THE CENTRAL MEDITERRANEAN NATURALIST

VOLUME 4 PART 3 MALTA, 2007

THE CENTRAL MEDITERRANEAN NATURALIST

2007

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SHORT COMMUNICATIONS

In 1998, three N.G.O.s sharing the common aim of promoting the awareness, conservation and study of Malta's natural heritage decided to join forces so as to form a single, more effective association. The organizations were the Society for the Study and Conservation of Nature (SSCN), founded in 1962, and the more recently formed groups Arbor and Verde.

This merger resulted in the formation of Nature Trust (Malta) which was officially launched by His Excellency the President of the Republic on Friday 8th January 1999. In June 2001, another organization, the Marine Life Care Group (MLCG) also joined Nature Trust (Malta).

Mission Statement

'Committed to the conservation of Maltese nature by promoting environmental awareness, managing areas of natural and scientific interest, and lobbying for effective environmental legislation.'

EDITOR: Dr. Alan Deidun

EDITORIAL BOARD: Ms. Jennifer Fiorentino, Dr. Paul Gatt, Mr. Titian Schembri

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EDITOR'S NOTE

My recent appointment as editor of the Central Mediterranean Naturalist (CMN) was a humbling experience indeed, especially since it introduced me to a special group of individuals – the dedicated cohort of local and foreign biologists who tirelessly and rigorously strive to study the wealth constituted by our local natural heritage and to relay the results of their studies to the rest of society in order to foster a culture of greater appreciation. The feat achieved by such individuals is even more laudable when one considers that their studies are usually conducted for no financial gains, against the backdrop of a society so adverse to perceived 'voluntary' or 'pro bono' work.

As a journal, the Central Mediterranean Naturalist (CMN) is a rare species indeed, since it is one of the few journals solely dedicated to the natural heritage of the islands. The journal has proved to be quiet resilient in managing to weather several a storm in the last forty years of its publication and has contributed in no insignificant way to the knowledge and appreciation of frequently disdained local natural heritage.

This year's issue follows on the path of previous issues by featuring works having a strident nature conservation timbre – in fact, scientific works highlighting the discovery or rediscovery of some rare floral or faunal species also carry with them an inherent call for the conservation of sites of ecological importance. One augurs, therefore, that the information contained in this journal is used as a valuable tool by environmental authorities in this country.

Three important initiatives adopted this year by the journal's editorial board include the use of recycled paper for the publication of the journal, the production of a fully digitized version of the journal contents on CD (to pave the way for further use of the journal) and the uploading of the journal abstracts on the website of Nature Trust (Malta – also to enhance the journal's outreach potential). The journal contents (abstracts) will also be listed and archived in the most popular citation systems, whilst a copy of the same journal will be deposited at the University of Malta library and at the public library in Beltissebh, Floriana, for ease of access.

The journal's editorial board wishes to express its heartfelt gratitude to the Environment Directorate of the Malta Environment and Planning Authority (MEPA) and to the Ministry for Resources, Agriculture and Environment (MRAE) for pledging to sponsor the publication of the journal for the next three years, thereby ensuring the erudite legacy of the journal for future generations. The board also wishes to thank previous editors of the journal, most notably Mr. David Dandria, for their sterling captainship through the years. Last (but certainly not least), I wish to thank my board colleagues and all the journal reviewers who have willingly giving their input in producing this year's issue.

Dr. Alan Deidun
Editor

FOREWORD

People often think of science as a search for information. However, information by itself is often of little value. It is in this context the MEPA uses scientific information and results achieved worldwide, and is one of the institutions in Malta employing science in its day-to day work and scientists to work on scientific and policy-making aspects, applying scientific results and coupling them with socio-economic aspects to produce a better Malta, based on the principle of sustainability.

MEPA has been instrumental in promoting scientific research in Malta, both directly and indirectly, throughout the years, since the inception of its parent organisations (the Environment Protection Department and the Planning Authority) in the late 80s, and has contributed financially and otherwise in the promotion of scientific information.

In this context, it is a pleasure for me to introduce the publication of this new issue of the Central Mediterranean Naturalist, one of the main scientific peer-reviewed journals in Malta. This issue is also based on many aspects which can provide a considerable amount of information that can be used for conservation purposes by MEPA and related institutions, aiding policy-makers and scientists alike, including new localities for rare and threatened species, new reports of alien species and their impacts, added information on areas of special conservation value and information of pest species on important cultivated species. MEPA is also proud to financially sponsor this publication.

The papers presented are very interesting from MEPA's perspective in that they relate to various aspect of our ecosystem-related work. All these studies would assist us in our work on the mapping of the distribution and range of rare and threatened species, the Habitat Inventorying Programme and the work on the control and eradication of invasive alien species, such as the eradication of *Rattus norvegicus* from the St. Paul's Islands Nature Reserve.

MEPA, in terms of natural aspects, is required to promote national and international research and scientific co-operation in the field of conservation and sustainable use of biological diversity, particularly with regards to the objectives and obligations of the Flora, Fauna and Natural Habitats Protection Regulations (Legal Notice 311 of 2006).

During the last few years, MEPA has sponsored various studies which were and are of interest to MEPA and related institutions, and in many instances, such works were published in peer-reviewed journals. As such, it worth noting that some of the authors contributing to this issue of the Central Mediterranean Naturalist have collaborated actively with MEPA throughout the years and some of our joint work was also published in the Central Mediterranean Naturalist, as well as other scientific journals. Various other studies published in the Central Mediterranean Naturalist have also been found useful in attaining our objectives, such studies on faunistics and floristics.

Such studies have proved very useful, particularly in our projects such as the Biodiversity Action Plans and Habitat Inventorying Project, in providing baseline data for monitoring; and in identifying national priorities to be covered by legal and other statutory, administrative or contractual issues.

The Environment Protection Directorate of the Malta Environment & Planning Authority has been in the recent years providing support to many scientific studies, both directly and indirectly, through financial support, issuing of relevant research permits, or other kinds of assistance, and is in many aspects committed towards ensuring the increase and proliferation of a quality approach to scientific research in the Maltese Islands.

A good chunk of our work relies on the scientific information and expertise, and it is within this context that we realise, with pleasure, that this issue of the Central Mediterranean Naturalist is based on many aspects which can provide a considerable amount of information that can be used for conservation purposes, aiding policy-makers and scientists alike, including new localities for rare and threatened species, rediscovery of species previous assumed to be extinct from the Maltese Islands, new reports of alien species, added information on areas of special conservation value and information of pest species on important cultivated species.

We are currently working with various scientists on different aspects. For example, MEPA has worked and is working with experts on the implementation of a number of EU environment directives and regulations, and is also working on developing a new scientific method by which the Mediterranean endemic sea-grass *Posidonia oceanica* is used as an indicator to assess the status of our coastal and marine environment. Scientific discussions are ongoing at a Mediterranean level, and this is certainly an opportunity to increase our research and innovation needs to enable us in meeting our targets for environmental protection and regulation.

Such collaboration is also planned to increase in the near future, also in line with the provisions of the Lisbon Agenda, which aims at promoting economic growth, fostering competitiveness and job creation, and advancing structural and regulatory reform, while ensuring social cohesion and environmental sustainability.

It is hoped that scientific research gains more importance in future; MEPA will do its utmost to support further valid research work, particularly noting the need to promote more scientific research related to the impacts on climate change on Malta's environment, further studies on marine aspects, the impact of alternative energy sources, scientific studies on threats affecting the European environment, and monitoring studies on trends in our waters, soil and wildlife, and the links of all these issues with socio-economic aspects.

Mr. Martin Seychell
Director Environment Protection
Malta Environment & Planning Authority

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PESTS AND DISEASES ASSOCIATED WITH OLIVE TREES IN THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)

Gilbert Haber [1] & David Mifsud [2]

ABSTRACT

A detailed study was carried out on pests and diseases of the olive tree in 31 different localities in the Maltese Islands (18 in Malta, 11 in Gozo and 2 in Comino). The work was mainly carried out between June 2006 and April 2007. A total of 16 species of insects, 3 species of eryophid mites, 2 fungal diseases and 1 bacterial disease were recorded. Two insects, the olive thrip, *Liothrips oleae* and the pollinia scale, *Pollinia pollini* and three eriophid mites, *Ditrymacus athiassella*, *Oxycenus maxwelli* and *Tegelophus hassani* were recorded for the first time from Malta. Additionally, five hymenopteran parasites were also recorded for the first time from Malta. These include *Psyttalia concolor*, *Pnigalio agruales* and *Eupelmus urozonus* as parasites of the olive fly, *Bactrocera oleae*; *Angitia armillata* as a parasite of the olive moth, *Prays oleae*; and *Eupelmus sp.* which was associated with the olive bark midge, *Reseliella oleisuga*. *Aleurolobus olivinus* and *Reselliela oleisuga* were previously recorded on the basis of a single record. *Otiorynchus moriger*, a weevil endemic to the Maltese Islands was here recorded for the first time as a pest of olives.

INTRODUCTION

The olive tree, *Olea europaea* L. is a species of small, evergreen tree in the family Oleaceae, native to the coastal areas of the eastern Mediterranean Region, from Lebanon and the maritime parts of Asia Minor to northern Iran at the south end of the Caspian Sea. Its fruit is of major agricultural importance in the Mediterranean Region and other Mediterranean type climates as a source of olive oil and table olives.

Olive culture in Malta has its origins in antiquity. It is not known when or by whom the first olive trees were introduced to the Maltese islands. Various symbolic icons that depict olive branches and leaves, olive groves and olive wreathes are found dating to different periods. The earliest example is afforded by the olive wood beams thought to have covered the Neolithic temples of Malta, the world's oldest free standing monuments. Borg (1922) indicates that according to prominent local historians, the cultivation of the olive tree was introduced in these islands by the first Phoenician settlers. Cultivation of olives was largely extended under the Roman and Byzantine domination. Under the Roman Empire and later during the Arabian period, Malta was considered as an olive rich nation. However, during the latter half of the eighteenth century there arose a large demand for cotton from Spain, and vast olive groves and vineyards where sacrificed to make room for the cotton plants. Borg (1922) stated that in the last decade of the eighteenth century over 80,000 olive trees where destroyed and the plains around Zebbug, where this tree flourished, became practically treeless. The production of olive oil had ceased altogether in the beginning of the nineteenth century, the produce of the remaining olive trees being pickled or salted for consumption.

Many villages throughout Malta and Gozo bear names associated with olive cultivation to the present day, indicating that olive culture was important in these localities. These include "Zebbug" that literally means olive in Maltese and is given to two localities, one situated in Malta and the other in Gozo. "Birzebbuga" means olive meadow, whilst "Zejtun" is the Arabic name for the olive, and "Ghasri" derives from the word "ghasar" and "ghasir" meaning squeezing, referring to olive pressing. It is worth mentioning that in some remote areas of the

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Maltese islands one can still find very old olive groves or single olive trees and one of the most import site is in Bidnija where some 30 olive trees are present including some over 1000 years old.

In recent years there has been an increase in the promotion of local olive culture so much so that a number of producers and entrepreneurs have imported modern presses and now offer olive grading and pressing services.

HISTORICAL REVIEW OF OLIVE PESTS AND DISEASES

The catalogue of organisms potentially harmful to the olive tree includes over 255 species at the present time and the number is increasing with the identification of new ones, especially mites, nematodes, and pathogenic micro-organisms (Haniotakis, 2003). About half of these are animal pests while the rest are disease causing micro-organisms and pathogenic fungi. However, only a small number of these are capable of causing damage of economic importance on the olive tree.

Local studies and information on the occurrence of pests and diseases of olive trees are very limited. The work of Borg (1922) entitled "*Cultivation and diseases of fruit trees in the Maltese Islands*" provided, among other things, some details with respect to olive pests and diseases. A major shortcoming of this book is that it is not always clear whether the species mentioned were actually recorded in Malta. Saliba (1963), in his work on the insect pests of crop plants included a list of insect pests that attack the olive, with general comments on the occurrence of the species listed. An important work carried out exclusively on olives in Malta was that by Pace-Lupi (2005), which focused on the incidence and distribution of the fungal pathogen *Verticillium dahliae.*

Most other works are limited to the citing of individual species associated with olives in wider taxonomic lists. In two local studies on scale insects (Borg, 1919; Borg [J.], 1932), seven species were recorded from olives. Cameron & Caruana Gatto (1907) in their work on the Coleoptera fauna of Malta mentioned the local occurrence of two beetles known to be associated with olives. Mifsud (1997), in his work on the jumping plant-lice of the Maltese Islands, documented the occurrence of the olive psyllid, *Euphyllura olivina* on olive trees. The Lepidoptera is a well documented insect order in the Maltese islands due to various works and collections by different entities. Of these, the works of Sammut (1984, 2000) are the most recent and detailed and include species of moths associated with the olive tree. The moth *Prays oleae* was documented as an olive pest by Borg [P.] (1932) and Valletta (1973). The works by Caruana Gatto (1905), Andres (1916), Darlow (1949), Amsel (1951), DeLucca (1965), Sammut (1983), Valletta (1973) and Vella (1991) all record one or few moth species from Malta that are known to be olive pests. In these works however there is no direct mention of the species as occurring on olives. Mifsud & Porta-Puglia (2005) recorded for the first time the olive whitefly, *Aleurolobus olivinus*, on local olive trees. Wheeler (1957) was first to record the fungus *Spilocaea oleaginea* and the bacterium *Pseudomonas syringae* subsp. *savastanoi* on olives in Malta. The fungus *Verticillium dahliae* was first recorded in Malta by Porta-Puglia & Mifsud (2005). The most recent work published to date in which olive diseases are mentioned is that of Porta-Puglia and Mifsud (2006).

MATERIAL AND METHODS

During the present study 45 different sites in 30 localities (Figure 1) were surveyed and sampled for olive pests and diseases. Places surveyed included semi naturalised olive trees present in local maquis communities, plantations of different ages, single or multiple trees in private and public gardens, trees present in coastal areas and trees planted by roadsides and in traffic roundabouts.

Insects associated with olives were collected from the tree canopy using three main methods, visual inspection, beating and sweeping. During visual inspection of the entire olive tree, including trunk, branches and leaves insects were collected by means of an aspirator or a fine-hair brush or occasionally forceps. Specimens collected were placed in small labelled sampling bottles or vials. When foliage or fruit was collected this was placed in labelled sealable plastic bags for later analysis. A list of the samples collected and descriptions of any symptoms was compiled on site. The specimens collected were conserved in two main ways. Most insects were conserved dry mounted but soft bodied insects were preserved in 70% ethanol. Some scale insects, thrips, whiteflies and jumping plant lice were slide mounted (permanent slides) for later examination with the compound microscope. The technique follows Ben-Dov & Hodgson (1997b)

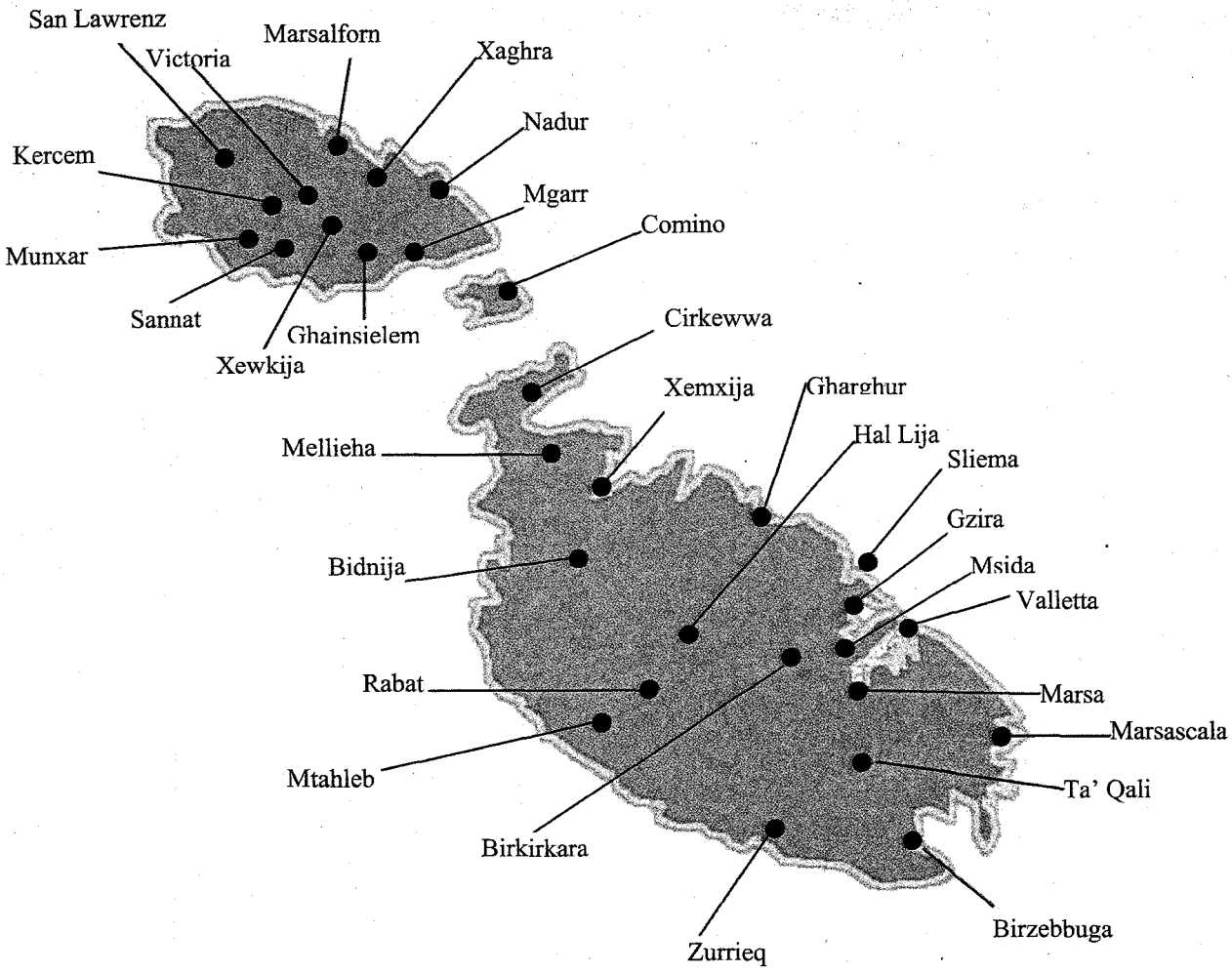

Figure 1: Localities sampled in the present study.

with some modifications. When required, immature insects were reared to adult stage by placing them in appropriately labelled ventilated jars sealed with a fine mesh. Smaller species such as the olive bark midge were cultured in closed Petri dishes. In both cases the bottom of the container was lined with tissue paper to absorb moisture and also to serve as a substratum for the formation of puparia when required. The above methodology was also adopted to rear parasites of olive pest species. The specimens emerging from cultures were left for at least 24 hours in order to harden. They were later preserved either in 70% alcohol or dry mounted. Insect identification was carried out using various works, such as Gill (1997); Guario *et al.*, (2001); Hodgson (1994); Kosztarab & Kozar (1988); Marullo (2003); Mound & Kibby (1998); Palmer *et al.*, (1992); Pollini (1998); Pollini *et al.*, (2002).

Eryophid mite extraction followed de Lillo *et al.*, (2001). This method extracts mites that occur free living on plant surfaces including leaves, buds or in crevices along the branches. The mites collected were stored in small vials containing a mixture of alcohol, acetic acid, glycerine and water in the following proportions, 20: 50: 27: 3.

For fungal pathogens, symptomatic and asymptomatic wood samples roughly 15cm long and about 2cm thick were collected from commercial olive groves, nurseries and wood plantations in various localities on the islands. The ideal time to view clear symptoms of *V. dahliae* is in the spring season that is February till May. In the laboratory, the infected stems were washed with water and liquid soap. These were then dried by means of a paper towel and subsequently washed with 70% ethanol. Glassware and instruments were autoclaved (121°C, 15min, 15psi). Autoclaved instruments and disinfested samples were stored under a laminar flow cabinet. Potato

dextrose (PDA) medium was used for isolating and growing of most fungi (Brooks, 2001). This medium was prepared by boiling 200g sliced potatoes in about 1 litre water and then filtered. To one litre of the filtrate 20g dextrose and 12g agar were added. The medium was properly sealed and autoclaved (121°C, 15min, 15psi). The medium was poured in sterilised Petri dishes under a laminar flow cabinet and left to cool. The procedure adopted to induce mycelial growth for deep infections or fungi that sporulate poorly followed Brooks (2001). The method was carried out to isolate *Verticillium dahliae*. All steps were effected under a HEPA class II laminar flow cabinet and basic microbiological procedures were followed to avoid contamination. Microscopic examination of PDA cultures in order to confirm the presence of *V. dahliae* followed Brooks (2001) and involved the observation of dark brown resting mycelium and micro-sclerotia which arise centrally in cultures and consist of dark brown to black spherical masses made up of swollen globular cells. Diagnosis of the olive peacock spot, *Spilocaea oleaginea* was carried out by taking a sample of about 100 leaves from the lower part of the canopy. In the laboratory, these were immersed in a warm solution of 5% sodium hydroxide for 3 minutes. After this treatment the leaves were inspected for any clearly visible brownish spots indicating that infection is present. This method was employed to confirm the presence or absence of this fungus from olive trees with no visible symptoms on site.

Infection of the bacterium, *Pseudomonas syringae* subsp. *savastanoi* was diagnosed by the presence of its symptoms, clearly visible hyperplastic galls on leaf midrib, petiole or young stems of olive (Brooks, 2001; Janse, 2007 *pers. comm*).

For all olive pests and diseases recorded, information is provided on material examined, local and global distribution, and additional notes. Unless otherwise stated, all material recorded during the present study was collected by the first author.

ANNOTATED LIST OF SPECIES ASSOCIATED WITH OLIVES IN MALTA

INSECTA

***Liothrips oleae* Costa 1857**
[Thysanoptera: Phlaeothripidae]
English name: Olive thrip.

Material examined: **MALTA**: Xemxija (Simar NR), 20.IX.2006, larvae and adults, 19.X.2006, adults; Mellieha, 7.XII.2006, adults; Gzira (tal-Qroqq), 14.XI.2006, adults; Msida (University Grounds), 22.IX.2006, adults, 13.X.2006, adults; Ta Qali, 21.XII.2006, adults and larvae; Bidnija, 20.X.2006, adults; Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Marsa (Ghammieri), 14.IX.2006, adults and larvae, 20.III.2007, adults; Zurrieq, 20.III.2007, adults. **GOZO**: Xewkija, 8.IX.2006, larvae and adults, 22.VI.2006, larvae and adults; Mgarr, 5.VII.2006, adults, 14.IV.2007, adults; Marsalforn (Ghajn Barrani), 30.VII.2006, adults, 10.IX.2006, adults; Munxar, 23.VIII.2006, adults, 9.IX.2006, adults, 2.X.2006, larvae and adults; Kercem (Lunzjata), 9.IX.2006, adults, 19.X.2006, adults and larvae; Victoria (Capuccini Valley), 5.X.2006, adults; Victoria (Villa Rundle), 18.VIII.2006, adults. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults, 28.IV.2007, adults; Southern Part, 27.X.2006, adults, 28.IV.2007, adults.
Distribution: Present throughout the Mediterranean Basin and Eastern Africa (Marullo, 2003).
Notes: This insect is a new record for Malta being host specific on olive trees. In Italy this pest goes through three to four generations per year. Typical leaf deformations (producing semi-circular leaf galls) indicate the presence of this pest. From the observations carried out during the present survey it can be concluded that in Malta this insect, although very common, does not cause damage of economic significance.

***Euphyllura olivina* (O.G. Costa, 1839)**
[Hemiptera: Psylloidea]
English name: Olive Psyllid.

Material examined: **MALTA**: Msida (University Grounds), 15.VI.2006, nymphs, 22.IX.2006, adults, 13.X.2006, adults, 14.XI.2006, adults, 20.XII.2006, adults and nymphs, 15.II.2007, adults and nymphs; Xemxija (Simar NR), 20.VI.2006, nymphs, 19.X.2006, adults, 19.XII.2006, adults and nymphs; Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Buskett, 30.IX.2006, adults; Bidnija, 20.X.2006, adults; Gzira (tal-Qroqq), 18.VI.2006, nymphs, 14.XI.2006, adults; Ta Qali, 21.XI.2006, adults; Cirkewwa, 7.XII.2006, adults and nymphs; Mellieha, 7.XII.2006, adults and nymphs; Zurrieq, 20.III.2007, adults and nymphs; Marsa (Ghammieri), 20.III.2007, adults and nymphs; Valletta (Argotti Gardens), 30.IX.2006, adults and nymphs. **GOZO**: Xewkija, 15.VI.2006, nymphs, 15.XI.2006, adults, 20.X.2006, adults, 22.VI.2006, adults and nymphs,

20.X.2006, adults, 05.IV.2007, adults, 10.IV.2007, adults and nymphs, 15.IV.2007, adults and nymphs; Mgarr, 5.VII.2006, adults and nymphs; Marsalforn (Ghajn Barrani), 30.VII.2006, adults; Munxar, 19.X.2006, adults; Kercem (Lunzjata), 19.X.2006, adults; Xaghra (ta Gajdoru), 19.X.2006, adults; Ghajnsielem (Ta Lambert), 29.VI.2006, adults, 9.IV.2007, adults and nymphs. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults, 28.IV.2007, adults and nymphs; Southern Part, 27.X.2006, adults, 28.IV.2007, adults and nymphs.

Distribution: *Euphyllura olivina* is found in all olive growing regions of the Mediterranean Basin including Italy, Southern France, Spain, North Africa and Canary Islands (Mifsud, 1997).

Notes: The occurrence of *E. olivina* has already been documented for the Maltese Islands (Borg, 1922; Saliba, 1963; Mifsud, 1997). The species is monophagous on *Olea europea*. In Italy the species undergoes two (Fimiani, 1985) or four to six (Silvestri, 1934; Grandi, 1951; Tremblay, 1981) generations per year. Although the species is locally common, no damage of economic significance was ever observed.

