., Rabitsch, J.-Y. & Roy, D.B. (Eds.), *Alien terrestrial arthropods of Europe*. *BioRisk*, 4 (2), 793–805.  
<http://dx.doi.org/10.3897/biorisk.4.46>
- Svensson, B.W. & Hall, K. (2010) *Nationalmyckeln till Sveriges flora och fauna. Stövsländor. Psocoptera*. ArtDatabanken, SLU, Uppsala, 204 pp. + numerous figs.
- Yoshizawa, K. & Johnson, K.P. (2006) Morphology of male genitalia in lice and their relatives and phylogenetic implications. *Systematic Entomology*, 31, 350–361.  
<http://dx.doi.org/10.1111/j.1365-3113.2005.00323.x>
- Yoshizawa, K. & Johnson, K.P. (2010) How stable is the «Polyphyly of Lice» hypothesis (Insecta: Psocodea)? a comparison of phylogenetic signal in multiple genes. *Molecular Phylogenetics and Evolution*, 55, 939–951.  
<http://dx.doi.org/10.1016/j.ympev.2010.02.026>
- Yoshizawa, K. & Lienhard, C. (2010) In search of the sister group of the true lice: A systematic review of booklice and their relatives, with an updated checklist of Liposcelididae (Insecta: Psocodea). *Arthropod Systematics & Phylogeny*, 68 (2), 181–195.
- Yoshizawa, K. & Smithers, C.N. (2006) Systematic position of *Trichadenotecnum enderleini* (Roesler) (Psocodea: "Psocoptera": Psocidae). *Records of the Australian Museum*, 58 (3), 411–415.  
<http://dx.doi.org/10.3853/j.0067-1975.58.2006.1467>
- Zhang, Z.-Q. (2011) Phylum Arthropoda von Siebold, 1848. In: Zhang, Z.-Q. (Ed.), *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness*. *Zootaxa*, 3148, 99–103.