***Aleurolobus olivinus* (Silvestri, 1911)**
[Hemiptera: Aleyrodidae]
English name: Olive whitefly.

Material examined: **MALTA**: Gzira (tal-Qroqq), 14.XI.2006, pupae; Ta Qali, 21.XI.2006, pupae; Gharghur, 15/IV/07, pupae; Birkirkara, 28.III.2007, pupae; Msida (University Grounds), 14.XI.2006, pupae, leg. D. Mifsud, 20.XII.2006, pupae, 15.II.2007, pupae; Mellieha, 7.XII.2006, pupae, Blata l-Bajda, 19.IX.2006, pupae; Hamrun, 11.XII.2006, pupae, leg. D. Mifsud.

Distribution: Typical Mediterranean species, recorded from most countries in this region including Corsica, Crete, Cyprus, France, Greece, Israel, Italy, Jordan, Mallorca, Morocco, Portugal, Sardinia, Sicily, Spain, Syria and Turkey (Martin *et al.*, 2000).

Notes: *A. olivinus* was first recorded in the Maltese islands by Mifsud & Porta-Puglia (2005), though its presence was already suspected by Mifsud (1993). Prior to this study this species was previously recorded from one locality and this study has added seven new localities for *A. olivinus*. Its appearance in different localities in such a short period of time may suggest that the species is of recent introduction. *A. olivinus* is mainly associated with oleaceous hosts (*Olea europea*, *Phyllyrea angustifolia* and *P. latifolia*) but it has also been recorded from *Erica* (Bink-Moenen, 1989). This species has only one generation per year with adults emerging in June and July. However, in western Sicily, two generations per year were recorded with adults emerging in June/July and again in Septemper/October (Maniglia, 1985).

***Pollinia pollini* Costa, 1857**
[Hemiptera: Asterolecaniidae]
English name: Pollinia scale.

Material examined: **MALTA**: Marsa (Ghammieri), 14.IX.2006, adults, 20.III.2007, adults; Zurrieq, 20.III.2007, adults; Lija, 21.II.2007, adults; Valletta (Argotti Gardens), 30.IX.2006, adults; Xemxija (Simar NR), 20.IX.2006, adults, 19.X.2006, adults; Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Msida (University Grounds), 22.IX.2006, adults, 13.X.2006, adults, 14.XI.2006, adults, 20.XII.2006, adults, 15.II.2007, adults; Gzira (tal-Qroqq), 14.XI.2006, adults; Ta Qali, 21.XI.2006, adults; Mellieha, 7.XII.2006, adults; Cirkewwa, 7.XII.2006, adults. **GOZO**: Xewkija, 8.IX.2006, adults, 24.IX.2006, adults, 22.X.2006, adults, 15.XI.2006, adults, 9.IV.2007, adults; Kercem (Lunzjata), 8.IX.2006, adults, 19.X.2006, adults; Victoria (Villa Rundle), 18.VIII.2006, adults; Mgarr, 25.VIII.2006, adults, 4.IV.2007, adults; Xaghra (ta Gajdoru), 20.X.2006, Marsalforn (Ghajn Barrani), 8.IX.2006, adults; Sannat, 11.XI.2006, adults. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults, 28.IV.2007, adults.

Distribution: This scale insect is found in most olive growing regions of the Mediterranean Region and in California.

Notes: *P. pollini* is a new record for Malta. It is found on leaves, twigs and fruit of its exclusive host, the olive tree. Generally one generation per year. The species is relatively frequent in Malta but no damage of economic significance was observed.

***Lichtensia viburni* Signoret, 1873**
[Hemiptera: Coccidae]
English name: Viburnum cushion scale.

Material examined: **MALTA**: Xemxija (Simar NR), 19.X.2006, adults; Msida (University Grounds), 22.IX.2006, adults, 13.X.2006, adults and nymphs, 14.XI.2006, adults and nymphs, 20.XII.2006, adults and nymphs; Gzira (tal-Qroqq), 14.XI.2006, adults and nymphs; Mellieha, 7.XII.2006, adults and nymphs; Cirkewwa, 7.XII.2006, adults and nymphs; Marsa (Ghammieri), 14.IX.2006, adults and nymphs; Zurrieq, 20.III.2007, adults; Hal Lija, 21.II.2007, adults. **GOZO**: Kercem

(Lunzjata), 8.IX.2006, adults and larvae, 19.X.2006, adults; Victoria (Villa Rundle), 15.XI.2006, adults and nymphs; Xewkija, 22.X.2006, adults and nymphs, 15.XI.2006, adults and nymphs; Mgarr, 25.VIII.2006, adults and nymphs, 4.IV.2007, adults; Sannat, 11.XI.2006, adults; Marsalforn (Ghajn Barrani), 8.IX.2006, adults and nymphs.

Distribution: *L. viburni* is known from the Czech Republic, France, Germany, Russia, Italy, Yugoslavia, England, Wales, Spain, Portugal and USA.

Notes: Borg (1922), described *Phillipia oleae* (= *L. viburni*) as rather uncommon on olive trees. Borg [J.] (1932), cited again *Phillipia oleae* as present here and there on the olive tree in both islands, more frequent in St. Julians, Sliema and St. Antonio Gardens. *L. viburni* infests leaves, twigs and stems of *Arbutus, Olea, Hedera, Ilex, Phillyrea, Prunus, Rhamnus* and *Viburnum.* Normally the species undergoes two generations per year (Kosztarab & Kozar, 1988; Pollini *et al.*, 2002). From the observations made during the present study, damage caused by this scale insect was rarely significant in Malta. *L. viburni* was observed to be widely distributed in the Maltese islands.

Saisettia oleae Olivier, 1791
[Hemiptera: Coccidae]

English name: Black scale.

Material examined: **MALTA**: Xemxija (Simar NR), 20.IX.2006, adults, 19.X.2006, adults; Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Buskett, 30.IX.2006, adults nymphs; Msida (University Grounds), 22.IX.2006, adults, 13.X.2006, adults and nymphs, 14.XI.2006, adults and nymphs, 20.XII.2006, adults and nymphs, 15.II.2007, adults; Bidnija, 20.X.2006, adults; Gzira (tal-Qroqq), 14.XI.2006, adults and larvae; Ta Qali, 21.XI.2006, adults; Mellieha, 7.XII.2006, adults; Cirkewwa, 7.XII.2006, adults; Marsa (Ghammieri), 14.IX.2006, adults, 20.III.2007, adults; Zurrieq, 20.III.2007, adults; Lija, 21.II.2007, adults; Mtahleb, 26.XI.2006, adults and nymphs; Valletta (Argotti Gardens), 30.IX.2006, adults. **GOZO**: Kercem (Lunzjata), 8.IX.2006, adults and nymphs, 19.X.2006, adults; Kercem (Public Garden), 18.VIII.2006, adults, 21.IX.2006, adults; Victoria (Villa Rundle), 18.VIII.2006, adults; Victoria (Capuccini Valley), 5.X.2006, adults; Marsalforn (Ghajn Barrani), 8.IX.2006, adults; Marsalforn (Valley), 28.VII.2006, adults;. San Lawrenz, 8.X.2007, adults and nymphs. Xewkija, 22.X.2006, adults and nymphs, 8.IX.2006, adults, 24.IX.2006, adults, 15.XI.2006, adults and nymphs, 9.IV.2007, adults; Mgarr, 25.VIII.2006, adults, 4.IV.2007, adults; Xaghra (ta Gajdoru), 20.X.2006, adults; Sannat, 11.XI.2006, adults. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults, 18.IV.2007, adults; Southern Part, 27.X.2006, 18.IV.2007, adults.

Distribution: Found in most Mediterranean countries including Spain, France, Italy and Greece. Recorded also from California and Australia.

Notes: *S. oleae* is a polyphagous insect recorded on different unrelated host plants. It was described by Borg (1919; 1922) as an important pest commonly affecting local olive cultivation. Borg [J.] (1932) described *S. oleae* as very common on Citrus trees, Olive trees, *Cycas revoluta, Abutilon, Hibiscus, Myrtus, Nerium, Oleander, Pistacia lentiscus, P. terebinthus, Punica granaum* and others. Saliba (1963) also stated that *S. oleae* is very common on olive and other hosts. *S. oleae* normally undergoes one generation per year (univoltine), although an incomplete generation may occur when the weather is mild in the autumn. In this study this species was observed to be very common on olive trees and was recorded in nearly all of the sites sampled. Damage is not very significant since the fruit is rarely affected, but serious damage can result from blackening of leaves due to sooty mould growing on the honeydew secreted by the nymphal instars. Heavy infestations were rarely observed locally.

Aspidiotus nerii Bouche, 1833
[Hemiptera: Diaspididae]

English name: Oleander scale.

Material examined: **MALTA**: Xemxija (Simar NR), 19.X.2006, adults; Msida (University Grounds), 22.IX.2006, adults, 13.X.2006, adults, 14.XI.2006, adults, 20.XII.2006, adults, Gzira (tal-Qroqq), 14.XI.2006, adults; Mellieha, 7.XII.2006, adults; Cirkewwa, 7.XII.2006, adults; Marsa (Ghammieri), 14.IX.2006, adults; 20.XII.2006, adults; Lija, 21.II.2007, adults. **GOZO**: Kercem (Lunzjata), 19.X.2006, adults; Victoria (Villa Rundle), 20.XII.2006, adults; Xewkija, 22.X.2006, adults, 15.XI.2006, adults; Mgarr, 25.VIII.2006, adults, 4.IX.2006, adults; San Lawrenz, 8.X.2007, adults; Munxar, 2.X.2006, adults; Sannat, 11.XI.2006, adults. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults; Southern Part, 27.X.2006, adults.

Distribution: *Aspidiotus nerii* has a worldwide distribution, especially in the tropical and subtropical zones (Zahradnik, 1990).

Notes: Borg (1919) described two species, *A. hedereae* (= *A. nerii*) and *A. nerii* as both occurring on olive and other hosts. Borg (1922) and Borg [J.] (1932) recorded *A. hederae* as very common, infesting several plant families including olive, but causing limited damage. Saliba (1963), also cited this insect as common. This polyphagous pest usually goes through three generations. In the present study the occurrence of this scale insect

was rather frequent. It was most often observed in abandoned and old trees. Shade and humid conditions favour this insect and in fact it was observed mostly in trees having a dense canopy due to lack of pruning. In table olive crops, the presence of this scale makes fruit unmarketable. Economic loss on table olives due to damage to fruits can be up to 70% (Alexandrakis & Benassy, 1981). In Malta, a heavy infestation by this species was observed in only one locality where the trees looked white-washed due to the presence of this insect.

***Hemiberlesia rapax* Comstock, 1881**
[Hemiptera: Diaspididae]
English name: Greedy Scale.

Material examined: **MALTA**: Marsa (Ghammieri), 14.IX.2006, adults; 20.XII.2006, adults; Mellieha, 7.XII.2006, adults. **GOZO**: San Lawrenz, 8.X.2007, adults.
Distribution: *H. rapax* is found in all tropical and sub-tropical regions of the world.
Notes: Borg (1919) describes the occurrence of *Aspidiotus rapax* (= *Hemiberlesia rapax*) as present on several tree species and ornamental shrubs with no specific reference to olive trees. This species is a polyphagous pest. During the present study this species was observed affecting the stem, leaves and fruit of olive trees. Most damage was inflicted to the fruit were it caused some form of deformation. In Malta the insect occurred in large numbers especially on the stem.

***Leucaspis riccae* Targioni Tozzetti, 1881**
[Hemiptera: Diaspididae]
English name: White Olive Scale.

Material examined: **MALTA**: Gzira (tal-Qroqq), 14.XI.2006, adults.
Distribution: Occurs in Israel, Syria, Italy, Yugoslavia, Uzbekistan, Tunisia, Sicily, Moroçco, Malta, Cyprus, Argentina, Turkey, Egypt, Algeria, France, Greece and Iran (Pollini, 1998).
Notes: This scale insect was recorded by Borg [J.] (1932), as found 'here and there' on olive trees. It was also mentioned by Saliba (1963) as occasional on olive. In Greece, *Leucaspis riccae* undergoes two generations per year (Argyriou & Kourmadas, 1981). *L. riccae* is known to occur on olive and *Ephedra alata*. In the present survey, only three specimens were observed on ripe olive fruit in one location. The fruit was severely deformed by this insect indicating that its damage is significant. This species seems to be rare in the Maltese Islands.

***Prays oleae* Bernard, 1788**
[Lepidoptera:Yponomeutidae]
English name: Olive moth.

Material examined: **MALTA**: Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Buskett, 30.IX.2006, adults; Xemxija (Simar NR), 20.IX.2006, symptoms on leaves, 19.IV.2007, larvae; Marsa (Ghammieri), 21.II.2007, larvae, 15.III.2007, adults; Msida (University Grounds), 22.IX.2006, symptoms on leaves, 13.X.2006, adults, 14.XI.2006, adults, 20.III.2007, larvae; Gzira (tal-Qroqq), 14.XI.2006, adults; Mellieha, 7.XII.2006, adults; Cirkewwa, 7.XII.2006, symptoms on leaves; Bidnija, 20.X.2006, adults. **GOZO**: Kercem (Lunzjata), 8.IX.2006, adults, 19.X.2006, symptoms on leaves; Munxar, 8.IX.2006, adults; Marsalforn (Ghajn Barrani), adults; Marsalforn (Valley), 28.VII.2006, symptoms on leaves; Xaghra (ta Gajdoru), 20.X.2006, symptoms on leaves; Victoria (Villa Rundle), 18.VIII.2006, adults; Mgarr, 13.VIII.2006, adults, 20.IX.2007, adults; Xewkija, 8.IX.2006, adults, 24.IX.2006, symptoms on leaves, 2.X.2006, larvae in olive fruit, 9.IV.2007, larvae. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, larvae, 28.IV.2007, larvae; Southern Part, 27.X.2006, symptoms on leaves, 28.IV.2007, larvae.
Distribution: *Prays oleae* is present throughout the Mediterranean basin and the Black Sea, the Middle East and Canary Islands (Tzanakakis, 2003).
Notes: This moth was first recorded for Malta by Borg (1922) under the name of *Prays oleaellus,* were he stated that it causes frequent damage. The damage described by Borg (1922) does not entirely correspond to the typical damage by *P. oleae*. Borg [P.] (1932) describes this moth as causing injuries on leaves, flowers and fruit and recorded the species as not common possibly due to the activity of a parasite. The moth was also recorded by Saliba (1963) as fairly common whereas Delucca (1965) mentioned it in his list. Valletta (1973) stated that the moth is not so common and attacks tender leaves, flowers and shoots. Sammut (2000) describes the moth as rare. In the present survey, leaf mining symptoms were commonly observed throughout the islands. Apart from the olive, this moth is also associated with filaria (*Phillyrea* spp.), privet (*Ligustrum* spp.) and jasmine (*Jasminum*

sp.). This moth is considered as a primary olive pest and significant loss in production is attributed to this insect. In Malta, larvae were observed causing some damage to flower buds during early spring and it was from these that adult moths were reared. Infected fruit by the carpophagous generation was only observed once in summer 2006. Thus although this moth is widespread in the Maltese Islands it seems that the damage caused is not very significant and overall population densities are low.

A parasitic wasp of this moth was recorded for the first time in Malta after it was reared as part of the present study. A single specimen of *Angitia armillata* (Grav.) (Hymenoptera: Ichneumonidae), was reared from *P. oleae* larvae that were infecting olive flowers. [Material examined: MALTA: Hal Lija, collected 21.II.2007, emerged 16.III.2007, *Angitia armillata* adult].

***Lobesia botrana* Denis & Schiffermüller, 1775**
[Lepidoptera: Tortricidae]
English name: Grapevine moth.

Material examined: GOZO: Xewkija, 11.X.2007, larvae and adults; San Lawrenz, 25.X.2007, larvae and adults.
Distribution: *Lobesia botrana* is a significant pest of berries and berry-like fruits in Europe, the Mediterranean, southern Russia, Japan, the Middle East, Near East, and northern and western Africa.
Notes: Borg (1922) stated that this species (as *Polychrosis botrana*) is common throughout Europe but absent in Malta. Delucca (1950) records one specimen from Gharghur. Saliba (1963) stated that this moth is fairly common on grapes. Valletta (1973), Sammut (1984) and Vella (1991) also mentioned the occurrence of this moth locally. Sammut (2000) stated that the species is common on grapes and occurs around Malta. In the present study, this species was found in two sites in Gozo where the moth emerged from cultured olive fruits. This is the first time that this species is recorded from the olive fruit. Worldwide this species feeds primarily on the flowers and fruits of grapevines (*Vitis vinifera*) and is recorded as a serious pest on this commodity. The grapevine moth is a polyphagous insect and can develop on plants belonging to more than 40 plant species (Ben-yehuda *et al.*, 1993; Moleas, 1988). From the present survey it can be concluded that the damage of this moth on olives is negligible.

***Palpita unionalis* Huebner, 1796**
[Lepidoptera: Pyralidae]
English name: Jasmine Moth.

Material examined: MALTA: Xemxija (Simar NR), 20.IX.2006, adults and larvae, 19.X.2006, larvae; Birzebbuga (Has-Sabtan), 30.IX.2006, larvae; Buskett, 30.IX.2006, larvae; Msida (University Grounds), 22.IX.2006, larvae, 13.X.2006, larvae, 14.XI.2006, larvae, 20.XII.2006, larvae, Bidnija, 20.X.2006, larvae; Gzira (tal-Qroqq), 14.XI.2006, larvae; Ta Qali, 21.XI.2006, larvae; Mellieha, 7.XII.2006, adults and larvae; Cirkewwa, 7.XII.2006, larvae; Marsa (Ghammieri), 14.IX.2006, adults and larvae, 20.III.2007, larvae; Zurrieq, 20.III.2007, larvae; Valletta (Argotti Gardens), 30.IX.2006, larvae. **GOZO**: Kercem (Lunzjata), 8.IX.2006, adults and larvae, 19.X.2006, larvae; Kercem (Public Garden), 18.VIII.2006, adults and larvae, 21.IX.2006, larvae; Victoria (Villa Rundle), 18.VIII.2006, adults and larvae; Victoria (Capuccini Valley), 5.X.2006, adults and larvae; Xewkija, 8.IX.2006, larvae, 24.IX.2006, adults and larvae, 22.X.2006, larvae, 15.XI.2006, larvae, 9.IV.2007, adults; Xewkija (Local Council Grove), 25.IX.2007, larvae and adults, Mgarr, 13.VIII.2006, adults and larvae, 4.IV.2007, adults, 9.IX.2007, larvae, 20.IX.2007, adults and larvae; Xaghra (ta Gajdoru), 20.X.2006, adults and larvae; Marsalforn (Ghajn Barrani), 8.IX.2006, larvae; Marsalforn (Valley), 28.VII.2006, larvae. **COMINO**: Wied l-Ahmar, 27.X.2006, adults and larvae, 18.III.2007, larvae; Southern Part, 27.X.2006, larvae.
Distribution: *P. unionalis* occurs throughout the Mediterranean Region (Balachowsky, 1972). It is also present in Asia Minor, North Africa, India, Japan, Australia and South America (Pollini, 1998).
Notes: This moth was first recorded by Caruana-Gatto (1905) as *Glydophodes unionalis* based on one specimen captured from Imtarfa. This moth was again recorded by Andres (1916) at Verdala Barracks. Borg [P.] (1932) recorded this species as *Margaronia unionalis* stating that it is "rare". Darlow (1949) took several specimens from Malta whilst Valletta (1950) records the species from Mriehel. Delucca (1965) also mentions this moth and for the first time it is said to be associated with olive trees in Malta. Valletta (1973) described the local occurrence of this moth, stating that it is an immigrant and feeds on olive and jasmine. Sammut (2000) recorded the species as very common especially between April to July and September to November and he also stated that its larvae feed on olive and jasmine. In the present survey, the moth was recorded during most of the year in many localities. Larvae feeding actively were observed from June up to early December. This species is a

polyphagous pest and is known to occur on olive, jasmine (*Jasminum*), privet (*Ligustrum*), ash (*Fraxinus*), arbutus (*Arbutus unedo*) and others. The species goes through 2 or 3 generations each year. Damage to large olive trees is not very significant but infection of young trees may prevent their healthy development. During the present study most damage was observed on the new growth of olive trees, where not only new leaves and buds were eaten but occasionally entire shoots up to 15cm were completely eroded.

***Resseliella oleisuga* (Targioni Tozzetti, 1887)**
[Diptera: Cecidomyiidae]
English name: Olive bark midge.

Material examined: **MALTA**: Xemxija (Simar NR), 20.IX.2006, larvae, 19.X.2006, larvae; Cirkewwa, 7.XII.2006, larvae ; Mellieha, 7.XII.2006, larvae ; Gzira (tal-Qroqq), 14.XI.2006, larvae; Msida (University Grounds), 22.IX.2006, larvae, 13.X.2006, larvae, 14.XI.2006, larvae. **GOZO**: Xewkija, 22.VI.2006, larvae, 5.XI.2007, larvae, 15.XI.2006, larvae, 15.III.2007, larvae; Mgarr, 5.VII.2006, larvae, 19.VII.2006, larvae, 1.VIII.2006, larvae, 2.VIII.2006, larvae, 5.VIII.2006, larvae, 4.IV.2007, larvae; Xaghra, 19.VII.2006, larvae, 5.XI.2007, larvae, 15.XI.2007, larvae; Marsalforn (Ghajn Barrani), 30.VII.2006, larvae, 10.IX.2006, larvae; Xewkija (Local council grove), 12.VIII.2006, larvae; Munxar 23.VIII.2006, larvae, 9.IX.2006, larvae, 2.X.2006, larvae and adults; Xewkija, 8.IX.2006, larvae, 15.XI.2006, larvae, 15.III.2007, larvae; Kercem (Lunzjata), 9.IX.2006, larvae, 19.X.2006, adults and larvae; Kercem (Public Garden), 18.VIII.2006, larvae, 21.IX.2006, larvae; Xaghra (ta Gajdoru), 2.X.2006, larvae, 20.X.2006, larvae; Victoria (Capuccini Valley), 5.X.2006, larvae; Victoria (Villa Rundle), 18.VIII.2006, larvae. **COMINO**: Wied l-Ahmar, 27.X.2006, larvae, 18.III.2007, larvae, 28.IV.2007, larvae; Southern Part, 27.X.2006, larvae, 28.IV.2007, larvae.
Distribution: This midge is known from most Mediterranean countries. It is recorded from Spain, France, Greece, Lebanon, Syria, Palestine, Morocco and Yugoslavia (Argyriou & Marakis, 1973).
Notes: This gall midge was first recorded in Malta by Skuhrava *et al.*, (2002), from one locality: Bajda Ridge. In this survey, the species was observed to be much more widespread. The gall midge was recorded in nearly all sites sampled in Gozo, though its presence in Malta was less frequent. This insect was most common in the warmer months but larvae and typical symptoms were observed nearly all year round. It appears to be specific to olive trees but it may develop on other Oleaceae such as filaria (*Phillyrea* spp.) and ash (*Fraxinus* spp.). The species goes through one to three generations per year depending on climatic conditions. One generation was recorded in Crete (Arambourg, 1966; Argyriou & Marakis, 1973) whilst two were reported in Italy. Each generation lasts about one month and the species over winters in the larval stage. Typical damage symptoms observed in this study were somewhat dry twigs and shoots in the outer parts of the tree canopy. On closer examination larvae were observed under the bark at the base of the wilted shoots. Damage was significant when the twigs affected bore fruit or inflorescences. Significant damage was observed on young olive plantations where dried branches constituted a large proportion of each tree.

The parasite *Eupelmus hartigi*, Forester (Hymenoptera: Eupelmidae) was reared from larvae of *Resseliella oleisuga*. The parasite emerged from larvae collected in four sites in Gozo. This species is a new record for Malta. [Material examined: GOZO: Xewkija, collected 22.VI.2006, emerged 4.VII.2006, *Eupelmus* sp. 1 ex; Mgarr, collected 19.VII.2006, emerged 1.VIII.2006, *Eupelmus* sp. 2 exs; Kercem (Public Garden), collected 18.VIII.2006, emerged 30.VIII.2006, *Eupelmus* sp. 1ex.]. The larvae appear to be ectoparasitic on larvae of the gall midge and their pupation takes place within the tunnels of the midge (Argyriou & Marakis, 1973).

***Bactrocera oleae* (Gmelin, 1788)**
[Diptera:Tephritidae]
English name: Olive Fly.

Material examined: **MALTA**: Xemxija (Simar NR), 20.IX.2006, adults and larvae, 19.X.2006, adults and larvae; Birzebbuga (Has-Sabtan), 30.IX.2006, adults and larvae; Buskett, 30.IX.2006, adults and larvae; Msida (University Grounds), 22.IX.2006, adults and larvae, 13.X.2006, adults and larvae, 14.XI.2006, adults and larvae, 20.XII.2006, adults and larvae, 15.II.2007, adults; Bidnija, 20.X.2006, adults and larvae; Gzira (tal-Qroqq), 14.XI.2006, adults and larvae; Ta Qali, 21.XI.2006, adults; Mellieha, 7.XII.2006, adults and larvae; Cirkewwa, 7.XII.2006, adults and larvae; Marsa (Ghammieri), 14.IX.2006, adults and larvae, 20.III.2007, adults; Zurrieq, 20.III.2007, adults; Lija, 21.II.2007, adults; Mtahleb, 26.XI.2006, adults and larvae; Valletta (Argotti Gardens), 30.IX.2006, adults and larvae. **GOZO**: Kercem (Lunzjata), 8.IX.2006, adults and larvae, 19.X.2006, adults; Kercem (Public Garden), 18.VIII.2006, adults and larvae, 21.IX.2006, adults and larvae; Victoria (Villa Rundle), 18.VIII.2006, adults and larvae; Victoria (Capuccini Valley), 5.X.2006, adults and larvae; Xewkija, 8.IX.2006, adults and larvae, 24.IX.2006, adults and larvae, 15.XI.2006, adults and larvae, 9.IV.2007, adults; Mgarr, 25.VIII.2006, adults and larvae, 4.IV.2007, adults; Xaghra (ta Gajdoru), 20.X.2006, adults and larvae; Marsalforn (Ghajn Barrani), 8.IX.2006, adults and larvae; Marsalforn (Valley), 28.VII.2006, adults and larvae; San Lawrenz, 8.X.2007, adults

and larvae; Munxar, 23.VIII.2006, adults and larvae, 9.IX.2006, adults and larvae, 24.IX.2006, adults and larvae, 19.X.2006, adults and larvae. **COMINO**: Wied l-Ahmar, 27.X.2006, adults and larvae, 18.III.2007, adults; Southern Part, 27.X.2006, adults and larvae.

Distribution: Throughout the Mediterranean basin, South and North Africa. The olive fruit fly is found in many olive-producing areas in the world (Ramos *et al.*, 1982; Van Steenwyk *et al.*, 2002). It was detected in California in October 1998 in the Los Angeles area and has since spread to the rest of southern California in 1999 (Rice *et al.*, 2003; Van Steenwyk *et al.*, 2002).

Notes: Briffa (1933) described this species as a serious olive pest and Saliba (1963) states that this fly is common on olive. The olive fruit fly is a serious pest of olives in most of the countries around the Mediterranean Region. The larvae are monophagous and feed exclusively on olive fruits, causing premature fruit drop and yield reduction. In regions where olive fruits remain on the trees in spring, the olive fly develops one or two spring generations. There may be a wide overlap in generations due to adult longevity and a long oviposition period (Mazomenos *et al.*, 2002). Locally the most important problem faced by the olive tree is the havoc caused by the olive fly (Borg, 1922). During the present survey, infected fruit and adult flies were observed from mid July up to early December 2006. Damage is very severe since 80% to 100% of the olives per tree are infected unless appropriate preventive control measures are taken. Large and early ripening olives were noted to be much more susceptible than smaller ones.

Several species of parasites are known to control the olive fly. In this study three of these species, *Pnigalio agraules* (Walker 1839) (Hymenoptera: Eulophidae), *Eupelmus urozonus* Dalman 1820 (Hymenoptera: Eupelmidae) and *Psyttalia* (=*Opius*) *concolor* Szépligeti 1910 (Hymenoptera: Braconidae), were reared from olives infected with *Bactrocera oleae* larva, and constitute new records for Malta. Of these three species, the latter was very commonly observed. The other two species were less frequent and were only recorded from four sites. It was observed that *Psyttalia concolor* started to parasite the fly during an advanced stage of infestation, when most fruit was already affected and was also very prolific as large numbers were observed in a short time. Both *Pnigalio agraules* and *Eupelmus urozonus* were isolated when the infection by the olive fly was at an early stage and when only few olives were infected. Few specimens of these species were observed and when *Psyttalia concolor* appeared, the others were no longer observed. The only local reference to these species is by Briffa (1933) where he states that the most practical way to control infestations by *Bactrocera oleae* was by using the parasitoid *Opius* (=*Psyttalia*).

[Material examined: GOZO: Victoria, collected 20.XI.2006, emerged 22.XI.2006, 1 *Pnigalio agraules*; Marsalforn, collected 06.VIII.2006, emerged 17.VIII.2006, 2 *Eupelmus urozonus*; Munxar, collected 29.XIII.2006 emerged 17.VIII.2006 1 *Eupelmus urozonus*; Xewkija, collected 5.XI.2006, emerged 22.XI.2006, 1 *Psyttalia concolor*; Kercem, collected 12.X.2006, emerged 30.XI.2006, 2 *Psyttalia concolor*; San Lawrenz, collected 11.X.2006, emerged 3.XI.2006, 2 *Psyttalia concolor*. MALTA: Cirkewwa collected, 7.XII.2006 emerged 12.XII.2006 2 *Pnigalio agraules*; Cirkewwa collected 7.XII.2006, emerged 18.XII.2006, 2 *Psyttalia concolor*; Msida, collected 15.XI.2006, emerged 28.XI.2006, 2 *Psyttalia concolor*].

Phloeotribus scarabaeoides scarabaeoides (Bernard, 1788)
[Coleoptera: Scolytidae]

English name: Olive bark beetle, Olive Scolytid.

Material examined: MALTA: Xemxija (Simar NR), 20.VI.2006, adults, 19.X.2006, adults and larvae; Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Buskett, 30.IX.2006, adults; Msida (University Grounds), 15.VI.2006, adults, 13.X.2006, adults; Bidnija, 20.X.2006, adults; Gzira (tal-Qroqq), 14.XI.2006, adults; Ta Qali, 21.XI.2006, adults; Mellieha, 7.XII.2006, adults and larvae; Cirkewwa, 7.XII.2006, adults; Marsa (Ghammieri), 14.VII.2006, adults, 20.III.2007, adults; Zurrieq, 20.III.2007, adults; Lija, 21.II.2007, adults; Valletta (Argotti Gardens), 30.IX.2006, adults. **GOZO**: Kercem (Lunzjata), 14.VI.2006, adults, 8.IX.2006, adults, 19.X.2006, adults; Kercem (Public Garden), 18.VIII.2006, adults, 21.IX.2006, adults; Victoria (Villa Rundle), 18.VIII.2006, adults; Victoria (Capuccini Valley), 5.X.2006, adults; Xewkija, 22.VI.2006, adults and larvae, 8.IX.2006, adults, 24.IX.2006, adults, 22.X.2006, adults 15.XI.2006, adults, 9.IV.2007, adults; Xewkija (Local Council Grove), 30.VI.2006, adults; Mgarr, 5.VII.2006, adults, 19.VII.2006, adults, 1.VIII.2006, adults and larvae, 5.VIII.2006, adults, 4.IV.2007, adults; Xaghra (Ramla Valley), 25.VII.2006, adults and larvae, 29.VII.2006, adults and larvae; Xaghra (ta Gajdoru), 20.X.2006, adults; Marsalforn (Ghajn Barrani), 30.VII.2006, adults, 8.IX.2006, adults; Marsalforn (Salvatur Hill), 6.VIII.2006, adults; Marsalforn (Valley), 6.VIII.2006, adults; Munxar, 23.VIII.2006, adults and larvae, 9.IX.2006, adults, 24.IX.2006, adults, 19.X.2006, adults. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults, 28.IV.2007, adults; Southern Part, 27.X.2006, adults, 28.IV.2007, adults.

Distribution: This beetle is found in all the Mediterranean Region and in Central Europe. It also occurs in North Africa except the Sahara Region, and in the Near and Middle Eastern countries including Turkey, Lebanon, Jordan and Iran (Pfeffer, 1995).

Notes: This insect was first recorded in the Maltese islands by Cameron & Caruana Gatto (1907). Borg (1922) stated that this beetle is often troublesome on olive trees whilst Saliba (1963) describes it as an occasional olive pest. In this study, this beetle has been recorded in practically all sites sampled. It often occurs in small numbers. It was recorded actively feeding and boring from April up till early December, indicating four or possibly more generations per year. This xylophagous (wood boring) pest (both in the larval and adult stages), is known to develop on *Olea europeae*, *Fraxinus* spp., *Ligustrum* sp., *Syringa* sp. and *Phyllirea* sp. (Pfeffer, 1995). The life cycle involves 1 to 3 generations per year. *Phloeotribus scarabaeoides* is an important insect pest of olive trees, and can lead to losses of up to 75% of the potential harvest (Gonzalez & Campos, 1994; Cuesta & Delgado, 1995). During the present survey it was observed that damage caused by this insect locally is not very significant. Heavy infestations were recorded only twice on living trees, at Mgarr and Marsalforn in summer 2006. Both trees showed severe signs of wilting and eventually died. The cause of their death could not be attributed directly to this insect and most likely *Phloeotribus scarabaeoides* was only a secondary problem.

Otiorhynchus moriger Reitter, 1913
[Coleoptera: Curculionidae]

Material examined: **MALTA**: Xemxija (Simar NR), 20.VI.2006, adults, 19.X.2006, adults; Birzebbuga (Has-Sabtan), 30.IX.2006, adults; Buskett, 30.IX.2006, adults; Msida (University Grounds), 15.VI.2006, 13.X.2006, adults; Bidnija, 20.X.2006, adults; Gzira (tal-Qroqq), 4.XI.2006, symptoms on leaves; Ta Qali, 21.XI.2006, adults; Mellieha, 7.XII.2006, symptoms on leaves; Cirkewwa, 7.XII.2006, symptoms on leaves; Marsa (Ghammieri), 14.VII.2006, adults, Zurrieq, 20.III.2007, symptoms on leaves; Lija, 21.II.2007, symptoms on leaves; Valletta (Argotti), 30.IX.2006, adults. **GOZO**: Xewkija (Local Council Grove), 1.VII.2006, adults; Kercem (Lunzjata), 14.VI.2006, adults, 8.IX.2006, symptoms on leaves, 19.X.2006, adults; Kercem (Public Garden), 18.VIII.2006, adults, 21.IX.2006, adults ; Victoria (Villa Rundle), 18.VIII.2006, adults; Victoria (Capuccini Valley), 5.X.2006, adults; Xewkija, 22.VI.2006, adults, 8.IX.2006, adults, 24.IX.2006, adults, 22.X.2006, adults, 15.XI.2006, symptoms on leaves, 9.IV.2007, symptoms on leaves; Mgarr, 5.VII.2006, adults, 19.VII.2006, adults, 1.VIII.2006, adults and larvae, 5.VIII.2006, adults, 4.IV.2007, adults; Xaghra (Ramla Valley), 25.VII.2006, adults, 29.VII.2006, adults; Xaghra (ta Gajdoru), 20.X.2006, adults; Marsalforn (Ghajn Barrani), 30.VII.2006, adults, 8.IX.2006, adults; Marsalforn (Salvatur Hill), 6.VIII.2006, adults; Marsalforn (Valley), 6.VIII.2006, adults; Munxar, 23.VIII.2006, adults, 9.IX.2006, adults, 24.IX.2006, adults. **COMINO**: Wied l-Ahmar, 27.X.2006, adults, 18.III.2007, adults, 28.IV.2007, adults; Southern Part, 27.X.2006, adults, 28.IV.2007, adults.

Distribution: Endemic to the Maltese islands (Magnano, 1992).

Notes: Magnano (1992) provided a detailed description of this species and stated that it is endemic to the Maltese islands. Mifsud (2000) also listed this species as endemic. The record of *Otiorhynchus cribricollis* by Cameron & Caruana Gatto (1907) should refer to this species. Saliba (1963) states that *O. cribricollis* is found associated with olive locally but this record should also refer to *O. moriger*. This is the first time that olive foliar damage is being attributed to this species in Malta. The damage is visible on the leaves as small, characteristic semi-circular notches bitten out of the periphery of the lamina. Young leaves and shoots are normally attacked. No serious damage was observed on well developed trees except on the suckers and shoots at the base that are normally heavily degraded by this insect.

ARACHNIDA

Oxycenus maxwelli Keifer, 1939
[Acarina: Eriophyidae]

English name: Olive bud mite.

Material examined: **MALTA**: Marsa (Ghammieri), 23.II.2007, 1 female; Msida (University grounds), 20.II.2007, 5 females and 4 juveniles; Xemxija (Simar NR), 22.II.2007, 4 females, 1 male and 6 juveniles.

Distribution: *O. maxwelli* is recorded from California, Algeria, Armenia, Brazil, Australia, Egypt, Greece, Italy, Portugal and Spain (Castagnoli & Papaionnou-Souliotis, 1982).

Notes: *O. maxwelli* is a new record for the Maltese Islands. Its only known host is *Olea europaea*. These mites commonly feed on the upper surfaces of olive leaves but infest the under surfaces when populations are high (Keifer, 1939). New buds, shoots, stems and leaves are preferred. It is difficult to estimate the amount and type of damage caused by this eryophid mite since other species often coexist and have similar feeding habits

(Castagnoli & Oldfield, 1996). However, heavy infestations of *O. maxwelli* can cause the premature fall of olive flowers, spotting and distortion of leaves (Russo, 1972).

***Ditrymacus athiasellus* Keifer, 1960**
[Acarina: Eriophyidae]

Material examined: **MALTA**: Msida (University Grounds), 20.II.2007, 3 males; Xemxija (Simar NR), 2 females, 1 male. **GOZO**: Xewkija, 8.II.2007, 7 males, 9 females; 10.II.2007, 3 males, 5 females; Mgarr, 27.II.2007, 1 male
Distribution: *Ditrymacus athiasellus* is known to occur in Armenia, Egypt, Greece, Italy and Ukraine (Castagnoli & Papaionnou-Souliotis, 1982).
Notes: *D. athiasellus* is a new record for the Maltese islands. This mite is species specific to olive trees. It occurs mostly on the upper part of the leaf, even in winter. In Italy, it reaches highest densities during mid May (Castagnoli & Papaionnou-Souliotis, 1982).

***Tegolophus hassani* Keifer, 1959**
[Acarina: Eriophyoidea]
English name: Olive rust mite.

Material examined: **MALTA**: Msida (University Grounds), 20.II.2007, 3 males, 3 females; Lija, 21.II.2007, 2 males, 9 females, 8 juveniles; Marsa (Ghammieri), 23.II.2007, 1 male; St. Thomas Bay, 10.I.2007, 10 females, 3 juveniles. **GOZO**: Xewkija, 8.II.2007, 3 female, 6 juveniles, 2males; Mgarr, 27.II.2007, 2 females, 1 juvenile.
Distribution: Armenia, Egypt, Greece, Italy and Ukraine (Castagnoli & Papaionnou-Souliotis, 1982).
Notes: *Tegolophus hassani* is a new record for the Maltese islands. In the present survey, this species was the most common and abundant eryophid mite associated with olives. The biology of *T. hassani* is largely unknown. It does not normally occur in high population densities and is usually found on the upper leaf surface and on new shoots. It is known to cause leaf deformation and russeting (Castagnoli, 1982).

FUNGI

***Spilocaea oleaginea* (Castagne) S. Hughes**
[Dothideomycetes: Pleosporales]
English name: Peacock spot.

Material examined: **MALTA**: Xemxija (Simar NR), 19.X.2006; Birzebbuga (Has-Sabtan), 30.IX.2006; Msida (University Grounds), 14.XI.2006, 20.XII.2006, 15.II.2007; Gzira (tal-Qroqq), 14.XI.2006; Ta Qali, 21.XI.2006; Mellieha, 7.XII.2006; Cirkewwa, 7.XII.2006; Marsa (Ghammieri), 14.IX.2006, 20.III.200; Zurrieq, 20.III.2007; Lija, 21.II.2007. **GOZO**: Kercem (Lunzjata), 19.X.2006; Victoria (Villa Rundle), 18.VIII.2006; Xewkija, 22.X.2006, 15.XI.2006, 9.IV.2007; Mgarr, 25.VIII.2006, 17.XI.2006, 4.IV.2007; Sannat, 11.XI.2006; Munxar, 23.VIII.2006, 9.IX.2006, 24.IX.2006, 19.X.2006.
Distribution: Widespread in the Mediterranean Region and in the major olive growing regions of the World.
Notes: This fungal disease was first recorded in Malta by Wheeler (1957) from Buskett. Porta-Puglia & Mifsud (2006) describe its local abundance as widespread and causing severe defoliation on some cultivars. In the present survey, it was frequently observed mainly on large olive trees, especially in dense groves. The disease was normally observed in the lower parts of the canopy that happened to be the most shaded. Young trees occurring in shaded places such as in internal yards were also observed to be severely infected. *Spilocaea oleaginea*, is among the most common fungal diseases of olive. It causes leaf abscission and, eventually, whole tree weakness, resulting in a subsequent loss in crop yield (Gonzalez-Lamothe *et al.*, 2002).

***Verticillium dahliae* Kleb.**
[Sordariomycetes: Phyllachorales]
English name: Verticillium wilt.

Materials examined: **MALTA**: Sliema, 5.I.2007; Marsa; 13.II.2007; Xemxija (Simar NR), 20.II.2007; Birzebbuga, 13.II.2007; Zurrieq, 20.III.2007. **GOZO**: Nadur, 18.XII.06; Victoria (Villa Rundle), 11.II.2007, Xewkija, 10.II.2007. COMINO: Southern part, 18.III.2007.
Distribution: *Verticillium dahliae* occurs in the Mediterranean Region and California. The disease was first recorded in Italy in 1946, and later in California, Greece, Turkey, Spain, Syria, Morocco and Algeria (Levin *et al.*, 2003).
Notes: This disease was first recorded on olive in the Maltese islands in April 2004 at Ghaxaq (Porta-Puglia & Mifsud, 2005). In 2005 a survey on the incidence of *Verticillium dahliae* was conducted by Pace Lupi, and the

fungus was isolated from 37 sites. Samples consisted mainly of olive tissue or soil in olive growing regions. Porta-Puglia & Mifsud (2006) recorded this pathogen as very frequent on olives. In the present survey *V. dahliae* was isolated from tissue samples taken from 10 different localities. Locally, damage to olive trees by this disease was observed to be most significant in young commercial plantations. *Verticilium dahliae* affects numerous plant species including olive, redbud, smoke tree, cherry and other stone fruits, barberry and other commodities. Due to the severity of this disease, the damage caused is significant as it greatly affects yield and sometimes is responsible for the loss of large numbers of olive trees. The uprooting and re-planting of trees in infected areas is not an option as the fungus can still occur in the soil for years (Mercado-Blanco *et al.*, 2003).

BACTERIA

***Pseudomonas syringae* subsp. *savastanoi* (*ex* Smith) Janse**
[Bacteria: Gracilicutes]
English name: Olive knot.

Material examined: **MALTA**: Xemxija (Simar NR), 20.VI.2006, 19.X.2006; Birzebbuga (Has-Sabtan), 30.IX.2006; Buskett, 30.IX.2006; Bidnija, 20.X.2006; Gzira (tal-Qroqq), 14.XI.2006; Ta Qali, 21.XI.2006; Mellieha, 7.XII.2006; Cirkewwa, 7.XII.2006; Marsa (Ghammieri), 14.VII.2006, 20.III.2007. **GOZO**: Kercem (Lunzjata), 14.VI.2006, 8.IX.2006, 19.X.2006; Kercem (Public Garden), 18.VIII.2006, 21.IX.2006; Victoria (Villa Rundle), 18.VIII.2006; Xewkija, 8.IX.2006, 24.IX.2006, 15.XI.2006, 9.IV.2007; Mgarr, 5.VII.2006, 19.VII.2006, 1.VIII.2006, 5.VIII.2006, 4.IV.2007; Marsalforn (Ghajn Barrani), 30.VII.2006, 8.IX.2006; Munxar, 23.VIII.2006, 9.IX.2006, 24.IX.2006, 19.X.2006. **COMINO**: Southern Part, 27.X.2006, 28.IV.2007.
Distribution: Found in all olive growing regions of the Mediterranean basin and in Australia.
Notes: Borg (1922) described this disease as "tubercle" caused by *Bacillus oleae* and said it was common wherever the olive tree is cultivated, however he does not specify its occurrence in Malta. Wheeler (1957) recorded this species only from Girgenti and provided the following comment: "it causes woody galls or knots on the small twigs and distortion and nodulation of the leaves". In the present survey the bacterium was observed to be infecting most olive groves around the islands. This bacterial disease is characterized by hyperplasia formation on the stems and branches of olive plants and occasionally on the leaves and fruits. The disease can cause severe damage in olive groves, mainly when weather conditions favour the survival of epiphytic populations of the pathogen and their entry into the bark. Olive yield and quality can be reduced as a consequence of bacterial infections of the plant by the pathogen (Schroth *et al.*, 1973).

CONCLUSIONS

During the present survey a total of twenty-two pests and diseases have been recorded on olives. These comprise sixteen insects, three eriophyid mites, two fungal pathogens and one bacterium. Most of the species recorded by Borg (1922) and Saliba (1963) were also recorded during this survey. However, Borg (1922) does not indicate clearly that the species mentioned in his work were necessarily records that he observed locally. The leopard moth, *Zeuzera pyrina* L., and the scale insect *Parlatoria oleae* Colvee were recorded by both Borg (1922) and Saliba (1963) as occurring on olives but were not found during this. *Zeuzera pyrina* is not a significant pest of the olive, and has a wide host range. However it is listed by both authors as an olive pest in the Maltese islands. *Parlatoria oleae* appears as typical black blotches on infected drupes (Guario *et al.*, 2001). This scale insect was also recorded by Borg [J.] (1932). Borg (1919) does not mention the occurrence of *P. oleae* but provides a morphological description of *P. follicularis* Targioni, and records it from Sliema and St. Julian's. Borg [J.] (1932) recorded this species from St. Julians, Sliema and San Anton. Among the synonyms he provided for this species he included *Phillipia oleae*. However, *Phillipia oleae* is not a synonym of *Philipia follicularis*, but for *Lichtensia viburni* Signoret which was found during the present survey. Taking the above into consideration, it is not sure whether previous records of *Lichtensia viburni* are consistent. It is possible that earlier records of *Philipia follicularis* could be attributed to *Philipia oleae* since none of the two studies on scale insects of Malta (Borg, 1919; Borg [J.], 1932) mentioned the similarity of the two species or any features for their discrimination.

The moth species, *Menophra japygiaria* is known to feed on olive leaves and its very characteristic pupae are found along branches of olive trees (Sammut, P., *pers. comm.*, 2007). This moth was recorded from the Maltese islands (Rabat, Buskett, Fomm ir-Rih and L-Armier) by Sammut (1983; 1984; 2000). In the present survey this moth was never found on olives in any of the sites surveyed. Considering that the order Lepidoptera has been thoroughly studied, the few documented records of this species and its absence from the present study it can be

assumed that currently this is only an occasional species on olive. However, authorities should be aware of its presence because it is a potential pest of olives in future.

With respect to fungal pathogens, Porta-Puglia & Mifsud (2006) included eight species as occurring on olives. Apart from *Spilocaea oleaginea* and *Verticillium dahliae* which were found during the present study, the following were also recorded: *Caldariomyces fumago* Woron., *Cylindrocarpon* sp., *Fusarium oxysporum* Schltdl., *Macrophomina phaseolina, Nectria haematococca,* and *Thanatephorus cucumeris* (A. B. Frank) Donk.

During this study, *Othiorrhynchus moriger* was for the first time documented as a pest on olives. *O. moriger* is a species of weevil endemic to the Maltese Islands (Magnano, 1992; Mifsud, 2000) and the damage it causes on olive trees is identical to that caused by *O. cribricollis* Gyllenhal. In fact, previous authors such as Cameron & Caruana Gatto (1907), Borg (1922) and Saliba (1963) recorded *O. cribricollis* and never mentioned *O. moriger*. *O. cribricollis* is a serious pest of olives in most olive growing regions of the world and can be controlled by placing a band of synthetic acrylic fibres around the base of the olive trunk. The weevils that attempt to get to the leaves are usually trapped in these fibres. This practice is also used in Malta to control *O. moriger*.

Table 1 lists all species recorded in this survey and summarises some of the relevant information on each species.

Table 1: Species recorded in this survey and summarises some of the relevant information on each species.

Pest species	Specificity to Olives	Previous records of the species locally	Occurrence on olives in Malta
Liothrips oleae	Specific	New Record	Common
Euphyllura olivina	Specific	Borg (1922), Saliba (1963), Mifsud (1997)	Common
Aleurolobus olivinus	Normally Specific	Mifsud & Porta-Puglia (2006)	Frequent
Pollinia pollini	Specific	New Record	Common
Lichtensia viburni	Polyphagous	Borg [J.] (1932), Borg (1919)	Frequent
Saissetia oleae	Polyphagous	Borg (1919; 1922) Borg [J.] (1932), Saliba (1963)	Common
Aspidiotus nerii	Polyphagous	Borg (1919; 1922) Borg [J.] (1932), Saliba (1963)	Common
Hemiberlasia rapax	Polyphagous	Borg (1919)	Rare
Leucaspis riccae	Normally Specific	Borg [J.] (1932), Saliba (1963)	Rare
Prays oleae	Normally Specific	Borg (1922), Borg [P.] (1932), Saliba (1963), DeLucca (1965), Valletta (1973), Sammut (2000)	Scarce
Lobesia botrana	Polyphagous	Borg (1922), DeLucca (1950), Amsel (1951), Saliba (1963), Valletta (1973), Vella (1991), Sammut (2000)	Rare
Palpita unionalis	Polyphagous	Caruana Gatto (1905), Andres (1916), Borg (1922), DeLucca (1950), Darlow (1949), Valletta (1950; 1973), Sammut (2000)	Common
Resseliella oleisuga	Normally Specific	Skuhrava *et al.*, (2002)	Common
Bactrocera oleae	Specific	Borg (1922), Aguis (1926), Briffa (1933), Saliba (1963)	Very Common
Phleotribus scarabaeoides scarabaeoides	Polyphagous	Caruana-Gatto (1907), Borg (1922), Saliba (1963)	Common
Otiorynchus moriger	Polyphagous	Magnano (1992)	Very common
Oxycenus maxwelli	Specific	New Record	Scarce
Ditrymacus athiasellus	Specific	New Record	Frequent
Tegolophus hassani		New Record	Common
Spilocaea oleaginea	Specific	Wheeler (1957), Porta-Puglia & Mifsud (2006)	Common
Verticillium dahliae	Polyphagous	Porta-Puglia & Mifsud (2005; 2006), Pace Lupi (2005)	Very common
Pseudomonas syringae subsp. savastanoi	Specific	Borg (1922), Wheeler (1957)	Common

Many pest species that infect the olive tree in other countries were not recorded during the present study. Of these, some are of economic importance and are found in countries geographically close to Malta. Guario *et al.* (2001) lists thirteen important olive insect pests as occurring in Italy. Of these, two species, *Hylesinus oleiperda* Fabricius [Coleoptera: Scolytidae] and *Coenorrhinus cribripennis* Desbrochers [Coleoptera: Curculionoidea], have not been recorded locally, *Hylesinus oleiperda* superficially resembles *Phleotribus scarabeoides scarabeoides* in the damage caused to the olive tree. It occurs in all olive growing regions of the Mediterranean, England and Russia (Pollini, 1998). *Coenorrhinus cribripennis* causes significant damage to olive fruit whatever the growth stage. This beetle bores through young drupes, eroding the stone when still soft. When the stone hardens, most injury is caused to the pulp, making the fruit unmarketable. One of us (DM) has observed olive fruit at Wied Has-Sabtan which had most likely been attacked by this pest. Thus, it is probable that this species is locally present. Apart from Italy, this insect was also recorded from Russia, Turkey, Greece and Asia Minor (Pollini, 1998).

Two gall midges [Diptera: Cecidomydae], *Prolasioptera berlesiana* Paoli and *Dasineura oleae* (Loew) affect the olive and are distributed all over the Italian peninsula. The first species is associated with the olive fly as it tends to oviposit its eggs at the opening of galleries of the olive fly larva in the fruit. During oviposition the midge transmits a fungal disease that results in the formation of a large dark and shrivelled patch on the olive fruits. *D. oleae* larva mine through leaves and also damage buds. More serious damage is caused by larvae feeding inside flower buds causing galling and their desiccation (Pollini, 1998).

The olive aphid, *Prochiphilus oleae* (Leach ex Risso) [Hemiptera: Aphididae] is mainly associated with *Oleae europea* L. but was also recorded from *Phillyrea media* (Blackman & Eastop, 2000). It is often observed as compact colonies covered in white waxy wool, on shoots near the base of the trunk in spring. It has been recorded in several sub tropical countries but it has not yet been observed in Malta.

Nine species of Eriophyid mites are known to be associated with olives, some of which are specific to this host (Nuzzaci & Parenzan, 1983). Of these nine species, five are known to occur in Italy. *Aceria oleae* (Nalepa) and *Aculus olearius* Castagnoli have been recorded in Italy and other Mediterranean countries but have not been found locally. The other three species recorded in Italy were also found locally.

Olive pest species do not cause equal levels of damage wherever olive trees are cultivated. This may be due to differences in climate, topography, different agricultural practices used and others. It is therefore useful to categorise the pest species according to the damage caused for a particular locality. The main olive pests and diseases are classified into four categories depending on their economic significance by the IOOC (International Olive Oil council). From the results of the present survey, this international categorisation of the main olive insect pests is not entirely applicable to olive pests as found in Malta. Taking into consideration the results from this present work and some of the previous studies, this classification can be amended to fit the local scenario. Table 2 shows the species recorded in this work categorised under the same criteria of the IOOC with respect to the situation in the Maltese islands.

Table 2: Species recorded in this work categorised under the same criteria of the IOOC with respect to the situation in the Maltese islands.

Category 1: Major pests, which cause damage of major economic importance, and require annual management.	*Bactrocera olea, Verticillium dahliae.*
Category 2: Major secondary pests, cause damage of major economic importance locally or occasionally.	*Palpita unionalis, Resseliella oleisuga, Saissettia oleae.*
Category 3: Pests of limited importance which cause damage of limited economic importance locally and/or occasionally.	*Aspidiotus nerii, Liothrips oleae, Phleotribus scarabeoides, Lichtensia viburni, Prays oleae, Othiorrynchus moriger, Euphyllura olivina, Spilocaea oleaginea, Pseudomonas syringae* subsp. *savastanoi.*
Category 4: Pests of no economic importance, which under very rare circumstances cause damage.	*Leucaspis riccae, Lobesia botrana, Menophra japygiaria, Aleurolobus olivinus, Zeuzera pyrina, Pollinia pollinii.*

Eriophyid mites were not included in the above categories since the damage done largely depends on the population densities that differ during different times of the year and due to the fact that different species often infect the same host. As indicated in Table 2. *B. oleae* and *V. dahliae* are the two most serious threats in olive cultivation. *V. dahliae* is surely far more serious because the disease will lead to the death of the tree and currently there is no proper remedy or means of control against this pathogenic fungus. Further more this disease is widely distributed throughout the Maltese archipelago since intensive cultivation with abundant fertilisation and watering encourages the diffusion of this pathogen (Pace-Lupi, 2005).

The present work is probably the most comprehensive study on olive pests ever carried out in the Maltese Islands. However, despite this there is still further need of research studies on other olive pests such as plant parasitic nematodes. Information on the relationship between pest and cultivar would be useful for all those undertaking olive cultivation. Further research on key parasites (natural enemies) would provide a means of effective pest management leading to a reduction in chemical control.

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REFERENCES

Aguis, P. (1926) "*Is Sigar taz-Zebbug*". *Il-Bidui*, Vol 1. no 4.

Alexandrakis, V. & Benassy, C. (1981) Experiment in biological control on olive in Crete using *Aphytis melinus* DeBach (Hym. Aphelinidae), parasite of *Aspidiotus nerii* Bouché (Hom. Diaspididae). *Acta Oecologica, Oecologia Applicata*, 2: 13-25.

Amsel, H.G. (1951) Uber Mediterrane Microlepidopteren und eimige transcaspis che arten. *Inst. Royal des Sc. Nat. de Belgique*. 31(83): 1-64.

Andres, A. (1916) Verzeichnis der wahrend meiner Kriegsgefangenschaftvon mir auf Malta gesammelten Lepidoptera, Hemiptera, und Coleoptera. *Entomologische Rundschau*, 33(9): 43-54, (10): 48-49, (11): 50.

Arambourg, Y. & Elant, H. (1966) Note sur *Dasyneura oleisuga* (Dipt. Cecidomyidae) Cecidomycetes nuisibles al l' Olivier en Syrie. *Ann. Soc. Ent. France, Nouvelle Serie 2:* 719-730.

Argyriou, L.C. & Marakis B. (1973) Some data on olive Midge *Clinodiplosis oleisuga* Targ. (Diptera: Cecidomyidae) in Crete. *Annales de l'Institut Phytopathologique Benaki,* N.S., 10: 364-368.

Argyriou, L.C. & Kourmadas, A.L. (1981) Contribution to the timing for the control of Diaspididae scales of olive trees. *Annales de l'Institut Phytopathologique Benaki*, 13: 65-72.

Balachowsky, A.S. (1972) Entomologie Appliquée a l'Agriculture, Vol. I Lepidopteres. Masson Paris, 1131-1133 pp.

Ben-Dov, Y. & Hodgson, C.J. (Eds.) (1997a) *Soft Scale Insects their Biology, Natural Enemies and Control.* World Crop Pests, Vol. 7B. Elsevier, Amsterdam. 442 pp.

Ben-Dov, Y. & Hodgson, C. J. (1997b) Techniques – Collecting and Mounting. pp. 389-395. In Ben-Dov, Y. & **Hodgson, C.J.** (Eds.) *Soft Scale Insects – Their Biology, Natural Enemies and Control.* Elsevier Science B.V.

Ben-yehuda, S., Izhar, Y., Wyosoki, M. & Argaman, Q. (1993) The grape berry moth, *Lobesia botrana* Denis & Schiffenmueller (Lepidoptera: Tortricidae), in pear orchards in Israel, *Journal of Pest Management*, 39: 149-151.

Bink-Moenen, R.M. (1989) A new species and new records of European whiteflies (Homoptera: Aleyrodidae) from heathers (*Erica* spp.). *Entomologist's Gazette,* 40: 173-181.
Blackman, R. L. & Eastop, V. F. (2000) *Aphid's on the World's Crops - An Identification and Information Guide.* 2nd Edition. John Wiley & Sons, Ltd., x + 466 pp.
Borg, J. (1922) *Cultivation and disease of fruit trees in the Maltese islands.* Malta Government Printing Office, Malta, 622 pp.
Borg, J. (1932) *Scale insects of the Maltese islands.* Government Printing Office, Malta, 20 pp.
Borg, P. (1919) *The Scale-Insects of the Maltese Islands.* Malta Herald Office, Malta, 20 pp.
Borg, P. (1932) *The Lepidoptera of the Maltese Islands.* Government printing press, Malta. v + 25 pp.
Briffa, J. (1933) Iz-zebbug. *Melita Agricola,* 3:5.
Brooks, F. E. (2001) *Plant diseases manual for semiarid and Mediterranean-type climates.* Malta University Press, xxxiii + 223 pp.
Cameron, M. & Caruana Gatto, A. (1907) The Coleoptera of the Maltese Islands. *Transactions of the Entomological Society of London,* 59: 383-403.
Caruana Gatto, A. (1905) *Seconda contribuzione alla Fauna Lepidopterologica dell isola di Malta - Eteroceri.* Tipografia del "Malta" Valletta, 32 pp.
Castagnoli, M. (1982) Gli acari dell'olivo in Italia e loro importanza fitopatologica. *Ann. Ist. Sper. Zool. Agr.,* VII: 85-91.
Castagnoli, M. & Oldfield, G. N. (1996) Other fruit trees and nut trees. pp. 543-559. In: Lindquist, E. E., Sabelis, M. W. & Bruin, J. [eds.], *Eriophyoid Mites - Their Biology, Natural Enemies and Control.* Elsevier Science BV, World Crop Pests. Amsterdam.
Castagnoli, M. & Papaioannou-Souliotis, P. (1982) Fluttuazioni stagionali e biologia degli eriofidi dell'olivo in Toscana. *Redia,* LXV: 329-339.
Cuesta, M. J. & Delgado, A. (1995) Aproximacion a las afecciones (plagas y enfermedades) del olivo cultivado, *Olea europaea sativa,* en el Subbetico. *Boleton Sanitario de Vegetales y Plagas,* 21, 539 - 550.
Darlow, H. M. (1949) Insects taken at sea in 1948. *Entomologist,* 82 : 63-68.
de Lillo, E., Guario, A. & Lasorella, V. (2001) Tecniche di laboratorio – Un semplice metodo di estrazione per il campionamento degli acari eriofidi (Eriophyoidea). *Informatore Fitopatologico,* Anno LI, 10: 57-60.
Delucca, C. (1950) A contribution to the list of Maltese Lepidoptera. *Ent. Mont. Mag.,* 86: 232-233.
Delucca, C. (1965) The place of the Lepidoptera in the zoogeography of the Maltese islands. *Rapport et process – verbaux de reunions de la C.I.E.S.M.M,* 18(2): 511-515.
Fimiani, P. (1985) Biological data on *Euphyllura* [sic] spp. in the Vivara Island (Gulf of Napes). Proc./CEC/FAO IOBC int. Joint Meeting on integrated pest control in olive groves, Pisa 3-6 April, 1984/ A.A Balkema publish., Rotterdam, Boston: 266-269.
Gill, R. J. (1997) The scale insects of California. Part 3. The armored scales (Homoptera: Coccoidea: Coccidae). *Technical Series in Agricultural Biosystematics and Plant Pathology,* No. 3. California Department of Food and Agriculture, Sacramento, California, USA. 307 pp.
Gonzalez-Lamothe, R., Segura, R., Trapero, A., Baldoni, L., Botella, M.A. & Valpuesta, V. (2002) Phylogeny of the fungus *Spilocaea oleagina,* the causal agent of peacock leaf spot in olive. *FEMS Microbiology Letters,* 210:149-155.
Gonzalez, R. & Campos, M. (1994) A preliminary study of the effect of attacks by *Phloeotribus scarabaeoides* (Bern.) (Col, Scolytidae) on the productivity of the olive tree (*Olea europea*). *Bulletin de la Societe Entomologique Suisse,* 67: 67-75.
Grandi, G. (1951). *Introduzione allo studio dell'entomologia.* ED Agricole, Bologna, 1: xxiv + 950. [Psylloids: 814-822].
Guario, A., Laccone, G., La Notte, F., Murolo, O. & Percoco, A. (2001) *Le Principali Avversita Parassitarie dell'Olivo.* Assesorato Agricoltura, Alimentazione, Foreste, Caccia e Pesca, Riforma Fondiaria, Osservatore per le Mallatie delle piante, BARI, 134 pp.
Haniotakis, G. E. (2003) Olive pest control: present status and prospects. In: *Proceedings of the IOBC/WPRS Conference on Integrated Protections of Olive Crops, Chania, Crete.*
Hodgson, C. J. (1994) *The scale insect family Coccidae: an identification manual to genera.* CAB International, London, UK, 639 pp.
Keifer, H. H. (1939) Eriophyid Studies III. *Bulletin of the Californian Department of Agriculture,* 28: 144-162.
Kosztarab, M. & Kozar, F. (1988) *Scale insects of Central Europe.* Akademiai Kaido, Budapest, Hungary. 456 pp.
Levin, A. G., Lavee, S. & Tsror (Lahkim), L. (2003) Epidemiology of *Verticillium dahliae* on olive (cv. Picual) and its effect on yield under saline conditions. *Plant Pathol.,* 52: 212-218.

Magnano, L. (1992) Note sugli *Otiorhynchus* del subgen. *Arammichnus*. 2. Le specie dei gruppi di *O. proximophthalmus, cribricollis, striatosetosus* e *sulcirostris* (Coleoptera, Curculionidae) (XXV Contributo alla conoscenza dei Curculionidi). *Fragm. Entomol.*, 24(1): 99-130.
Maniglia, G. (1985) Contributo alla conoscenza sull' *Aleurolobus olivinus* (Silv.) (Hom. Aleyrodidae). *Atti XIV Congr. Naz. Ital. Ent.*, 411-415.
Martin, J. H., Mifsud, D. & Rapisarda, C. (2000) The whiteflies (Hemiptera: Aleyrodidae) of Europe and the Mediterranean Basin. *Bulletin of Entomological Research*, 90: 407-448.
Marullo, R. (2003) *Conoscere i Tisanotteri. Guida al Riconoscimento delle Specie Dannose alle Colture Agrarie.* Edagricole, Bologna, Italy. 75 pp.
Mazomenos, B. E., Konstantopoulou, M., Stefanou, D., Skareas, S. & Tzeiranakis, L. C. (2002) Female calling behaviour and male response to the synthetic sex pheromone components of *Palpita unionalis* (Lepidoptera: Pyralidae). Use of pheromones and other semiochemicals in integrated production *IOBC, wprs Bulletin*,Vol. 25.
Mercado-Blanco, J., Rodríguez-Jurado, D. & Parrilla-Araujo, S. (2003) Simultaneous Detection of the Defoliating and Nondefoliating *Verticillium dahliae* Pathotypes in Infected Olive Plants by Duplex, Nested Polymerase Chain Reaction. *Plant Dis.*, 87:1487-1494.
Mifsud, D. (1993) The Whiteflies (Homoptera, Aleyrodiae) and their parasitoids in the Maltese islands. Unpublished B.Sc Thesis, Faculty of Science, University of Malta. 114 pp.
Mifsud, D. (1997) The Jumping Plant-Lice (Hemiptera: Psylloidea) of the Maltese Islands. Unpublished M. Sc Thesis, Faculty of Science, University of Malta, 84 pp.
Mifsud, D. (2000) Present knowledge of the Entomofauna of the Maltese Islands. *Entomologica*, 22: 75-86.
Mifsud, D. & Porta-Puglia, A. (2005) First record of *Aleurolobus olivinus* (Silvestri) (Hemiptera: Aleyrodidae) in Malta. *The Central Mediterranean Naturalist*, 4 (2): 139.
Moleas, T. (1988) La *Lobesia botrana* Den. Et Schiff. (Tortricidae: Lepidoptera), un potenziale pericolo per l'actinidia (*Actinidia chinensis* Planchon). *Informatore Fitopatologico*, 12: 71-73.
Mound, L. A. & Kibby, G. (1998) *Thysanoptera - An identification guide.* 2nd Edition. Wallingford, CAB International, 70 pp.
Nuzzaci, G. & Parenzan, P. (1983) Gli Eriofidi (Acarina: Eriophyoidea) dell' Olivo. *Entomologica*, XVIII: 137-149.
Pace-Lupi, T. (2005) Incidence of olive Verticillium wilt and molecular characterization of *Verticillium dahliae* isolates within the Maltese Archipelago. Unpublished M. Sc Thesis (No. 394), CIHEAM, Istituto Agronomico Mediterraneo, Bari, Italy.
Palmer, J. M., Mound, L.A. & du Heaume, G. J. (1992) *2. Thysanoptera. IIE Guides to Insects of Importance to Man.* CAB International. UK. 73 pp.
Pfeffer, A. (1995) Zentral- und westpaläarktische Borken- und Kernkäfer (Coleoptera: Scolytidae, Platypodidae). *Pro Entomologia*, 5-310.
Pollini, A, (1998) *Manuale di entomologia applicata.* 1st Edition. Edagricole - Edizioni agricole della Calderini, Bologna. 1462 pp.
Pollini, A., Ponti, I. & Laffi, F. (2002) Insetti dannosi alle piante da frutto. Schede fitopathologiche, *L'Informatore Agrario-Verona.* 314 pp.
Porta-Puglia, A. & Mifsud, D. (2005) First record of *Verticillium dahliae* on olive in Malta. *Journal of Plant Pathology*, 87: 149.
Porta-Puglia, A. & Mifsud, D. (2006). Fungal and fungal-like plant pathogens of the Maltese islands. *PETRIA, Giornale di patologia delle Piante*, 16: 161-256.
Ramos, P., Jones, O. T. & Howse, P. E. (1982) The present status of the olive fruit fly (*Dacus oleae* (Gmel.)) in Granada, Spain, and techniques for monitoring its populations. In: *Proc. CEC/IBOC Int. Symposium, Fruit Flies of Economic Importance.* Athens, Greece. Rotterdam:A.A. Balkema, pp. 38-40.
Rice, R. E., Phillips, P. A., Stewart-Leslie, J. & Sibbert, G. S. (2003) Olive fruit fly populations measured in Central and Southern California. *Calif. Agric.*, 57:122-127.
Russo, L. F. (1972) *Oxypleurites maxwelli* Keifer (Acarina: Eriophyidae) in Campania. *Bollettino del Laboratorio di Entomologia Agraria 'Filippo Sivestri'*, 30: 165-168.
Saliba, L. (1963) *Insect pests of crop plants in the Maltese islands.* Department of Agriculture, Malta, 35 pp.
Sammut, P. M. (1983) Die Geometriden der Maltesischen Inseln (Lepidoptera-Geometridae). *Neue. Ent. Nachr.*, 63 pp.
Sammut, P. M. (1984) *A systematic and synonymic list of Lepidoptera of the Maltese Islands.* 60 pp.
Sammut, P. M. (2000) *Il-Lepidoptera.* Kullana Kulturali, Pin Publications, Malta. x + 245 pp.

Schroth, M. N., Osgood, J. W. & Miller, T. D. (1973) Quantitative assessment of the effect of the olive knot disease on olive yield and quality. *Phytopathology*, 63:1064-1065.
Silvestri, F. (1934) Compendio di entomologia applicata. Parte speciale. *Tipografia Bellavista*, Portici, vol. 1: viii + 974pp. [Psylloids].
Skuhrava, M., Skuhravy, V. & Ebejer, M. (2002) Gall Midges (Diptera: Cecidomyiidae) of Malta. *Entomologica*, 36: 25-43.
Tremblay, E. (1981) *Entomologia applicata*, vol II, Parte I – Liguori (Ed.), Napoli: 1-312, 257 figs. [Psylloids: 87-96].
Tzanakakis, M. E. (2003) Seasonal development and dormancy of insects and mites feeding on olive: a review. *Netherlands J. Zool.*, 52: 87-224.
Valletta, A. (1950) Moths taken at light, 1948-1949. *Ent. Mon. Mag.*, 86: 306-308.
Valletta, A. (1973) *The moths of the Maltese islands*. Progress Press, 72 pp.
Van Steenwyk, R. A., Ferguson, L. & Zalom, F. G. (2002) Olive fruit fly. University of California Pest Management Guidelines.
Vella, A. (1991) *Mard u Parassiti tad-Dielja*. Dipartiment ta' l-Agrikoltura u Sajd. 94 pp.
Wheeler, B. E. J. (1957) *A plant disease survey of Malta*. Department of Information (Multilith Section), Malta. 24 pp.
Zahradník, J. (1990) Other forests. Pp. 645-65.In: Rosen, D. (ed.) *Armoured scale insects - their biology, natural enemies and control*. 4B. World Crop Pests. Elsevier Science Publishers B.V. xxvi + 688 pp.

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NOTES ON THE LAND AND FRESHWATER MOLLUSCA OF THE ISLAND OF GOZO (MALTESE ISLANDS)

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ABSTRACT

An annotated list of living species of land and freshwater molluscs from the Island of Gozo, in the Maltese archipelago is presented. *Pisidium personatum* is listed as still extant in at least one local stream. *Deroceras panormitanum* (Lessona & Pollonera, 1882) and *Hohenwartiana hohenwarti* (Rossmässler, 1839) are listed as recorded from the island for the first time.

INTRODUCTION

During the years 2001 to 2006, searches were conducted for land and freshwater molluscs at several stations throughout the island of Gozo. This short survey was undertaken to determine the conservation status of the land and freshwater molluscs of the island. An effort was made to concentrate mainly on the species of Limacidae which could possibly be presently living on the island. With a few exceptions, the molluscan fauna is similar to that of the main island, Malta. The need is stressed for proper conservation efforts to be taken in order to preserve the habitat of a few endangered species.

ABBREVIATIONS USED

FF = a common species; not threatened; F = a locally frequent species, but could be threatened; R = a rare species; RR = a rare species and highly threatened; PR = a previously recorded species not met with; NR = a newly recorded species for Gozo Island; CM = Constantine Mifsud.

MATERIAL AND METHODS

Sampling was largely conducted during the spring and winter months in order to record living material when possible; however, sampling during the summer months was also occasionally conducted. The "larger" species were hand picked or noted while searching under stones and amongst various vegetation, while the "smaller" species were found by examining leaf litter, sediment gravel and silt from streams and springs.

RESULTS

Hereunder is an annotated list of species recorded from Gozo, with additions encountered during the recent survey. The systematics follow Giusti, Manganelli & Schembri (1995):

Pomatias sulcatus (Draparnaud, 1801) - FF
The species was found living under stones at various localities.

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Pseudamnicola moussonii (Calcara, 1841) - F
Many living specimens were noted attached to stones and other material in the stream at Wied ix-Xlendi, in moss in the fountain at Fontana, and at Il-Qattara a small spring and pool at Il-Qawra.

Ovatella myosotis (Draparnaud, 1801) - PR
No specimens were found by the present authors. However, one of us (CM) had the opportunity to examine a few live specimens collected on Gozo. These were found from il-Qawra in the supralittoral (at the shingle beach in the 'Inland sea') during both warm (May/June) and cold (January/February) seasons, by M.J. Gauci during studies for her (unpublished) M. Sc. dissertation.

Mercuria* cf. *similis (Draparnaud, 1805) - R
Found living in the spring at Fontana and at Ghajn Hosna. A few specimens were also noted live in the stream at Wied ix-Xlendi and at Il-Qattara, in the limits of il-Qawra.

Carychium schlickumi Strauch, 1977 - PR
No live specimens were found, however, a fresh empty shell of this very small species was recently found in a sediment sample taken from Xlendi Bay in a depth of 15 metres (CM). We cannot recognize any difference between this specimen and specimens of *C. minimum* (O. F. Müller, 1774), from France, except for slight obvious rubbing of the growth lines. Although the species is cited as rare, it is probably being overlooked, because of its minute size.

Physa (Physella) acuta (Draparnaud, 1805) - F
Many live specimens were noticed at Wied ix-Xlendi, while single specimens were seen at Il-Qattara in the limits of il-Qawra.

Lymnea (Galba) truncatula Draparnaud, 1805 - R
Only a few live and dead specimens were found at Il-Qattara and at
l-Ghadira ta' Sarraflu

Planorbis moquini Requien, 1848 - RR
A few fresh, empty shells were found in a gravely sediment at Wied ix-Xlendi

Ancylus fluviatilis Müller, 1774 - FF
Live specimens were seen at Fontana and Il-Qattara, while a few empty shells of this species were found in sediments from Wied ix-Xlendi and at Ghajn Hosna, limits of Xaghra.

Truncatellina callicratis (Scacchi, 1833) - FF
Specimens were found at Munxar, Wied ix-Xlendi and Nadur in leaf litter.

Granopupa granum (Draparnaud, 1801) - FF
A common species, especially in garigue areas where wild thyme (*Thymbra capitata*) predominates.

Ruprestrella philippi (Cantraine, 1840) - FF
This is a frequent to common species inhabiting the top of rocky hills in all the Maltese Islands. It was found live at the top of the Tar-Riefnu hill at Xlendi. Fresh empty shells were found in leaf litter from Munxar.

Lauria cylindracea (Da Costa, 1778) - R
This seems to be a rare species in Gozo. Only two fresh empty shells were found at Wied ix-Xlendi.

Vallonia pulchella (Müller, 1774) - PR
Apparently also a rare species in the Maltese Islands. No specimens were found in this survey.

Pleurodiscus balmei (Potiez & Michaud, 1838) - F
A few fresh empty shells were found at Ghajn Hosna, near Xaghra.

Chondrula (Mastus) pupa (Linnaeus, 1758) - FF
A locally common species. It was found at Munxar, Wied ix-Xaghra, Nadur, Dwejra and Marsalforn.

Vitrea contracta (Westerlund, 1871) - R
A few empty shells were found in leaf litter from under a carob tree at Nadur, in the limits of San Blas Bay and an empty shell from Wied ix-Xlendi.

Vitrea subrimata (Reinhardt, 1871) - PR
No specimens were found in this survey.

Vitrea species (Giusti *et al.* 1995) - PR
No specimens were found in this survey.

Oxychilus draparnaudi (Beck, 1837) - FF
A common species noted under stones at Wied Haneq, limits of Xaghra.

Oxychilus hydatinus (Rossmässler,1838) - R
Two empty shells were found in leaf litter from Nadur.

Milax nigricans (Philippi, 1836) - FF
A locally common slug known to be a pest on crops. It was found under stones on the sides of the stream at Wied ix-Xaghra, Dwejra, San Dimitri, San Blas and Nadur near Ta' Xhajma bore hole. The colour of the animal varies from dark, tar-black to greyish white. A few specimens from Wied ir-Ramla had a very light greyish colour with a yellow carina and a totally black head. Although we have tentatively placed them under this name, following the advice of Karl H. Beckmann who examined images, there still remains a problem. After dissections by ourselves and various other European experts on this family, no genitalia have been found, notwithstanding the fact that a few specimens, at a size of 35 to 40mm, gave the impression of being of an adult size.

Deroceras panormitanum (Lessona & Pollonera, 1882) - FF - NR
Many specimens were found under stones at Wied ix-Xaghra, while other specimens were noted at San Blas, Nadur and Il-Qattara. *D. panormitanum* is known locally to be a widespread pest.

Cecilioides acicula (Müller, 1774) - F
A few specimens were found in leaf litter at Wied ix-Xlendi, Munxar and Nadur.

Cecilioides janii (De Betta & Martinati, 1855) - PR
No specimens were found in this survey.

Hohenwartiana hohenwarti (Rossmässler,1839) - R - NR
A fresh empty shell was found from fine silt at Ghajn Hosna, limits of Xaghra, on the road to Ramla Bay, while another fresh shell was found at Wied il-Haneq.

Ferussacia folliculus (Gmelin, 1791) - FF
A rather common species found under stones and leaf litter in many places.

Rumina decollata (Linnaeus, 1758) - FF
Another common species locally.

Testacella riedeli Giusti *et al.*, 1995 - PR
We have not encountered this species during sampling.

Muticaria macrostoma macrostoma (Cantraine, 1835) - R
A few shells were found in a rocky habitat with wild thyme (*Thymbra capitata*), between Xaghra and Nadur. Another form of this species, ***oscitans*** (Charpentier, 1852) is quite common and inhabits crevices in rocks. However, only few specimens of the form ***mamotica*** (Gulia, 1861) were noted live. This locally endemic form occurs at Munxar on a patch of rock with shallow soil deposits about a hundred square metres in area. The site is just above Wied ix-Xlendi. Most of the area where it lives has been recently built up and building is still threatening the site. The mosses or lichens on which the species is found are scarce. Presently the site is heavily grazed by goats.

Papillifera papillaris (Müller, 1774) - FF
A common species found in every part of the island.

Sphincterochila candidissima (Draparnaud, 1801) - PR
Notwithstanding the very thorough search which was carried out at San Dimitri, where it was previously recorded, no specimens of this species were found.

Xerotricha conspurcata (Draparnaud, 1801) - FF
A very common species at all sites visited. The colour of the animal may be cream, or greyish-black.

Xerotricha apicina (Lamarck, 1822) - FF
The species was found on the sand dunes at Ramla l-Hamra. Many empty shells were scattered everywhere at this site.

Trochoidea spratti spratti (Pfeiffer, 1846) - F
Many empty shells of the typical *spratti* and a few living specimens were noted on a hillside, near the salt pans at Il-Qolla s-Safra, limits of Marsalforn. Other forms (*calcarata, ogygiaca* sensu Beckmann 1987) of this very variable species were also found.

Tochoidea gharlapsi Beckman, 1987 - PR
This species was recently also recorded from Xlendi and Ras in-Newwiela,
Gozo (Giusti *et al.,* 1995), however only a single, fresh dead shell was found from Ta' Cenc, during this survey. The species is known to be 'not threatened' mainly due to its rather inaccessible habitat.

Cochlicella acuta (Müller, 1774) - FF
A very common species everywhere.

Cochlicella conoidea (Draparnaud, 1801) - FF
The species was found living among the leaves of *Pancratium maritimum* on the sand dunes at Ramla l-Hamra. Many empty shells were also scattered everywhere at this site.

Cernuella caruanae (Müller, 1774) - FF
A common species found live at San Dimitri.

Caracollina lenticula (Michaud, 1831) - FF
A common species, found living under stones in many of the localities visited.

Schileykiella parlatoris (Bivona, 1839) - PR
No specimens were found.

Theba pisana (Müller, 1774) - F
This species is probably one of the most abundant mollusc species in Gozo. Specimens are beautifully decorated with fine equally spaced, dark spiral lines.

Eobania vermiculata (Müller, 1774) - FF
A very common species, at all sampled locations.

Marmorana melitensis (Férussac, 1821) - F
A few live specimens were observed in shady places, attached to walls of houses at Qala.

Cantareus apertus (Born, 1778) - FF
An extremely common species, at all locations.

Cantareus aspersum (Müller, 1774) - FF
The species is common and regarded as a pest by farmers. It is however considered as a culinary delicacy on the Maltese Islands. Unfortunately, many of the rubble walls have suffered irreparable damage or complete destruction in the search for these molluscs by the people who collect them for food. Around the island it is also frequently seen packed in net-bags for sale at food outlets.

Pisidium personatum Malm, 1855 - RR
This, our unique, still living, freshwater bivalve, had been rediscovered after more than a hundred years by Sammut & Mifsud (1988 as *P. casertanum* (Poli, 1791) living in a stream at Wied ix-Xlendi. The species is reported herein to be still living at the same locality, albeit only a few specimens were noted alive. Specimens were found in both thick mud and in the sedimentary gravel of the stream. The largest specimens noted measured 3.25mm in length, 3mm in height and 2mm in width.

Giusti *et al.* (1995), after examining a few valves from material originally collected by the present authors, have reassessed that the material examined by them actually belong to *P. personatum* and not to *Pisidium casertanum* (Poli, 1791). However, they also maintained that both species are present at Wied ix-Xlendi. The new material examined belongs solely to *P. personatum.* It is opportune to add here that *P. personatum* retains its young in a special brood pouch up to the veliger stage.

DISCUSSION AND CONCLUSIONS

Most of the previously recorded species (and forms) for the Island of Gozo have been rediscovered in this short survey, and the majority were found alive. Moreover a few other species not previously recorded have been found either as empty shells or living and have been added to the list.

Muticaria macrostoma form *mamotica* (Gulia, 1861) is in our opinion in greatest danger since it is threatened to extinction by development, which is advancing in on its extremely limited habitat, and also by overgrazing. Other species threatened are all the freshwater mollusca living at Wied ix-Xlendi. Frequent illegal dumping of waste building material into this valley could lead to partial or complete blockage of the perennial stream and the extinction of the *Pisidium* and also other fauna. *Pisidium personatum* has been found live only in this particular freshwater habitat in Gozo.

The Limacidae of this island seem to have never been thoroughly studied, probably due to some difficulties in determining the species. *Deroceras panormitanum* and *Milax nigricans* are common and may be pests in some areas. The lack in the stations sampled on Gozo of any specimens of *Limacus flavus* (Linnaeus, 1758) and *Lehmannia melitensis* (Lessona & Pollonera), very common species on the main island of Malta, has still not yet been fully explained.

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REFERENCES

Beckman, K. H. (1987). Land und Süßwassermollusken der Maltesischen Inseln. *Heldia*, 1: 1-38.
Gauci, M. J. (2006). Seasonal Variation in Physical and Biotic Factors on Shingle Beaches in the Maltese Islands. *Unpublished M.Sc. dissertation, Department of Biology, University of Malta,* 230pp.

Giusti F., Manganelli, G. & Schembri, P. J. (1995). *The non-marine molluscs of the Maltese Islands*. Monografie XV, pp. 607. Museo Regionale di Scienze Naturali. Torino.
Sammut, P. M. & Mifsud, C. (1988). Rediscovery of *Pisidium casertanum* (Poli, 1791). *Potamon*, 2(16): 155-157. Malta.

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UPDATES IN THE FLORA OF THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)

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ABSTRACT

During the last 5 years, this author has been involved in the research and exploration of the flora of the Maltese islands in order to create and update the website http://www.maltawildplants.com. This paper consists of several important discoveries of new populations of very rare or endangered floral species for the Maltese Islands which were recorded during field surveys to collect material for this website. It also includes the species *Calendula bicolor* Rafin., which is a new record for the Maltese islands.

***Muscari commutatum* Gussone**

Muscari commutatum was first recorded by Michael Briffa in 1986 from Wied Rini as single population consisting of few individual plants. Since so far, this was the only population found in Malta, and since it resides very close to a planted lemon tree, he correctly reasoned out that this species might have been introduced rather than being native in origin. [Briffa Michael, 1986]

New evidence may however change the current origin status of this species. On the 22nd of March, 2005, a patch of plants was encountered with an inflorescence consisting of dark-indigo, inflated tubular flowers. The plants were identified as *Muscari commutatum* Gussone since the outer toothed rim of the flowers were typically dark-indigo, unlike that of *M. neglectum* Gussone which is white. [Blamey M., Grey-Wilson C., 2004]

This species was found in a pristine garigue on the coastal cliffs of Qrendi (close to a bird trapping site) in 5 different populations of different sizes in an area of 2m x 3m. The largest population had some 80-100 plants, very close to each other, looking as a tuft of about 40cm in diameter. The surroundings (approx. 80m radius from the population) were explored several times, but no other specimens of *M. commutatum* Gussone were encountered. It is unlikely that this population has been planted there.

Fig.1 Population of *Muscari commutatum* found at Qrendi in 2005. (Photo: Stephen Mifsud, Maltawildplants.com)

It is the author's opinion that, in view of the large number of plants forming the population, and their location in an open garigue, in a depth of few cm of soil, the established population has been growing there for a very long time, and hence most probably native in origin.

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Detailed botanical descriptions and an extensive photogallery of this population can be found on www.Maltawildplants.com/HYCN/Muscari_commutatum.php

***Calendula bicolor* Rafin.**

Calendula (Marigolds) has always been a difficult group and a number of subspecies, varieties and forms have been described by early botanists. Taxonomical updates, insertions, and deletions are an ongoing process in the taxonomy of *Calendula*. Currently, the *Calendula* species in Malta are basically grouped into three complexes:

1) *Calendula arvensis* agg. (annual plants with flowerheads less than 2cm)
2) *Calendula suffruticosa* agg. (suffruticose perennial plants with woody stem bases and flower heads greater than 2cm)
3) *Calendula officinalis* agg. (various ornamental and horticultural plants with large showy flower heads)

In the course of this author's investigations on the genus *Calendula* in the Maltese Islands, an interesting observation was made. Some photos of a *Calendula* with orange and relatively large flower heads had been taken. This population was observed and photographed on the 26th of March, 2005 from Dwejra, Gozo. The main morphological features were as follows:

i) A non-shrubby herb without a woody stem.
ii) Flower capitula consisting of vivid orange ray florets (ligules) with an orange-maroon disc.
iii) A rather large flower-head (capitulum) measuring 22mm c. across.

Fig.2: Herbaceous and non bushy *Calendula bicolor* Rafin. from Dwejra

These features excluded any of the three complexes above. The closest previous identification was *Calendula aegyptiaca* Pers., but this species does not form large flower heads and orange ray petals.

The variety of *Calendula arvensis* L. with smallish discolorous flowerheads - thus consisting of yellow ray-petals and a central brown disc (as shown in Fig.3) - has been locally referred to as *Calendula aegyptiaca* Pers. However, the latter is a desert species from our islands, since this plant has narrower leaves described as linear-lanceolate (Pignatti, 2002; Migahid, 1989) in contrast to the oblanceolate ones of *C. arvensis* s.l. found in Malta. Such plants with a discolourous capitulum less than 2cm wide are for the moment placed as *Calendula arvensis* var. *bicolor* (Rafin.) DC. (Edwin Lanfranco, personal communication)

Fig 3: Calendula arvensis var. *bicolor* (Rafin.) DC. previously mistaken for *Calendula aegyptiaca* Pers.

New identification clues came from an Italian online forum where Luigi Rignanese (personal communication) suggested to check the species *Calendula bicolor* Rafin. The species from Dwejra fits well as *C. bicolor* Rafin., both by the keys from Pignatti.(2002) and Fiori (1969). The vegetative part of *C. bicolor* Rafin. looks similar to that of *Calendula arvensis* L. s.l. – in fact, it is a herbaceous plant that forms several green branches and sub-branches, but which does not attain the gross form of a bush. It has sessile, oblanceolate leaves, rather obtuse and minutely ciliated or pubescent.

The capitulum consists of a single row of slender phyllaries (involucral bracts), closely packed next to each other and a single row of ligules (ray florets) that are twice as long as the phyllaries. The ligules have a vivid orange colour with a slightly paler region at the base. The disk florets are relatively large and dark orange in colour. The buds are darker. The diameter of the capitulum observed varied between 20 to 24mm. Achenes are variable in size and shape, and similar to *C. arvensis* L.

When contrasted, the flowers of *C. bicolor* Rafin. appear different and larger from those of *C. arvensis* var. *bicolor* (Rafin.) DC.

Fig.4: Calendula bicolor Rafin. compared to C. arvensis var bicolour (Rafin.) DC

On discussing this with Edwin Lanfranco, he stated that the photos looked identical to the *Calendula bicolor* Rafin. that he saw in Tunis with such large flower diameters. These plants from Dwejra were also confirmed as belonging to *Calendula bicolor* Rafin.

This recorded presence of *Calendula bicolor* Rafin is the first on the Maltese islands and this comes as no surprise, because this species is reported in neighbouring territories like Sicily and Tunisia (Pignatti , 2002]. Only one patch of few specimens was found in Dwejra and this is endangered by surrounding invasive and higher vegetation namely *Galactites tomentosa* Moench and *Bituminaria bituminosa* (L.) Stirton.

***Ornithogalum divergens* Boreau**

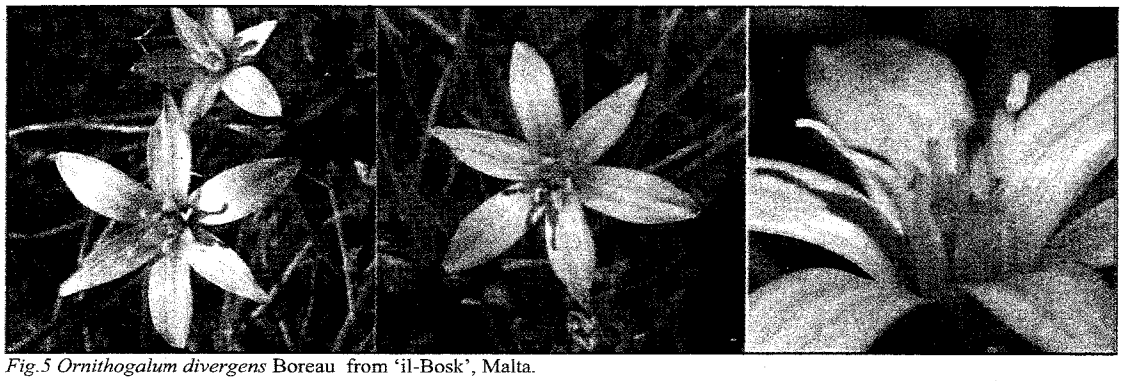

Fig.5 Ornithogalum divergens Boreau from 'il-Bosk', Malta.

Two specimens of *Ornithogalum divergens* Boreau were found on the 2nd April 2006 in a site from which it has never been reported: a garigue known as tal-Bosk, close to Buskett Woodland. This species was believed to be extinct for several decades (Lanfranco, 1989) and was in the recent few years to be

rediscovered at Buskett and Girgenti (Edwin Lanfranco, personal communication). The site where this author found the specimens has a certain importance because it is not easily accessible to the public. On the other hand, the high-growing vegetation of *Asphodelus aestivus* Brotero, and *Bituminaria bituminosa* (L.) Stirton, which are gradually increasing in number and encroaching upon the area taken by the low-growing plants, are serious threatening factors. Monitoring of the area is recommended.

Detailed botanical descriptions and a photo-gallery of this species can be found on www.Maltawildplants.com/HYCN/Ornithogalum_divergens.php

***Iris pseudopumila* Tineo**

The endangered and sub-endemic *Iris pseudopumila* Tineo, is a species listed in the National Red Data Book (Lanfranco, 1989). On the 22nd of April 2007, while exploring Marfa area, the author came across a very large population of *Iris pseudopumila* Tineo. The population covered an area of about 12m x 8m and in some patches it was found as dense populations (ref. Fig 6). This extensive population from Marfa has never been reported, and it is estimated to be the largest population of *Iris pseudopumila* Tineo in Malta in terms of coverage area. It is larger than the population at Selmun or that at Ras il-Pellegrin (decreasing!).

Fig.6: Population of *I. pseudopumila* Tineo discovered at Marfa.

The population of Marfa consists of plants with short leaves like the yellow-coloured variety of Ras il-Pellegrin, but this can be confirmed only in winter (January) when the species is in bloom.

Detailed botanical descriptions and an photo-gallery of this species can be found on www.Maltawildplants.com/IRID/Iris_pseudopumila.php

***Oxalis fontana* Bunge**

Oxalis Fontana Bunge has been very recently discovered by Edwin Lanfranco (Edwin Lanfranco, personal communication) as an introduced alien species. A small group of plants has been surprisingly found growing from a crevice in the pavement of a street in Ta'Xbiex. The plant was still in few blooms in July 2006 when it was first observed. This location is reported for distribution purposes of this new species for the Maltese islands.

Fig. 7: Close up of the small flowers of *Oxalis Fontana* Bunge

The main differences between *Oxalis fontana* Bunge and *Oxalis corniculata* L. - a frequent naturalized alien - are given in the Table 1:

Table 1: Main differences between *Oxalis corniculata* L. and *Oxalis fontana* Bunge

Feature	*Oxalis corniculata*	*Oxalis fontana*
Growth form	Creeping	Ascending to sub-erect
Leaf arrangement	Alternate	Opposite or in whorls of few leaves arising from stem nodes
Rooting at stem nodes	Present	Absent
Leaf Stipules	Small but well visible	Minute, often absent
Fruit stalks (pedicels)	Recurved	Variable, mostly straight
Leaf colour	Leaves often have a purple or maroon coloration, sometimes the entire plant is so.	Green leaves without any trace of violet coloration (except stems).

Detailed botanical descriptions and a photo-gallery of this species can be found on: www.Maltawildplants.com/OXIL/Oxalis_fontana.php

***Muscari neglectum* Gussone**

A few specimens of *Muscari neglectum* Gussone where found on the 19th of March 2005 at Wied Ħanżira, Gozo. This species, which is reported as a rare species with restricted distribution in Malta (Lanfranco, 1989), has never been reported from Gozo (Haslam *et al.*, 1977). This data is hence valuable for distribution purposes.

Not far away from this *Muscari* population, large populations of *Ononis biflora* Desf., another species mentioned in the Red Data Book (Lanfranco, 1989), was encountered and hence its presence reconfirmed on the 6th of April 2007.

Fig.8: Muscari neglectum Guss. From Xewkija, Gozo

Linaria pseudolaxiflora Lojacono

According to a recent Natura 2000 report (Natura 2000), the Pelago-Maltese endemic - *Linaria pseudolaxiflora* Lojacono was mentioned as recorded from the Southern part of Comino, namely, the area near the Tower. This species was seen in late April 2007 in the Northern coast and garigue of Comino, known as the Għemmieri peninsula. The Natura 2000 report does not mention *L. pseudolaxiflora* Lojacono in its account of flora found at the Għemmieri peninsula area and hence it is a new location for this endemic species.

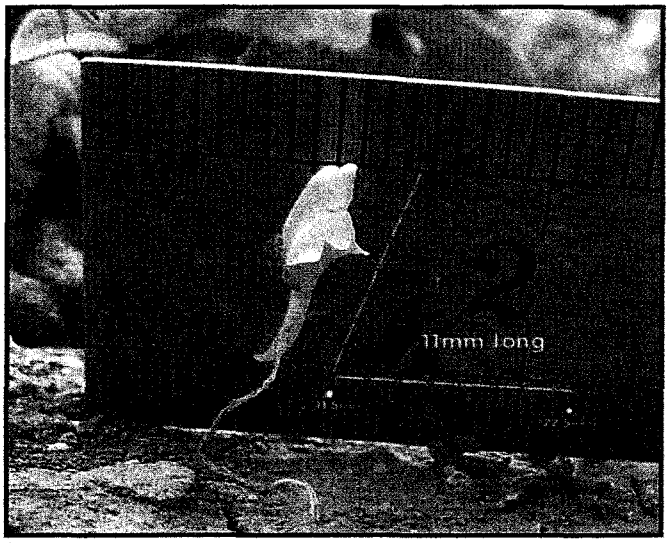

Fig.9: The small corolla of populations of *Linaria pseudolaxiflora* Lojacono from Ghemmieri peninsula, Comino

Some 20 specimens were observed scattered around the sampling area. Dense populations were not observed. Additionally, these specimens had a very small form with flowers measuring only 10-13mm in length. It is the first time that such a small corolla size has been recorded. For example, Haslam *et al.* (1977) give a corolla length of 15-18mm in its description of the species. This may raise doubts about a possible new variety for this particular species on north Comino or otherwise extend further the variable characteristics of this endemic plant so as it should be described that the length of the corolla can be between 10-18mm.

***Abutilon theophrasti* Medicus**

While exploring the arable area of Qormi, the author found a population of 33 specimens of *Abutilon theophrasti* Medicus, scattered along an area of about 30m x 40m in a fallow field. The plants were large, and enjoying the rich soil that they were growing in. The major habitat of this species is arable land, and this finding is important because plants in Malta are decreasing due to agricultural practices (e.g. destruction of 'weeds' by farmers using broad-spectrum herbicides).

This 80-100cm high, annual plant is easily identified from the particular shape of its fruit as seen in Fig.10. It has large sub-cordate to orbicular leaves up to 14cm across with long petioles and bright yellow flowers, which is uncommon for members of the Malvaceae family, often having purple flowers.

Fig.10: Photo of *Abutilon theophrasti* Medicus from fallow fields in Qormi,

***Trifolium pratense* L.**

The only records of *Trifolium pratense* L. (Red clover) in Malta, date back to 19th century by Gavino Gulia and Grech Delicata and never reported again. [Edwin Lanfranco and Michael Briffa, personal communications]. Red clover is a very common plant in the central and northern part of Europe, and it is also the national plant of Denmark.

Trifolium pratense L. is again being recorded from the islands since, on the 30th of June 2007, a small population of *Trifolium pratense* L. was observed in fallow fields at Qormi. The plant is easily distinguished in Malta by being the largest species of *Trifolium*, both in its general size and in the inflorescence. The plant can grow up to 60cm high with its purple flower-heads reaching 2-3cm across. Other remarkable identification features include the pair of conspicuous stipules that are moderately hyaline with anastomosing green veins and pointed tip and also the V-shaped pale patch on the leaves. The fruit is a tiny circumscissile capsule containing only one seed.

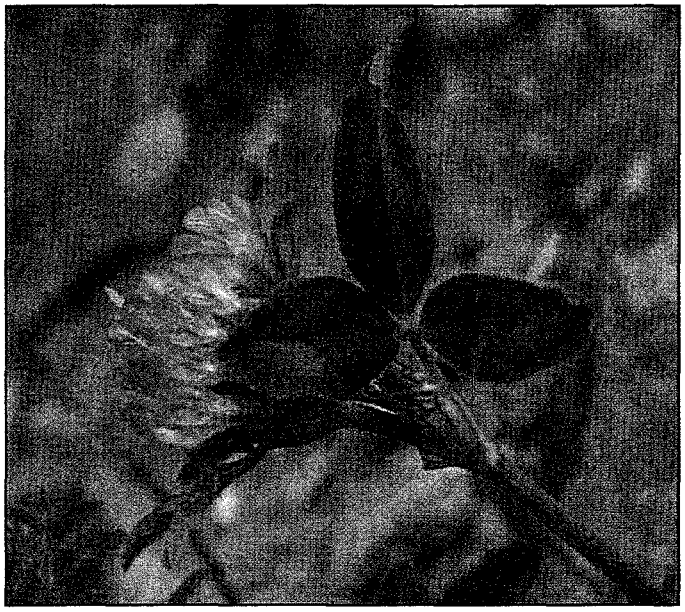

Fig.11: Leaves, stipules and flower-head of *Trifolium pratense* L.

Twenty-one plants have been counted in a single fallow field, in a small area of about 10m x 12m. Neighbouring fields (which were not fallow) did not reveal any plants of the red clover. No more plants were found in surrounding lanes or field paths.

Although it is difficult to establish the origin and age of this population, most probably, these plants might have been very recently reintroduced with agricultural products such as contaminated soil, bird-seed products, or animal feed. It would be an interesting study to determine if the small seeds of *Trifolium*

pratense L. can be found with imported barley and wheat, and furthermore if they can survive the feed-formulating process and hence found viable for germination in cattle feed pellets.

A sample of the plant was deposited at the Argotti Gardens herbarium in July 2007. Identification confirmed by Edwin Lanfranco.

Detailed botanical descriptions and a photo-gallery of this species can be found on www.Maltawildplants.com/FABC/Trifolium_pratense.php

Fig.12: Inflorescence of *Trifolium pratense* L. found in Qormi

***Vicia bithynica* (L.) L.**

The presumably native *Vicia bithynica* (L.) L. is an endangered species for the Maltese islands, and only found in one location in Malta, that is Għajn il-Kbira, Girgenti (Edwin Lanfranco, 1989). On the 3rd of April 2007, a large population of. *Vicia bithynica* (L.) L. was found at Wied Gerżuma, Baħrija. The population growing on a partially shaded and sheltered area comprised of some 60 specimen in a stretch of 30-40m. No previous record ever mentioned this locality. The importance of this record lies both in the fact that it is a large and established population, and also the specimen was found healthy without much competitive vegetation and public disturbance, due to the restricted access to the site to the general public.

The most important identification features of this very rare species are: a leaf with 1 – 3 pairs of narrow-elliptic leaflets having an entire margin and a simple apical tendril, a characteristic conspicuously-dentate stipule, only one, two or rarely three flowers per inflorescence and a corolla with indigo-blue standard and white to lilac keel and wings.

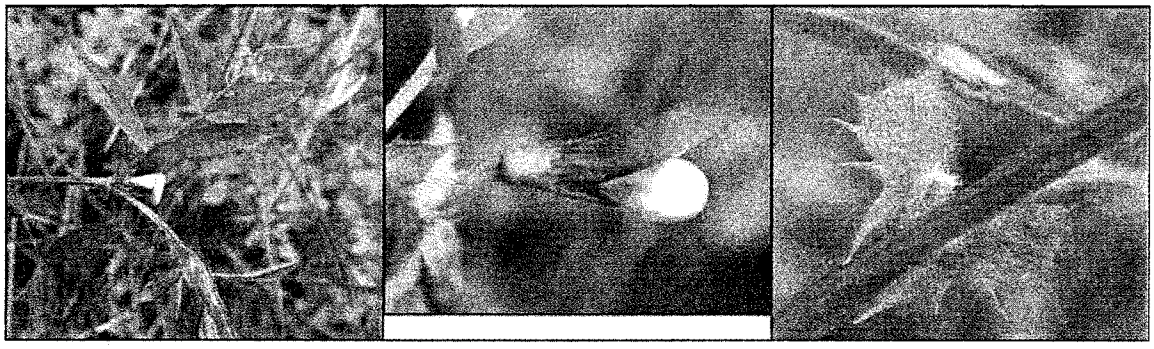

Fig.13: Photos of *Vicia bithynica* (L.) L. from a large population in Wied Gerzuma, Malta.

Cardaria draba (L.) Desvaux

Cardaria draba (L.) Desvaux is considered as a rare to very rare plant, found growing mainly on arable land. It is constantly decreasing from our islands, mainly due to weed control for agricultural practices. This evidence was proved last April 2007, when *C. draba* was searched for in a location where it was present in considerable numbers, some 18 years ago (precisely on 8th May 1989) in fields at Wied il-Ħemsija, Mtarfa. (Michael Briffa, personal communication) Unfortunately no specimens were found in April 2007.

Six specimens were found in March 2007 in a fallow field at Mġarr, Gozo, a location where it was never recorded from. On revisiting the site about 2 weeks later the field was found devoid of plants because it was totally ploughed off. Hopefully, enough seeds would have been shed for next season.

Fig.14: Cardaria draba (L.) Desvaux from Mgarr, Gozo.

Asparagus stipularis Forssk.

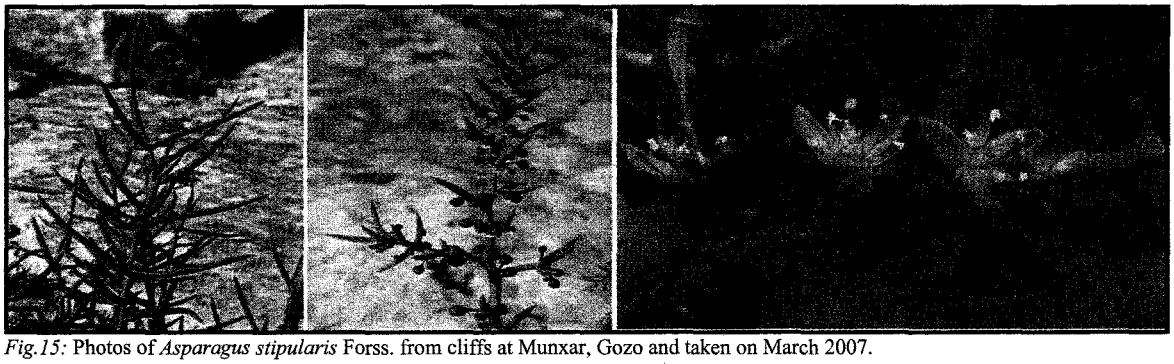

Fig.15: Photos of *Asparagus stipularis* Forss. from cliffs at Munxar, Gozo and taken on March 2007.

A large population of *Asparagus stipularis* Forssk. was found in a rocky habitat at the Sanap Cliffs, Gozo. A specimen of this population was identified and confirmed by Edwin Lanfranco. About 200 specimens of varying sizes were found occupying an area of 125m x 25m along the cliff edges, accompanied mainly by *Darniella melitensis* (Botchantzev) Brullo. The first 2 specimens of this population were found on the 5th of March 2007. So far, this particular population was not previously officially recorded, though I was aware that another population has been previously found a few kilometers away. (Edwin Lanfranco, personal communication)

The main differences between the common *Asparagus aphyllus* L. and *Asparagus stipularis* Forssk. are given in Table 2:

Table 2: Main differences between *Asparagus aphyllus* L. and *Asparagus stipularis* Forssk.

Characteristic	*A. aphyllus* L.	*A. stipularis* Forss.
Flowering season	Spring (Mar-May)	Autumn (Sep-Nov)
Apical cladodes	Borne in clusters	Solitary
Cladodes length	Not more than 2cm	Larger cladodes are between 3-4cm
Colour at the underside of the tepals	Yellow	Reddish brown
Colour of the berries	Black	Bluish black

This species was believed to have become extinct because the last record was dated in 1927 by Borg (1927), and subsequently never recorded again. Some even speculated that Borg may have mistaken it for

the variable *A. aphyllus* L. Recently, a concrete path was laid very close to this population, and it is possible that some specimens of *A. stipularis* may have been destroyed with this unnatural development.

Detailed botanical descriptions and a photo-gallery of this species can be found on www.maltawildplants.com/ASPR/Asparagus_stipularis.php

ACKNOWLEDGEMENTS

Special thanks goes primarily to Edwin Lanfranco for identifying or confirming the identification of many of the species in this article. Mr. Lanfranco was also responsible for revising the article so as it has a scientific style suited for the Central Mediterranean Naturalist. Credit must also be given to Michael Briffa for his devotion with several questions related to this article. Finally, deserved gratitude should also go to my wife for her unstinting support and patience.

REFERENCES:

Blamey M., Grey-Wilson C. (2004) *Wild Flowers of the Mediterranean*, A & C Black Publishers Ltd.
Borg J. (1927) *Descriptive Flora of the Maltese Islands*, Government Printing Office. 846pp. Malta.
Briffa, M. (1986) Two interesting additions to the flora of the Maltese islands, *Central Mediterranean Naturalist* 1 (4): 85 - 86.
Fiori A. (1969) *Nuova Flora Analitica D'Italia* (Vol.2); Edizioni Agricole.
Lanfranco, E. (1989) The Flora, in: P.J. Schembri and J. Sultana, *Red Data Book for the Maltese Islands*: pp. 5 – 70, Ministry of Education, Malta.
Pignatti S. (2002) *Flora d'Italia,* 3 volumes Edagricole, Bologna.
Migahid A.M. (1989) *Flora of Saudi Arabia* (Vol.3); Riyadh Univ.
Natura 2000 (2000) *Natura 2000 standard data form for Comino*, Site MT000017, Malta Environment and Planning Authority.
Haslam, S.M., Sell, P.D., P.A.W. Wolseley (1977) *A Flora of the Maltese Islands*, Malta University Press. Lxxi + 560 pp. Msida, Malta.

All photographs in this in this were taken by the author himself.
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A LIST OF RECORDS OF SOME RARE VASCULAR PLANT SPECIES OCCURING IN THE MALTESE ISLANDS. (CENTRAL MEDITERRANEAN)

Timothy J. Tabone[1]

ABSTRACT

A checklist of sixty-two rare vascular plants occurring in the Maltese Islands is hereby given, along with brief notes concerning the record date and location, population size and distribution on the islands.

KEY

In compiling the following species list, the author has followed the family sequence adopted by Lanfranco 2001.

For each species, the localities where populations of the species were discovered by the author are given. The wider district where a specific locality is situated is given when: a) the locality name is a micronym known only by a handful of farmers who happen to live or own land in the same locality eg. il-Mellieħa area (district): ta' Pennellu (micronym); b) when a single toponym serves different specific localities that are well separated geographically eg. Ħal Qormi area (district): Wied il-Kbir (a toponym of at least 3 different valleys in Malta and Gozo).

* = Species no longer found in the mentioned locality;

(Number) = Number of individuals found in a locality on date of discovery.
(Only given when the discovered population consists of < 5 individuals).

The list covers a period of field research from Spring 1991 to Summer 2007. The date on which each species was first discovered in each locality is given in brackets. In cases where the exact date of discovery was not recorded, an approximate date is given:

(early 1990's) = found between 1991 and 1995;
(late 1990's) = found between 1996 and 1999;
(c.xxxx) = found in the specified year or up to 2 years before or after the specified year.

In some cases, especially during the dry season, no vegetative, flowering or fruiting stages of the floral species encountered were evident – identification of these species was still possible.

This article is the first of a two-article series, the sequel of which will be published by the author in the next issue of The Central Mediterranean Naturalist.

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Species List

PART 1.

Family : *Aristolochiaceae*

1.*Aristolochia clusii* Lojacono MALTA - Wied id-Dis, Wied il-Faħam valley system (5-4-2000) - Wied il-Għasel, near and opposite the quarry, close to the valleybed (2002) - Wied Ħarq Ħamiem (1995) - Wied Ħoxt, Wied iż-Żurrieq valley system (13-3-1993).

Family : *Ranunculaceae*

2. *Delphinium staphisagria* L. GOZO - Mġarr valley* (7 - 1992), in a fallow terrace, destroyed a few months later to make space for tomato cultivation.
May be extinct.

Family : *Ulmaceae*

3. *Ulmus canescens* Melville MALTA - Ġnien il-Kbir (1991) - l-Għajn il-Kbira, Girgenti valley system (1992) - Wied ir-Rum (1994).

Family : *Urticaceae*

4. *Parietaria lusitanica* L. MALTA - il-Mellieħa area: l-Imġiebaħ, Ras il-Griebeġ (11- 2006) - Rdum Majjiesa (5-2000) - Wied Dalam (3-10-2003) - Wied Fulija, near Għajn il-Kbira (2005) - Wied il-Għasel (late 1990's). GOZO - below Chambray fort, west side (4-3-2004) - Fontana area: ix-Xagħri, is-Sqaq tax-Xagħri (3-4-2004) - ta' Għammar hill (9-11-2006) - Mġarr ix-Xini (2005) - in-Nuffara hill (5-4-2006) - below il-Qortin ta' Għajn Damma: Għajn Barrani to Rdum ta' Kilillu (21-3-2004) - Wied Biljun (20-4-2005) - ix-Xagħra: Triq il-Kortoll (13-3-2003); a country-lane branching from Triq Marsalforn (21-3-2004).
This species is more frequent than is suggested by past literature (eg. Haslam & al. 1977; Lanfranco 1989). Its apparent rarity is probably due to the fact that most of the larger populations occur among boulder screes below the coralline plateaus that are not easily accessible. Grows on well shaded very humid rocks and rubble walls.

Family : *Chenopodiaceae*

5. *Atriplex halimus* L. GOZO - On coastal clay slopes below Qortin Ta' Għajn Damma : Rdum ta' Kilillu to Rdum tas-Surgu to Għajn Barrani & Pergla (5-1994).

Family : *Polygonaceae*

6. *Polygonum bellardi* Allioni MALTA - Wied is-Sewda (13-8-2007), where it is a dominant component of the valleybed vegetation.

7. *Polygonum maritimum* L. MALTA - Baħar iċ-Ċagħaq* (1993), destroyed by cultivation of palms - Ramla tat-Torri (1992). GOZO - ir-Ramla l-Ħamra (1993) - ix-Xatt l-Aħmar (10-1992), population now severely reduced by beach cleaning.

Family : *Plumaginaceae*

8. *Plumbago europaea* L. MALTA - around Addolorata cemetery (early 1990's) - Ħal Far area: tal-Baqqari (7-10-2002) - Ħal Luqa: in a field at the turning point from Triq San Tumas to Vjal l-Avjazzjoni (2-2003); Wied Ħal Saflieni (9-2003) - Ħal Qormi area: Wied il-Kbir (early 1990's) -

Ħal Safi: Triq Ħlantun (3-3-2005) - Sta. Lucija: Wied ta' Garnaw (2005) - is-Siġġiewi: ta' Kallozzu (28-5-1998); Wied il-Ħesri (19-6-2006) - Wied il-Qoton (3-3-2005) - Wied Qirda (c.2005).
Frequent in S.E.Malta, growing alongside country-lanes between cultivated fields and roadsides. Virtually absent in other parts of the country.

Family : *Brassicaceae*

9. *Cardaria draba* (L.) Desvaux GOZO - along pathways on the terraced slopes below Chambray fort, facing South (10-1992) - ir-Rabat area: in roadside centrestrips along Triq il-Wied & Triq Wied il-Lunzjata, next to the upright Roman stone (2-2004)* - ir-Ramla l-Ħamra carpark (1992)* - Wied tal-Għajjun valleybed watercourse (between ix-Xagħra and Nuffara hill) (5-4-2006).

10. *Coronopus squamatus* (Forsskal) Ascherson MALTA - Ħal Qormi: Wied il-Kbir* (late 1990's) - il-Mellieħa area: Wied tal-Kalkara (22-4-2005) - San Pawl il-Baħar: around the perimeter of Is-Simar bird sanctuary (c. 2004) - Wied ta' l-Imselliet (2002). GOZO - Wied Marsalforn (16-10-2002).
Grows on bare soil, usually in valleybeds, especially in troughs behind dams that are briefly flooded in winter and parts that are heavily trampled.

11. *Matthiola incana* ssp. *melitensis* Brullo, Lanfranco, Pavone & Ronsisvalle MALTA - il-Mellieħa area: Ġnien Ingraw (2000) - Rdum Rxawn (1990's).
Records for Gozo, where it is frequent, are not given.

12. *Neslia apiculata* Fischer, Mayer & Ave-Lallemont GOZO - il-Qala area: il-Gwiedi (19-4-2005) (2).
Grows in cultivated fields among forbs.

13. *Rapistrum rugosum* (L.) Allioni MALTA - Pieta pinetum (c. 2003).

Family : Resedaceae

14. *Reseda lutea* L. MALTA - between Baħar iċ-Cagħaq and Pembroke (1991) - frequent at Għajn Tuffieħa - Mġarr region: il-Ħamra (plateau facing the Roman Baths) (1990's) (1); il-Mejjieli / il-Ħażin (between ta' l-Abatija and Wied il-Ħmar) (18-5-2005); in fields alongside Triq Għajn Tuffieħa and the road leading to Golden Bay, vicinity of Ħal Ferħ (26-2-1997); il-Wita tat-Torri, vicinity of the tower (1990's); ix-Xagħra tat-Torri (facing Ras il-Pellegrin) (3-2007) - il-Mellieħa area: between it-Torri l-Aħmar and Triq Għajn Tuta (13-6-2003) - on the plain facing Wied id-Dis (c. 2000). GOZO - it-Telgħa taż-Żewwieqa* (between Għajnsielem and il-Qala) (23-3-1997) (1) - ix-Xagħra area: vicinity of il-Qortin ta' Għajn Damma refuse dump (early 1990's); between Triq Marsalforn and Wied ta' Kanol (21-9-2007).
Grows in cultivated and fallow fields, rarely along roadsides and country lanes.

Family : *Salicaceae*

15. *Populus alba* L. MALTA - il-Baħrija area: Wied il-Luq (1992) - along watercourse between il-Ballut tal-Wardija and San Pawl il-Baħar (P?) (early 1990's) - Ġnien il-Kbir (P?) (8-1992) (1) - l-Għajn il-Kbira, Wied Fulija, il-Girgenti valley system (1991) - Wied tal-Buskett, Wied il-Luq valley system (1991) - Wied Ħażrun (1992) (1) - Wied tas-Santi (27-8-1996).

16. *Salix pedicellata* Desfontaines MALTA - Wied l-Isqof (1992) - Mtaħleb area: Wied ta' Markozz (1992); il-Wied ta' Ġordajna (2).

Family : *Malvaceae*

17. *Malope malacoides* L. MALTA - Mġarr area: il-Wied ta' Għoxx ta' Ħida (between il-Ballut and tal-Palma) (3-2000) (2).

Presumed extinct (Lanfranco 1989) before the rediscovery recorded above. Though past literature records it as growing on humid clay soil (eg. Haslam & al. 1977), the discovered specimens were growing on limestone rocky slopes.

Family : *Euphorbiaceae*

18. *Euphorbia aleppica* L. MALTA - Binġemma, vicinity of Punic tomb necropolis (1990's) (1) - Bubaqra area: il-Bur ta' l-Imtoli (24-6-2003) - il-Wardija area: id-Demus (25-4-2007) - Wied il-Ħesri (20-8-2004) - Wied il-Qoton (21-8-2007) - ix-Xagħra tat-Tombu, near Imselliet school (26-10-2006) (1) - iż-Żurrieq area: Ħal Lew (18-6-2003); ta' Cassia (24-6-2003).

19. *Euphorbia characias* L. MALTA - il-Girgenti, below Inquisitor's Palace (1992); Laroka plateau, overlooking il-Buskett (1992) - Mtarfa area: Sant Alessio (6-5-1996) - below Victoria Lines Fortifications, near Wied id-Dis (5-4-2000) (1) - below Victoria Lines fortications, facing Żebbiegħ (c.2000) - Wied Fulija, vicinity of il-Girgenti (2005) - Wied Liemu (c. 2001) (1). GOZO - Ta' Ċenċ area: escarpments below ix-Xagħra l-Kbira and il-Ħamra, overlooking tal-Gruwa (18-10-2005) - Wied tax-Xlendi (1993).

20. *Euphorbia peplis* L. MALTA - il-Marfa peninsula: Ramla tat-Torri (8-1992). GOZO - Marsalforn* (1994), a large population that was wiped out by bulldozing soon after the recorded date - ix-Xatt l-Aħmar* (10-1992) (1).

Family : *Crassulaceae*

21. *Crassula tillaea* Lester-Garland MALTA – Pieta area: Sa Maison bastions (1996) - San Pawl tat-Tarġa area: in-Nigret (31-3-2006) - parts of Wied il-Għasel (late 1990's), including tal-Markiż (c. 2000) - Wied Moqbol (13-3-2004).

22. *Sedum album* L. MALTA - Dingli, il-Wardija ta' San Ġorġ, Ġebel Ciantar cliff-tops (early 1990's) – Paceville area: on a hump of rock at carpark alongside Triq id-Dragonara (1990's) - Wied Moqbol (20-3-2004) - Rdum il-Qaws (early 1990's).

23. *Sedum caespitosum* (Cavanilles) DC. MALTA - il-Baħrija cart ruts (late 1990's) - il-Bidni area, vicinity of Marsacala: ix-Xagħra ta' Rafiela (3-4-2007) - Dingli cliffs (late 1990's) - Ġebel Majn, overlooking Chadwick Lakes (c.2000) - l-Għallis area: Xagħret Frankin (2002) - Laroka plateau, overlooking il-Buskett (c.2000) - il-Marfa peninsula: id-Dahar (4-2007) - Misraħ Għonoq (late 1990's) - il-Miżieb (25-3-2003) - in-Naxxar (c. 2000) - ir-Rabat area: ix-Xagħra ta' Għajn Qajjed (c.2000) - Rdum Majjiesa (5-2000) - vicinity of is-Salib tal-Għolja (18-3-2003) - San Ġwann cart ruts (2007) - San Ġwann tal-Għargħar (2006) - San Pawl tat-Tarġa area: in-Nigret (31-3-2006) - San Tumas bay area: ta' Majru (2002) - Sta. Luċija area: parts of Wied ta' Garnaw, including taċ-Cagħki (2004) - Selmun area (c.2000) - is-Swatar area (2005) - on Victoria Lines bastions alongside ix-Xagħra ta' Qaduma (c. 2000) - il-Wardija area: the karstland behind Palazzo Gauci (25-4-2007) - Wied Babu (late 1990's) - high ground overlooking Wied Babu (vicinity of il-Ħofra tal-Bħir) (24-6-2003) - Wied Dalam (3-10-2003) - throughout Wied il-Għasel, including tal-Markiż (late 1990's) - Wied il-Ħesri (3-4-2003) - Wied Ħoxt (3-2006) - Wied tal-Kalkara (10-3-2004). GOZO - vicinity of Ħondoq ir-Rummien (7-2003) - Xewkija: ta' Blankas olive grove (late 1990's); vicinity of ta' Lambert airstrip, including ix-Xagħra tal-Kus (late 1990's).

This species is far more frequent than is suggested by past literature (eg. Lanfranco 1989). Its apparent rarity is probably due to oversight. However its populations are rather localised, maybe due to competition with the abundant *Sedum caeruleum* L. Occurs on the coralline plateaus and rocky outcrops of cultivated fields.

24. *Sedum stellatum* L. MALTA - Wied il-Għasel, opposite the quarry (6-4-2003) - Wied Ħesri (3-4-2003).

Family : *Fabaceae*

25. *Anagyris foetida* L. MALTA - Mġarr area: vicinity of tal-Palma, in a scree below ix-Xagħra ta' San Martin (1998) - Mtarfa area: Sant Alessio (6-5-1996) - Wied il-Luq (early 1990's) - San Ġużepp tat-Tarġa* (near downhill road from il-Mosta to Għajn Riħana) (early 1990's) (1) - San Pawl tat-Tarġa area: in-Nigret (1993) - Wied Anġlu, l-Għar ta' San Brinkat (1993) - Wied id-Dis (5-4-2000) (1).

26. *Lathyrus aphaca* L. MALTA - road alongside Għajn Tuffieħa Roman Baths (late 1990's) - il-Mellieħa area: Wied tal-Kalkara (2004). GOZO - Wied il-Għasri (early 1990's).
Past literature records this species as frequent (eg. Sommier & Caruana Gatto 1915; Borg 1927; Haslam & al. 1977). Seems to have become rare. Does not grow in habitats subject to regular anthropogenic disturbance such as arable land. Occurs among high garrigue and valleybed vegetation.

27. *Lathyrus cicera* L. MALTA - Dingli cliffs (1992) - il-Manikata area: ta' Ċiantar (31-1-2007) (2) - Mġarr area: ix-Xagħra tat-Torri (facing Ras il-Pellegrin) (3-2007), the only sizeable population known to the author - Wied il-Qoton (3-3-2005) (2).
Past literature records this species as frequent (eg. Sommier & Caruana Gatto 1915; Borg 1927; Haslam & al. 1977) and was as common as *Lathyrus clymenum* L. during the 1960's (E.Lanfranco, pers. com.). Seems to have declined dramatically.

28. *Medicago monspeliaca* (L.) Trautvetter MALTA - il-Baħrija area: il-Qortin ta'l-Imdawwar plateau, overlooking tat-Tulliera (5-4-2003) - Dingli cliffs (29-4-2003) - Laroka plateau, overlooking il-Buskett (4-8-2007) - il-Manikata area: ix-Xagħra l-Ħamra (13-7-2007); ix-Xagħra ta' Rassa (13-7-2007) - il-Mellieħa area: ta' Pennellu (4 - 2007) - Mġarr area: near the downhill road between Mġarr centre and il-Bokka taċ-Ċerċura (c.1998) - il-Mistra area: ix-Xagħra tal-Qortin (12-3-2003) - vicinity of is-Salib tal-Għolja (18-3-2003) - San Pawl tat-Tarġa area: in-Nigret (31-3-2006) - il-Wardija area: on the karstland behind Palazzo Gauci (25-4-2007) - it-Triq ta' l-Imdawwra, overlooking Wied il-Bassasa (3-2000) - Wied id-Dis, Wied il-Faħam, on footpath along Victoria Lines (5-4-2000) - Wied il-Għasel (1993) - Wied Għollieqa* (1991) - Wied Ħoxt (3-2006). GOZO - Għajn Abdul, il-Mixta (5-4-2004) - il-Qortin ta' Għajn Damma (21-3-2004) - in-Nuffara hill (5-4-2006) - Wied Biljun (23-3-2004).

This species is thinly scattered across the country, occurring on rocky areas that have been subject to much trampling, such as old footpaths, rocky outcrops of fields and coralline plateaus, among degraded garrigue and steppic vegetation. It is however unusually abundant on a stretch of karstland at Nigret, South Malta: ix-Xagħra ta' Sur Anġla (8-4-2003), where it forms dense mats, then occurring intermittently further downhill to il-Munqar.

29. *Ononis biflora* Desfontaines MALTA - Ħal Far: ta' Rikka (15-3-2005). GOZO - in-Nuffara hill (5-4-2006), the largest known population, occurring in cultivated wheat fields - ir-Rabat area: ta' Marżiena (26-2-2004), among prehistoric remains.

30. *Ononis ornithopodioides* L. MALTA - Għajn Tuffieħa area: il-Qarraba (7-2006) - il-Mellieħa area: on boulders between Għajn Żnuber tower and Rdum id-Delli (16-5-2006). GOZO - il-Qala area: tal-Bombli, a scree below iż-Żewwieqa (20-4-2005); Ħondoq ir-Rummien (4-7-2003).

31. *Trifolium lappaceum* L. MALTA - beside a watercourse at Rdum Majjiesa clays (5-2000).

32. *Trifolium angustifolium* L. MALTA - high ground overlooking Wied Babu (vicinity of il-Ħofra tal-Bħir) (24-6-2003) - Għajn Tuffieħa clays (7-2002).

33. *Vicia villosa* Rothmaler MALTA - Dingli cliffs area: among a boulder scree facing the North East side of il-Wardija ta' San Ġorġ (29-4-2003).

34. *Vicia tenuissima* (Bieberstein) Schinz et Thellung GOZO - Wied ir-Riħan: ta' Xalati (24-4-2003).

Family : *Linaceae*

35. *Linum bienne* Miller MALTA - il-Bidnija area: tal-Għazzi (12-3-2000) - ix-Xagħra tat-Tombu cart-ruts, near Imselliet school (c.2001), a population much depleted by the creation of bird-trapping hides - Selmun area (c.2005).

Family : *Santalaceae*

36. *Thesium humile* Vahl MALTA - il-Blat plateau (overlooking Wied Bufula) (25-4-2007) - il-Marfa peninsula: il-Qatgħa ta' Sufa (on hills facing Ċirkewwa quays) (30-3-2003) - Mġarr area: in-Naqla, vicinity of l-Iskorvit (18-5-2005) - Laroka plateau, overlooking Buskett (6-2002) - ta' Pijru, ta' Żejsi, humps pf rock near the road between Mosta and Żebbiegħ (c. 2000) - is-Salina area: ta' Mattew rocks (c. 2004). GOZO - Għajn Abdul, il-Mixta (5-4-2004) - Fort Chambray, west side (4-5-2003) - San Lawrenz area: Wied il-Kbir, in a disused quarry (26-3-2003).

Family : *Lamiaceae*

37. *Stachys ocymastrum* (L.) Briquet MALTA - Mtarfa area: Għajn Kellija (c.1996) (1) - frequent between Wied il-Magħlaq and Wied Ħoxt, Wied iż-Żurrieq valley system (late 1990's). GOZO - Daħlet Qorrot (2-1993) - il-Fontana area: il-Muntanja tas-Saqwi (3-4-2004) - Wied ir-Riħan (8-4-2004).

Family : *Scrophulariaceae*

38. *Kickxia elatine* (L.) Dumortier MALTA - Wied Għollieqa (1991); Wied Għollieqa University carpark (8-2007). GOZO - fields between Triq ta' Bordin and Triq ta' Xħajma (4-9-2007) - ix-Xewkija: tal-Muknar (8-2007).

39. *Linaria chalepensis* (L.) Miller MALTA - il-Mellieħa area: fields between Wied il-Miżieb and it-Telgħa ta' Selmun (27-4-2005) - Mġarr area: il-Mielħa, overlooking Ġnejna valley (late 1990's) - il-Wardija: id-Demus (25-4-2007) - Wied Bufula (c. 2000).

40. *Linaria pseudolaxiflora* Lojacono MALTA - Wied il-Bassasa (3-2000); Wied id-Dis (5-4-2000); Wied Żnuber (27-2-2004). GOZO - iċ-Ċittadella: St.John's demibastion, St.Martin's demibastion, stairs outside Citadel gate (c.2002) - Gelmus hill (early 1990's) - ta' Ħarrax hill (early 1990's) - il-Qolla s-Safra (11-3-2003). COMINO - rocky ground between Għemieri peninsula and Sta. Marija bay (28-3-2005); on rubble around Comino tower ditch and adjoining peninsula (2005).

41. *Verbascum creticum* (L.) Cavanilles MALTA - il-Girgenti (1992) - Wied Ħanżira (1992) - Wied tal-Lewża* (28-5-1998) (2), along the road between is-Siġġiewi and Għar Lapsi.

Family : *Orobanchaceae*

42. *Orobanche lavandulacea* Reichenbach MALTA - ta' l- Ibraġ area: Wied Mejxu (4-1995) - il-Manikata area: ix-Xagħra l-Ħamra (1990's) - Wied il-Għasel (2002) - Wied Ħoxt (4-2006) (1) - Mtaħleb area: ix-Xagħra tal-Borgħom (2006) - between ix-Xemxija heights and il-Miżieb woodland (26-4-2005), possibly the largest known population..

Family : *Plantaginaceae*

43. *Plantago bellardi* Allioni MALTA - il-Manikata area: ix-Xagħra tal-Majjiesa, ix-Xagħra tal-Qortin (c.2000) - il-Mellieħa area: between il-Miżieb wood and Wied tal-Kalkara valleybed (26-4-2005); tat-Tomna, near uphill road from il-Manikata to il-Mellieħa ridge (c. 2000); Wied San Niklaw

(28-1-2003) - il-Mistra area: ix-Xagħra tal-Qortin (12-3-2003) - Qalet Marku peninsula* (29-4-1993) - Wied Ħarq Ħamiem (1995). GOZO - in-Nadur area: ix-Xagħra tal-Magun (3-2000).

Family : *Asteraceae*

44. *Ambrosia maritima* L. MALTA - near Għadira bird sanctuary (early 1990's). GOZO - Wied Sara (10-1992) (3).

45. *Atractylis cancellata* L. MALTA - il-Manikata area: Wied l-Abjad, ta' Ciantar (31-1-2007) - il-Mellieħa area: West side of Danish Village (c.2000) - intermittently on cliff-tops between il-Munqar and Wied il-Bassasa (5-4-1999) - Pembroke (22-6-2003) - Wied Ħarq Ħamiem (1995) - Wied Ħoxt (3-2006) - Wied Moqbol (13-3-2004) - Wied Żnuber (27-2-2004). GOZO - ta' Ġordan hill plateau (9-11-2006); Ħondoq ir-Rummien (6-7-2004).

46. *Carduncellus coeruleus* (L.) DC. MALTA - il-Buskett (2004) (1) - Mġarr area: vicinity of tas-Santi (c. 2000) (1) - il-Qolla (vicinity of Chadwick Lakes) (late 1990's), the only sizeable population known to the author - Wied ir-Rum (1994) (1). GOZO - ta' Għammar hill (9-11-2006) (1).

47. *Catananche lutea* L. MALTA - il-Mellieħa area: Wied Ħanżira (16-5-2006); vicinity of Torri l-Aħmar (31-8-2004) - Pembroke (22-6-2003) - frequent on the stretches of karstland between wied Rini and Bieb ir-Ruwa, towards plateaus overlooking wied tas-Santi (2002).

48. *Centaurea melitensis* L. GOZO - iċ-Ċittadella* (c.2002) (1); Nuffara hill* (c.2000) (1) - il-Qala area: l-Irdum cart ruts (18-4-2005).

49. *Glebionis segetum* (L.) Fourr. MALTA - Mtaħleb area: l-Irdum tas-Sarġ (1995).
Records for Gozo, where the species is frequent, are not given.

50. *Onopordum argolicum* Boissier MALTA - Għajn Tuffieħa tower* (6-2002) (1). GOZO - il-Qala area: il-Wardija, along a road now called Triq il-Barbaġann* (23-3-1997) (1) - it-Terrapien* (near Fort Chambray) (late 1990's), the largest population known to the author, destroyed when a road was widened to create parking space. COMINO - roadside along il-Palazz (15-11-1996).

51. *Otanthus maritimus* (L.) Hoffmannsegg & Link MALTA - Marfa peninsula: Ramla tat-Torri* (8-1992) (4). GOZO - Xatt l-Aħmar* (5-2002) (1), destroyed by beach cleaning.
May be extinct.

52. *Rhagadiolus stellatus* (L.) Willdenow MALTA - Ħad Dingli area: Misraħ Suffara (2004) - il-Mellieħa area: between it-Telgħa ta' Selmun and il-Migduma (27-4-2005) - high ground overlooking Wied Gerżuma* (17-4-1993) (4), destroyed by bird-trapping activities. GOZO - il-Qala area: ta' Cassar, ta' Simar (high ground overlooking wied is-Simar) (25-4-2005).
Grows in cultivated fields with shallow soil among forbs.

Family : *Alismataceae*

53. *Damasonium bourgaei* Cosson MALTA - l-Għallis ta' Ġewwa (1993) - Mġarr area: ix-Xagħra ta' San Martin (overlooking il-Palma) (3-2000) - Wied ta' l-Imselliet (2002) - Wied il-Għasel, San Pawl tat-Tarġa region (1993) - Sta. Luċija borehole reservoir (c.2000), the largest known population. GOZO - Xlendi area: Ras il-Fekruna (1993) - Ta' Ċenċ area (1993).

Family : *Hyacinthaceae*

54. *Muscari neglectum* Gussone MALTA - Ħal Far: ta' Rikka (15-3-2005).

55. *Scilla clusii* Parlatore MALTA - Wied il-Ħżejjen (2002), 1 clump growing in clay soil close to the valleybed watercourse..

Family : *Iridaceae*

56. *Iris sicula* Todaro MALTA - uphill road between ir-Rabat and Mtaħleb* (1990's) - clay fields below Dingli cliffs* (2003). GOZO - Wied tax-Xlendi (1993).

Family : *Orchidaceae*

57. *Ophrys ciliata* Bivona MALTA - il-Marfa peninsula: id-Dahar (4-2007) (1) - il-Mellieħa area: Iċ-Ċumnija acacia wood (c. 2000) (1) - Mġarr area: ta' Mrejnu (1) (c. 2000) - Pembroke (early 1990's) (1) - San Pawl tat-Tarġa area : in-Nigret (31-3-2006) - Wied id-Dis (5-4-2000) (1) - Wied il-Faħam (5-4-2000) (1).
Records for Gozo, where this species is frequent, are not given.

58. *Ophrys lutea* Cavanilles MALTA - vicinity of Għar il-Kbir (early 1990's) - Verdala* (26-3-1994) (1) - Wied Babu (3-1992) (1) - high ground overlooking wied Babu (vicinity of il-Ħofra tal-Bħir) (c. 2000). GOZO - ta' Ħarrax hill (early 1990's) (1).

Family : *Juncaceae*

59. *Juncus articulatus* L. GOZO - in a watercourse on clays below il-Qortin ta' Għajn Damma, between Rdum tas-Surgu and Għajn Barrani (5-1994).

Family : *Cyperaceae*

60. *Bolboschoenus maritimus* (L.) Palla MALTA - Wied l-Arkata, Wied Għajn Mula, Għajn Riħana valley system (early 1990's) - Wied tal-Ġnejna (2-1992). GOZO - Wied tal-Grazzja, Wied Marsalforn valley system (10-1992) - in a marshy area behind Ramla l-Ħamra sand dunes (8-1992).
Seems to be spreading, maybe due to soaring nitrogen levels in watercourses. C.2000 it appeared close to the point where il-Baħrija valleybed watercourse meets Fomm ir-Riħ cliffs and in il-Fiddien, Wied il-Qliegħa valley system.

61. *Cyperus fuscus* L. GOZO - Wied tal-Grazzja* (10-1992).
Destroyed soon after original discovery. The author has conserved this species by growing it in his private garden from seeds collected from the above-mentioned population. Introduced to Argotti Botanic Gardens, Floriana, and Wied Għollieqa nature reserve.

Family : *Poaceae*

62. *Melica ciliata* L. MALTA - Wied il-Ħesri (1990's).

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REFERENCES

Borg, J. (1927). Descriptive Flora of the Maltese Islands. - Malta: Government Printing Office. 846 pp.

Haslam, S.M., Sell, P.D. & Wolseley, P.D. (1977). A Flora of the Maltese Islands. - Msida, Malta : Malta University Press. lxxi + 560 pp.

Lanfranco, E. (1989). The Flora. In : Schembri, P.J. & Sultana, J. (eds.). Red Data Book for the Maltese Islands. - Malta : Department of Information: 5-70.

Lanfranco, E. (1997 - revised 2001). VASCULAR FLORA OF THE MALTESE ISLANDS, draft check list. 46 pp. (unpublished).

Sommier, S. & Caruana Gatto, A. (1915). Flora Melitensis Nova. - Firenze, Italy : Stab.Pellas. vii + 502 pp.

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NOTES ON THE ECOLOGICAL IMPORTANCE OF THE BEACH MACROFAUNAL ASSEMBLAGES AT IX-XATT L-AHMAR, GOZO (MALTESE ISLANDS)

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ABSTRACT

No data from comprehensive, multi-seasonal macrofaunal studies for the two secluded beaches at Xatt L-Ahmar (Gozo) has been published to date. This paper reports on the deployment of pitfall trap constellations (for nocturnal surface-active macrofauna) and hand-towed nets in shallow water (for infralittoral macrofauna emerging at night in the water column) for eight consecutive seasons. Despite their small size, the beaches at ix-Xatt l-Ahmar harbour relatively high macrofaunal individual abundances, high fractions of psammophilic (i.e. sand-specific species) species and high fractions of rare or endangered species. On the basis of the results reported in this study, it is suggested that the current conservation regime afforded to the ix-Xatt L-Ahmar environs (mainly on cultural and historical grounds) is revised and extended in order to safeguard this ecologically important site.

INTRODUCTION

Ix-Xatt L-Ahmar ('Red Beach') actually consists of two secluded and largely inaccessible (except by sea and by narrow winding paths at the base of clay slopes) beaches found along the south-eastern coastline of Gozo, at a short distance from the main port of Mgarr and beneath the Fort Chambray fortifications. The 'main' beach has a bare-sand length of 80m, with a width of 18m, whilst a smaller sandy stretch is found behind the rocky peninsula (known as 'is-Salina' or 'il-Ponta tal-Mellieha'), having just a few metres in length. Despite its limited dimensions, the smaller sandy stretch is still considered as a beach and as a functional ecological unit in view of its persistence over time, which in turn enables colonization and establishment of macrofaunal communities.

The 'main' beach receives large inputs of *Posidonia* seagrass debris which accumulate due to the sheltered position of the beach and due to the general absence of any 'beach-cleaning' activity on site. However, occasional severe storms, such as that which hit the Maltese coasts in winter 2005, carry out to sea all the accumulated seagrass debris.

The conservation importance of the sandy beaches at Ix-Xatt L-Ahmar is to date considered only on the basis of the rare floral species occasionally recorded from the incipient pockets of dune vegetation found at the base of the clay slopes and globigerina escarpments which back the beaches. These pockets are mainly dominated by *Salsola soda* and *Cakile maritima* and rare dune plants recorded on site include *Euphorbia peplis* and *Polygonum maritimum* (Cassar & Stevens, 2002) and the recently rediscovered *Otanthus maritimus* (Tabone, personal communication). At the time of writing of this short note, no data from extensive multi-seasonal faunal surveys conducted at Xatt L-Ahmar had been published, but just the data from snapshot sampling events (e.g. Nardi & Mifsud, 2003). The Malta Environment and Planning Authority (MEPA) carried out brief surveys in the ix-Xatt l-Ahmar area, on two occasions (in 1999 and in 2000), and according to its records, the endemic beetle subspecies *Allophylax picipes melitensis* was present in the area (Marie-Therese Gambin, Darrin Stevens, personal communication). The area surveyed by MEPA, however, extends far beyond the two beaches and includes the clay slopes – *A. picipes*

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melitensis is widely distributed across the Maltese Islands and was recorded in the ix-Xatt l-Ahmar area in large numbers by MEPA. This psammophilic (sand-specific) beetle species was also recorded in the present study in spring 2002 from the beaches at ix-Xatt l-Ahmar.

MATERIALS AND METHODS

This short note reports on some of the data emerging from multi-seasonal sampling conducted on the beaches at Ix-Xatt L-Ahmar, for eight consecutive seasons, from autumn 2001 to summer 2003, as part of a wider study focusing on the beach macrofaunal assemblages of four different beaches in the Maltese Islands. Sampling was conducted by means of pitfall trap constellations and handnets. The pitfall trap constellations consisted of five 7.5cm-diameter surface-flush plastic cups (half-filled with a mixture of water and glycerol to minimize the possibility of faunal individuals crawling back out of the same traps and the occurrence of predator-prey interactions within the traps), connected in a cross-like pattern by means of wooden walkways, which were used to maximize sampling efficiency. Pitfall trap constellations were deployed at dusk in the supralittoral, at 5 metres away from the Mean Sea Level, and emptied at dawn. Note was taken of the length of time the traps were deployed on each occasion, so as to be able to standardize and compare (in temporal terms) faunal collections from different seasons and from different beaches. The number of pitfall trap constellations deployed on every beach reflected the dimensions of the beach – for example, just one pitfall trap constellation on each of the ix-Xatt L-Ahmar beaches was used due to the limited dimensions of the same beaches.

The handnet technique consisted of standardised nocturnal towing of a 0.5mm-mesh handnet, of mouth area $0.1m^2$, through the water column to cover an area of seabed *ca* $25m^2$. Each haul using handnets was made parallel to the shore, in water less than 1 metre deep and lasted for 20 minutes. These hauls were designed to collect upper infralittoral infauna that emerged to swim in the water column at night – hence, care was taken not to disturb the seabed during the handnet towing so as not to collect non-target benthic species. Again, the number of handnet hauls conducted on different beaches was related to the dimensions of the same beach – just one haul per beach was conducted at the ix-Xatt L-Ahmar beaches.

RESULTS and DISCUSSION

Despite their small size, a mean macrofaunal individual abundance of 29.8 inds/trap/hour was recorded from the beaches at Ix-Xatt L-Ahmar through the use of the pitfall trap constellations, much higher a value than for other larger, local beaches such as Golden Bay and White Tower Bay, sampled for the same frequency and using the same sampling technique (Deidun & Schembri, in press), with only Ramla l-Hamra reporting a higher value.

Ix-Xatt L-Ahmar also recorded the highest fraction (98.3%) of psammophilic macrofaunal individuals amongst the local beaches sampled seasonally and the second highest fraction (50.0%) of psammophilic species through the use of the same sampling technique. In addition, the highest fraction of species collected from one beach only (55.6% of all the species collected on the same beach) was also recorded from Ix-Xatt L-Ahmar (Deidun & Schembri, submitted). These species include endemic ones, like *Erodius erodius melitensis* and *Stenosis schembrii*, and like *Clithobius ovatus*, the latter species being restricted to the Maltese Islands and Tunisia. Another macrofaunal species recorded from Ix-Xatt L-Ahmar and having a restricted local distribution is the psammophilic anthicid *Cyclodinus minutus minutus*, which, along with other dune- and marsh-associated anthicids, is considered to be locally threatened by Nardi & Mifsud (2003).

A total of 36 species was recorded from the beaches at Ix-Xatt L-Ahmar over the entire two-year sampling period. Whilst some psammophiles are not considered as rare, the local paucity in the sandy habitat to which they are restricted still underpins their conservation importance. Mifsud (1999), in fact, considers all beach-associated tenebrionid beetles, along with other psammophilic species, to be threatened. The tenebrionid beetle *Phaleria bimaculata* was recorded in large individual densities from the beaches at Ix-Xatt L-Ahmar, reaching a maximum of 50 individuals/trap/hour in summer 2003. The closely-related *Phaleria acuminata* was not recorded from the beaches at Ix-Xatt L-Ahmar. *Erodius siculus melitensis, Clithobius ovatus, Stenosis schembrii and Phaleria acuminata* are all listed in the Red Data Book for the

Maltese Islands (Schembri & Sultana, 1989). In addition, *Bembix oculata*, one of the few locally-known sand-associated bee species, was commonly encountered on the shorter sandy beach at Ix-Xatt L-Ahmar. In addition, all local endemic species are protected in terms of paragraph 26 of the Flora, Fauna and Natural Habitats Protection Regulations 2006 (except those found in Schedule X). None of the faunal species reported in this study are listed in this schedule.

The ecological importance of Ix-Xatt L-Ahmar is also evident from handnet collections, which were distinct from those recorded on other local similarly sampled beaches. This distinctiveness of the Ix-Xatt L-Ahmar samples appears related to the exclusive presence of many fish species (mainly *Atherina* sp. and *Labrus* sp.) and the absence of most species of mysids (e.g. *Siriella clausii*) and amphipods (e.g. *Atylus swammerdami* and *Gammarus subtypicus*) in the uppermost levels of the infralittoral zone on this beach. Surf zones are often important nursery areas for fish due to their high levels of secondary production by resident crustacean populations (Brown & McLachlan, 1990); hence, the inverse relationship between fish and mysids at Ix-Xatt L-Ahmar may be related to this. Ix-Xatt L-Ahmar is one of the most sheltered local beaches and this fact may also contribute to the high population density of fish found here in autumn and winter, when juvenile fish seek shelter from the turbulence of the open coast.

To date, the beach at Ix-Xatt L-Ahmar and it environs are not scheduled (protected) under local legislation, which only affords protection to a nearby freshwater wetland (at Ghajn Klin) and its buffer zone (as per Government Notice 288/95), scheduled as a Level 1 Area of Ecological Importance and as a Level 1 Site of Scientific Importance, and to the Fort Chambray fortifications, adjacent glacis and underlying clay slopes (as per Government Notice 840 of 2005), for their historical and cultural value. This, despite Schembri *et al.* (1987) listing the Chambray-Mgarr ix-Xini coastal stretch (which includes Ix-Xatt L-Ahmar) as a site of conservation importance. Policy GZ-RLCN-1 of the Gozo and Comino Local Plan (approved in July 2006) however proposes the Ix-Xatt L-Ahmar area as a Level 2 SSI/AEI (Site of Scientific Importance/Area of Ecological Importance) and as an Area of High Landscape Sensitivity.

In view of the data presented in this paper (especially the endemic and rare species recorded from ix-Xatt L-Ahmar beaches) which supplements existing faunal data possesses by MEPA and in view of the reported 'compartmentalisation' and high beta diversity values of different beach assemblages, whereby no beach assemblage is expendable due to its distinctiveness (Deidun *et al.*, 2003; Gauci *et al.*, 2004; Deidun & Schembri, submitted), the current protection regime afforded to part of the ix-Xatt L-Ahmar environs should also be extended to the two beaches and their associated habitats. This so as not to protect the ix-Xatt L-Ahmar area only on cultural and historical grounds (as is mainly the case, to date) but also on ecological and scientific ones. This would also be in line with the recommendations of the Gozo and Comino Local Plan and in compliance with the Habitats Directive (transposed into local legislation as LN 311 of 2006) which defines all endemic, rare, vulnerable and endangered species as species 'of community interest'.

ACKNOWLEDGEMENTS

The author wishes to thank Prof. P.J. Schembri (Department of Biology, University of Malta) and Mr. Darrin Stevens (MEPA) for their invaluable assistance on aspects concerning the current conservation status of the insect species reported in this study and of the Ix-Xatt L-Ahmar area.

REFERENCES

Brown, A.C. & McLachlan, A. (1990). *Ecology of sandy shores*. Elsevier Publishing, Amsterdam: 328 pp.
Deidun, A., Azzopardi, M., Saliba, S., Schembri, P.J. (2003). Low faunal diversity on Maltese sandy beaches: fact or artefact? *Estuarine, Coastal and Shelf Science* 58: 83-92.
Deidun, A. & Schembri, P.J. (submitted). *Assessing inter-beach differences in semi-terrestrial arthropod assemblages on Maltese pocket sandy beaches* (Central Mediterranean). Marine Ecology.
Gauci, M.J., Deidun, A., Schembri, P.J. (2005). Faunistic diversity of Maltese pocket sandy and shingle beaches: are these of conservation value? *Oceanologia* 47(2): 219-241.

L.N. 311 of 2006: Environment Protection Act (CAP. 435) - Flora, Fauna and Natural Habitats Protection Regulations, 2006

Mifsud, D. (1999). Tenebrionids associated with sandy shores in the Maltese Islands (Coleoptera, Tenebrionidae). *The Central Mediterranean Naturalist* 3(1): 23-26.

Nardi, G. & Mifsud, D. (2003). *A review of the Anthicidae of the Maltese Islands (Central Mediterranean).* Fragmenta entomologica 35(2): 77-127.

Schembri, P.J., Lanfranco, E., Farrugia, P., Schembri, S., Sultana, J. (1987). Localities with conservation value in the Maltese Islands. Environment Division, Ministry of Education, Valletta:27pp.

Schembri, S. (1989). Insects excluding Coleoptera and Lepidoptera In: Schembri, P. J. & Sultana, J. [eds] *Red data book for the Islands* (pp. 90-96). Valletta, Malta: Department of Information, viii + 142pp. + plates I-VIII.

(Accepted October 2007)

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FIRST RECORD OF *Pyrenula chlorospila* Arnold (PYRENULALES: PYRENULACEAE) FROM THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)

Jennifer Fiorentino[1]

ABSTRACT

One specimen of an inconspicuous, corticolous lichen found on the bark of an oak tree at Buskett was identified as *Pyrenula chlorospila* Arnold. This species is not included in the checklist published by Sommier and Caruana Gatto in Flora Melitensis Nova (Sommier & Caruana Gatto, 1915). Instead *Pyrenula nitida* var *nitidella* is mentioned which name is also used for specimens in Caruana Gatto's collection housed in the herbarium at Argotti. Three of these specimens were also examined and were found to represent *P. chlorospila*. Consequently, *Pyrenula chlorospila* is recorded for the first time from the Maltese Islands.

INTRODUCTION

The lichens of the Maltese Islands are poorly known. The only floristic work is that of S. Sommier and A. Caruana Gatto (Sommier & Caruana Gatto, 1915).

The genus *Pyrenula* is characterized by its crustose thallus containing algal cells of the genus *Trentepohlia*. Its fruiting bodies consist of black perithecia which produce 3-septate spores (Purvis *et al.*, 1992). The most common species in the Mediterranean area are *P. chlorospila* Arnold and *P. macrospora* (Degel.) Coppins & P. James. These are species growing mostly on the smooth bark of deciduous trees in shaded humid conditions
The checklist of lichens of the Maltese Islands published by Sommier & Caruana Gatto (1915) refers to a *Pyrenula nitida* var *nitidella* found growing on carob tree branches at Buskett. In a previous paper published in CMN (Fiorentino, 2002), the synonym *Pyrenula nitida* for *Pyrenula nitida* var *nitidella* was used as at that time no reference to this variety was found. Since then, a more recent publication (Nimis & Martellos, 2003) suggests that the synonym for *Pyrenula nitida* var *nitidella* (Schaer) should be *Pyrenula nitidella.*
Caruana Gatto's collection of lichens was identified by A. Jatta (Sommier & Caruana Gatto, 1915) and is presently housed at the Argotti herbarium. This collection contains numerous specimens of *Pyrenula nitida* var *nitidella* (syn. *P. nitidella*) growing on different bark samples. Three of these specimens were studied for the present work, together with one specimen from Buskett Gardens (Rabat, Malta).

This is the first record of *Pyrenula chlorospila* Arnold from the Maltese Islands. This lichen may be easily overlooked considering its small size and its fawn- coloured thallus.

MATERIAL & METHODS

One specimen collected from Buskett Gardens on the outskirts of Rabat, Malta (N 35° 51' E 14° 24') found on a 2-cm thick branch of an oak tree (*Quercus ilex*) was studied (*Fig. 1).* Additionally, 3 specimens (C/L5/03) from the Argotti herbarium, from unspecified localities and previously identified by Antonio Jatta (Sommier & Caruana Gatto, 1915) as *Pyrenula nitida* var *nitidella,* were studied.

Specimens were observed with a stereomicroscope at X20. A compound microscope was used to observe spores at X100 and X400.

Morphology: Thallus fawn with a waxy aspect, showing in some parts a brown prothallus. Perithecia numerous, 0.15 to 0.3 mm in diameter, most of which almost totally immersed; ostiole of each involucrellum surrounded by a lighter coloured area; many empty pits left off by eroded perithecia present. Numerous white small, rounded pseudocyphellae, 30-70 μm in diameter were scattered across the whole thallus. Thalli of Argotti Herbarium specimens were fawn to pale brown in colour and presented all the above features.

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Fig. 1. Thallus and apothecia of *Pyrenula* specimen found by author at Buskett Gardens, Rabat

Chemistry: Thallus C^-, K^+ yellow (reaction taking some time to develop), PD-. Sections of perithecial wall K- (without reddish purple reaction; in some of these sections a yellow pigmentation tended to diffuse into the K medium. This must have been due to the K^+ yellow reaction of thallus tissue still attached to the perithecial wall). The same reactions present also in material from the Argotti herbarium.

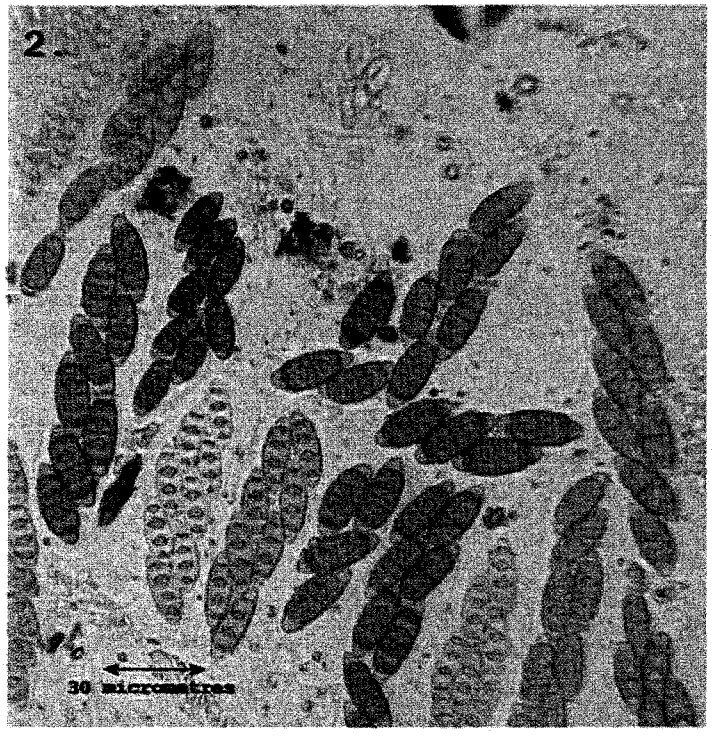

Fig. 2. Asci and spores of *P. cholorospila* specimen collected from Buskett.

Anatomy: Asci cylindrical, 8-spored. Spores 23-34.5 × 8-14 µm, brown, narrowly ellipsoid with rounded apices, 3-septate, thick walled, distoseptate (individual cells delimited by a wall formed within the outer wall); cell lumen angular (*Figs. 2 and 3*). Spores of specimens from the Argotti herbarium: 23-38 × 8-14 µm (*Fig. 4*).

DISCUSSION AND CONCLUSIONS

All examined specimens of *Pyrenula chlorospila* from the Maltese Islands are very similar to each other. They differ from other European specimens in the chemistry. Purvis *et al* (1992) report that the thallus of *P. chlorospila*

from Great Britain and Ireland reacts Pd+ faint yellow. This was not the case with the Buskett specimen and with the specimens from the Argotti Herbarium. Clauzade & Roux (1985) do not report any information on PD reaction. K test on thallus and perithecial sections as well as C test on thallus of all four local specimens agreed with Purvis *et al* (1992) and Clauzade & Roux (1985).

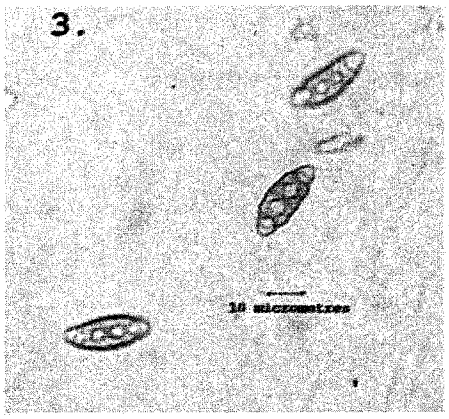

Fig.3. Spores of *P. chlorospila* from Buskett

Fig. 4. Spores of *Pyrenula* sp. from Herbarium collection Argotti

Spore size is in accordance with descriptions from other European countries. Clauzade & Roux (1985) report a size of 20-38 × 9-15 µm from western Europe, and according to Purvis *et al.* (1992), spores have a (25-)28-32(-35) × (9-)11-13(-14) µm size in Great Britain and Ireland.

One should also add that while Purvis *et al* (1992) declare that *P. chlorospila* has white spots (pseudocyphellae) between 50-75 µm in diameter, Clauzade & Roux (1985) contend that white spots are rarely or never found on this species. The specimen found at Buskett as well as the Herbarium specimens had numerous white patches as reported above.

The specimens of the Herbarium Argotti are reviewed as *Pyrenula chlorospila* Arnold, since not belonging to *Pyrenula nitida* var *nitidella* (*P. nitidella*) as indicated on the label and as quoted in the checklist of the lichens of the Maltese Islands (Sommier & Caruana Gatto, 1915). *P. chlorospila* differs from *P. nitidella* in the K reaction of perithecial sections and in the spore size, which is quoted as 15-25 × 5-9 µm (Clauzade & Roux, 1985) and (20-)22-26(-28) × (8-)8.5-11(-12) µm (Purvis *et al*, 1992). *P. chlorospila* has been often mistaken for *P. nitidella.* According to Nimis & Poelt (1987), the record of *P. nitidella* from Sardinia by Baglietto (1879) refers to *P. chlorospila,* while Purvis et al., (1992) state that most pre-1980 records of *P. nitidella* from the British Islands belong to *P. chlorospila.*

The specimen at Buskett and the examined specimens from the Argotti Herbarium represent the first record of *Pyrenula chlorospila* from the Maltese Islands. Having a different chemistry in comparison to described *P. chlorospila* from other countries, they could represent a new variety or subspecies. Further investigations, including studies on chemistry by TLC (Thin Layer Chromatography), will be therefore necessary to better understand its taxonomic position.

ACKNOWLEDGEMENTS

I am very grateful to Dr. Luciana Zedda, Department of Mycology, University of Bayreuth for accepting to review this paper and for making very useful suggestions. Thanks are due to Mr. Joseph Buhagiar, curator of the Herbarium at Argotti for giving me permission to examine specimens in the lichen collection and for allowing me to use the herbarium's stereomicroscope.

REFERENCES

Baglietto, F. (1879) Lichenes Insula Sardiniae recensit F. Baglietto - *N. Giorn. Bot. Ital., 11:50-123*
Clauzade, G. & Roux, C. (1985) *Likenoj de Okcidenta Europa. Illustrita Determinlibro.* Bull. Soc. Bot. Cent-Ouest, ns., nr. spéc.7. 894 pp
Fiorentino, J. (2002) An appraisal of scientific names used in the 1915 list of lichens of the Maltese Islands by Stefano Sommier and Alfredo Caruana Gatto. *The Central Mediterranean Naturalist* 3(4): 189-196
Nimis, P.L. (1993) *Lichens of Italy, An annotated catalogue.* Museo Regionale di Scienze Naturali, Monogr. 12, Torino. 897 pp.
Nimis, P.L. & Martellos, S. (2003) *A Second Checklist of the Lichens of Italy with a thesaurus of synonyms,* Monografie ~ 4, Museo Regionale di Scienze Naturali, Saint-Pierre – Valle Dáosta. 192 pp
Nimis, P.L. & Poelt, J. (1987) *The Lichens and Lichenicolous Fungi of Sardinia (Italy).* Studia Geobotanica, 7, suppl. 1. 269 pp
Purvis, O.W., Coppins, B. J., Hawksworth, D. L., James, P. W. & Moore, D.M. (1992) *The Lichen Flora of Great Britain and Ireland.* Second Edition., Natural History Museum Publications for The British Lichen Society. 710 pp
Sommier, S. & Caruana Gatto, A. (1915) *Flora Melitensis Nova, Firenze,* Italy. 502 pp

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REDISCOVERY OF *ASPARAGUS STIPULARIS* FORSKÅL (FAMILY: ASPARAGACEAE) IN THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)

Sdravko Vesselinov Lalov[1]

ABSTRACT

The presence of *A. stipularis* on the island of Gozo (Maltese islands) is reported and information on distribution and habitat is given. Old unconfirmed records from the island of Malta are discussed.

Asparagus stipularis Forskål (*A. horridus* L. f.) is native to the Canary islands and the Mediterranean from Portugal and Morocco (Schönfelder & Schönfelder 1994) to Lebanon and Palestine (George 1932). It is present in Sicily (Tornabene 1887) and Lampedusa while similar plants from Linosa with long and thick cladodes are considered unusual specimens of *A. aphyllus* L. (Sommier 1908).
Sommier & Caruana Gatto (1915) do not record *A. stipularis* from Malta but describe two unusual varieties of *A. aphyllus* L. (var. *abbreviatus* and var. *elongatus*) both of which do not resemble *A. stipularis*. In the Maltese islands *A. stipularis* is recorded under the name *Asparagus aphyllus* var. *stipularis* Forsk. from the island of Malta (Wied Incita, Buskett and Wardija) by Borg (1927) who also provides a correct description of the species. However, his records were never confirmed by other botanists and a search of Borg's herbarium at Argotti Botanic Gardens by the curator Mr Joseph Buhagiar revealed no material to substantiate Borg's records (Joseph Buhagiar personal communication). *A. stipularis* is not included in Haslam *et al.* (1977) or Lanfranco (1989).

During a survey of the south-western coastal cliffs of Gozo between Xlendi and Wied Sansun in June 2006 a group of *Asparagus stipularis* was encountered growing on a small terrace beneath the clifftops. In October of the same year a much larger population was found fringing the clifftops between Ta'Cenc and Xlendi for several kilometres and in March 2007 the species was encountered in some locations along the cliffs between Wardija point and Xlendi. In all cases the plants grew mainly on small terraces in the cliffs. Only where such terraces with *A. stipularis* were present near the clifftops the population extended few metres into the degraded garrique and abandoned fields nearby. The sole exception was one single plant at Ta'Cenc which was encountered on a patch of degraded garrigue approximately 300 m inland.

The only other native Asparagus species in the Maltese islands is *A. aphyllus,* a common species which is present in large numbers in all Gozitan *A. stipularis* locations. While both species are extremely variable in growth habit, branching, shape and length of the cladodes and colour they can be easily distinguished by the number of cladodes. *A. aphyllus* has several (usually three to seven) cladodes of different length per fascicle while the number of cladodes in *A. stipularis* is usually one to three per fascicle (Tutin 1980). Another distinguishing feature is the usually much more glacous colour in *A. stipularis* (Fig. 1).

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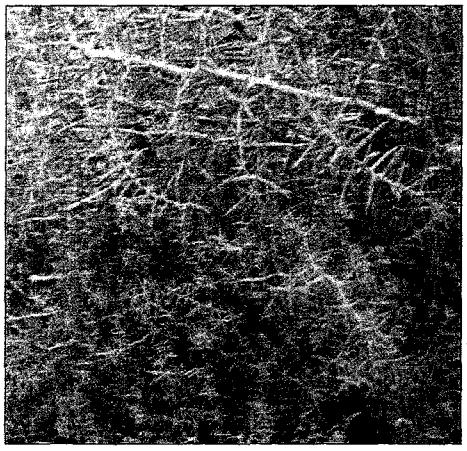

Fig 1: *A. stipularis* (above) and *A. aphyllus*, Ta'Cenc

Fig. 2: A. stipularis, Xlendi

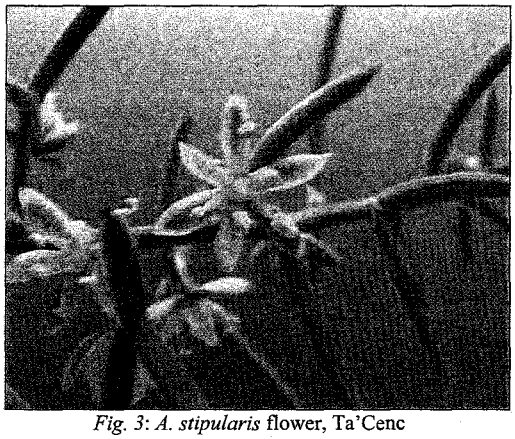

Fig. 3: *A. stipularis* flower, Ta'Cenc

Although the flowering time of both species overlaps no hybrids or intermediates could be found in any of the populations. In contrast, the situation in Linosa and Lampedusa seems to be more complicated (Sommier 1908). It is possible that *A. stipularis* has a wider distribution along maritime cliffs in Gozo and maybe in other islands of the Maltese archipelago but the records of Borg (1927) from inland sites in Malta remain doubtful. It is still unclear why the species seems to be largely restricted to maritime cliffs in Gozo, especially since it can be found in inland and even mountain areas on the European continent (own observation).

Voucher specimens of *A. stipularis* from Ta'Cenc were deposited in the private herbaria of Mr Edwin Lanfranco (University of Malta) and of the author while live material from Wardija point was planted in the Argotti botanic garden of Malta.

ACKNOWLEDGEMENTS

The author is indebted to Mr Joseph Buhagiar of Argotti botanic garden for the research of Joe Borg's herbarium, to Mr Mario Gauci for the generous help during all visits to Gozo and to Mr Edwin Lanfranco from the University of Malta for confirming the identification of *A. stipularis*.

REFERENCES

Borg, J. (1927) *Descriptive Flora of the Maltese Islands.* Malta: Government Printing Office, 846pp

George, E. (1932) *Flora of Syria, Palestine and Sinai Vol. II.* Beirut: American Press, 928pp

Haslam, S.M.; Sell, P.D. & Wolseley, P.A. (1977) *A Flora of the Maltese Islands.* Malta: Malta University Press, lxxi+560pp.

Lanfranco, E. (1989) The Flora. In: Schembri, P.J. & Sultana, J. (eds.): *Red Data Book for the Maltese Islands,* pp. 5-70; Malta: Department of Information. viii+142pp.

Schönfelder, I. & Schönfelder, P. (1994) *Kosmos-Atlas Mittelmeer und Kanarenflora: über 1600 Pflanzenarten.* Stuttgart: Franckh-Kosmos, 304pp

Sommier, S. (1908) *Le Isole Pelagie, Lampedusa, Linosa, Lampione e la loro Flora con un Elenco completo delle Piante di Pantelleria.* Firenze: Stabilimento Pellas, 344pp

Sommier, S. & Caruana Gatto, A. (1915) *Flora Melitensis Nova.* Firenze: Stabilimento Pellas, viii+502pp

Tornabene, F. (1887) *Flora Sicula viva et exsiccata seu Collecto Plantarum in Sicilia sponte nascentium hucusque cognitarum juxta Methodum Naturalem Vegetabilium exposita in Horto Botanico Regiae Universitatis Studiorum Catinae Autore Francisco Tornabene in eadem Universitate Botanices Professore et in eodem Horto Praefecto.* Catania: En Typis Francisci Galati, 688+ivpp

Tutin, T.G.; Moore, D.M.; Valentine, D.H.; Walters, S.M. & Webb, D.A. (1980) *Flora Europea, Volume 5: Alismataceae to Orchidaceae (Monocotyledones).* Cambridge: Cambridge University Press, xxxvi+452pp

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NEW RECORDS FOR THE MALTESE FLORA: *OPUNTIA MICRODASYS* (LEHM.) PFEIFFER (FAMILY: CACTACEAE)

Sdravko Vesselinov Lalov[1] and Edwin Lanfranco[2]

ABSTRACT

The occurrence of *Opuntia microdasys* in the Maltese islands is reported. Information on distribution and invasive potential of the species is provided.

In the years 2006/7 four populations of *Opuntia microdasys* (Lehm.) Pfeiffer were discovered by one of us (SVL) on the island of Malta. One population consisted of a single specimen found south of Rabat in the area known as 'Ir-Rondzia'. The plant was growing near the valleybed of Wied tal-Isqof on a flat, sparsely vegetated rock of Upper Coralline Limestone surrounded by *Arundo plinii* Turra. No flowers or fruits were developed on this young individual which measured 30 cm with a trunk diameter of three cm. Since the road Triq il-Buskett is passing within 10 m from the site an introduction of the *Opuntia* by illegal waste dumping is probable.

Another population consisting of a large old specimen and several young plants originating from fallen pads grew on a south-facing Globigerina Limestone cliff surface at Wied Xkora, northeast of Siġġiewi. The large plant measured about one metre with a trunk diameter of 10 cm. During a visit to Wied Xkora in May 2006, a large number of fruits were encountered on the ground surrounding the adult specimen but an examination of those revealed no seeds. In this case the way of introduction of the species is obvious for it grew at the base of an illegal dumping site.

A third population consisting of roughly 25 specimens of different sizes was recorded at another illegal dumping site in Birkirkara valley near the road Triq Indri Grima. Some of the plants were well established, the largest measuring 60 cm with a trunk diameter of 6 cm. Many young plants were obviously pieces of older ones broken by the repeated dumping of refuse. It could not be established if the older plants produce fruit or not.

A forth population consisting of two large specimens over one metre in size and several small ones originating from fallen pads grew in an abandoned garden near the road Triq Fisher in Mġarr (Malta). This last population is probably a relic of cultivation.

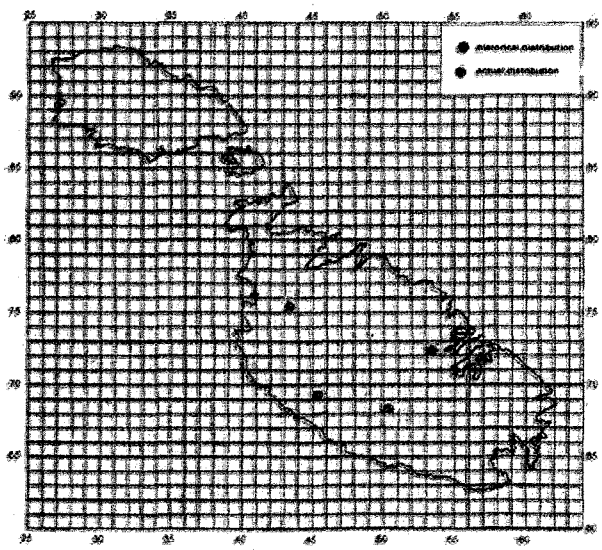

Fig.1: Distribution of *Opuntia microdasys* in Malta (UTM, zone 33S, 1 km x 1 km grid)

O. microdasys is native to northern Mexico (Borg, 1959). In the south its range includes Zacatecas and the north of Hidalgo in central Mexiko (Backeberg 1977). The species has always been quite popular as an ornamental

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(Borg, *op. cit.*, Hecht 1982) and is naturalized in many tropical and subtropical areas. While few records of naturalized populations exist in classic floristic literature (e.g. George 1984, *Flora of Australia*), *O. microdasys* already figures in lists of invasive or naturalized species for South Africa (I), Namibia (II), The Galapagos islands (III), Venezuela (IV), the USA (V, VI), Australia (VII) and the Balearic islands (VIII) available on the internet. The species suffers in severe winters on the southern shores of the Mediterranean (Borg, *op cit.)* but the naturalized populations in the Balearic Islands (VIII) and on the Spanish mainland in the provinces of Tarragona (Sanz-Elorza *et al.* 2006), Valencia and Castellon (Guillot 2003) demonstrate that the invasive potential of *O. microdasys* in Malta should not be underestimated.

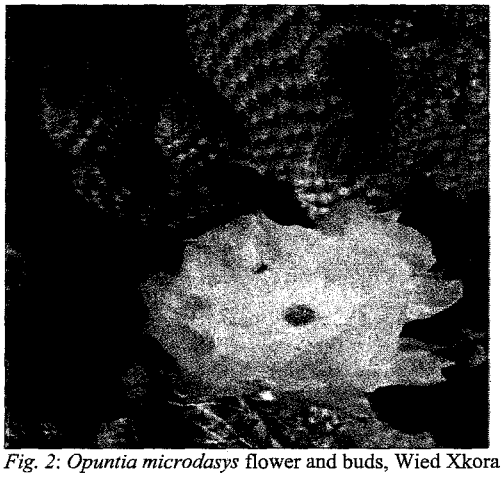

Fig. 2: *Opuntia microdasys* flower and buds, Wied Xkora

Fig. 3: Mature specimen of *O. microdasys,* Wied Xkora

REFERENCES

Backeberg, C. (1977) *Das Kakteenlexikon Enumeratio Diagnostica Cactacearum.* Stuttgart: Gustav Fischer Verlag, 822pp

Borg, J. (1959) *Cacti a Gardener's Handbook for their Identification and Cultivation,* 3rd Edition. Blanford Press, London 512pp + 65 plates.

George, A. S. (editor) (1984) *Flora of Australia Volume 4 Phytolaccaceae to Chenopodiaceae.* Canberra: Australian Government Publishing Service, x + 354pp

Guillot, D. (2003) Sobre la presencia de 17 táxones de la familia Cactaceae en la Communidad Valenciana. *Flora Montiberica* **24**, pp6-13

Hecht, H. (1982) *BLV Handbuch der Kakteen.* Munich: BLV Verlagsgesellschaft mBH, 391pp

Sanz-Elorza, M.; Dana Sánchez, E.D. & Sobrino Vesperinas, E. (2006) Further naturalized Cactaceae in northeastern Iberian Peninsula, *Anales del Jardin Botanico de Madrid,* Vol. **63**(1): pp7-11

Websites:

I Global Invasive Species Programme (2003). "Invasive Alien Species in Southern Africa." Available at http://www.gisp.org (accessed on 19. December 2006)

II John Irish (2003). "Aliens: Species not indigenous to Namibia." Available at http://www.biodiversity.org (accessed on 27. April 2007)

III Philip A. Thomas (2003). "Plant Species introduced to Galapagos." Available at http://www.hear.org (Accessed on 27. April 2007)

IV Ojasti, Juhani (2001). "Estudio soble el estado actual de las especies exoticas." Available at http://www.comunidadandina.org (Accessed on 27. April 2007)

V Pima County Government "Township 11 South, Range 08 East, Pima County, Arizona." Available at http://www.pima.gov (Accessed on 27. April 2007)

VI USDA, NRCS (2007). "*Opuntia microdasys* (Lehm.) N.E. Pfeiffer - angel's-wings OPMI4." Available at http://plants.usda.gov (Accessed on 27. April 2007)

VII Rich Morris (2007). "*Opuntia microdasys.*" Available at http://www.ibiblio.org (Accessed on 27. April 2007)

VIII Universitat de les Illes Balears (2006). "*Opuntia microdasys* (Lehmann) Pfeiffer." Available at http://herbarivirtual.uib.es (Accessed on 27. April 2007)

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REDISCOVERY OF *ORNITHOGALUM DIVERGENS* BOREAU (HYACINTHACEAE) IN MALTA (CENTRAL MEDITERRANEAN)

Sdravko Vesselinov Lalov [1], Alex Casha [2], Edwin Lanfranco [3], Martin Psaila [4] and Timothy Tabone [5]

ABSTRACT

Ornithogalum divergens had not been reported from the Maltese islands since 1927 and was presumed to be extinct here. Recently the species was rediscovered at the Buskett woodland and a new population was recorded at Girgenti.

Ornitogalum divergens Boreau is a species of S. Europe, extending northwards to Slovakia and to 49° in France. It grows in dry pastures and waste places. The taxon used to be included in *O. umbellatum* L. from which it differs by possessing small bulbils around the main bulb which remain dormant for at least a year and by the fruiting pedicels being patent or ± deflexed (Tutin *et al.,* 1980). Two other *Ornithogalum* species occur in the Maltese islands. *O. narbonense* L. can be distinguished from *O. divergens* by the spicate inflorescence whilst *O. arabicum* L. can be distinguished by the large flowers and conspicuous black ovary (Haslam *et al.* 1977).

In Malta the species was recorded for the first time by Caruana Gatto (1890) in April 1890 from "Uied Kerda" (Wied Qirda) while botanising with G. Henslow and provisionally identified "*Ornithogalum excapum* Ten. (?)", which is a different species but, according to Sommier & Caruana Gatto (1915), is to be equated with *O. divergens*. Later Sommier & Caruana Gatto (*op. cit.*) record it from Wied Qirda and Buskett and cite a record by Borg from Wied Incita. The last published records from the wild are by Borg (1927) from the same locations. A specimen dated April, 3. 1939 by M. E. Delia is preserved in the Argotti herbarium in a folder named 'Maltese Flora'. No location is given for that specimen but it may have been collected from cultivated specimens growing at Argotti Botanic Gardens (Joseph Buhagiar, personal communication) where the species used to grow until the 1980s.

The species is not mentioned in Lanfranco, G. (1969). Under the name *Ornithogalum umbellatum* L. it is included in a list of 'Plants which have not been recorded for a considerable time and may be presumed to be extinct or on the verge of extinction.' by Lanfranco, E. (1976). Haslam *et al.* (1977) cite only the old records by Borg and Sommier & Caruana-Gatto. Lanfranco, E. (1989) states that the plant has not been seen in the wild for several decades.

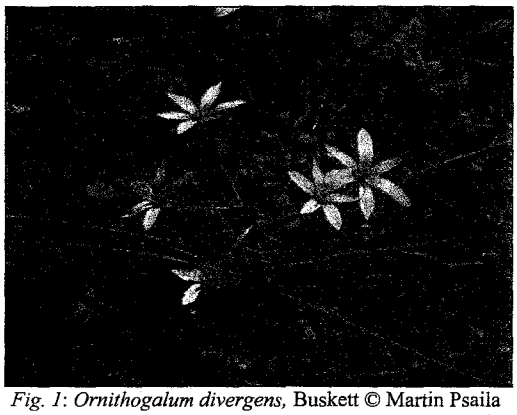

Fig. 1: Ornithogalum divergens, Buskett © Martin Psaila

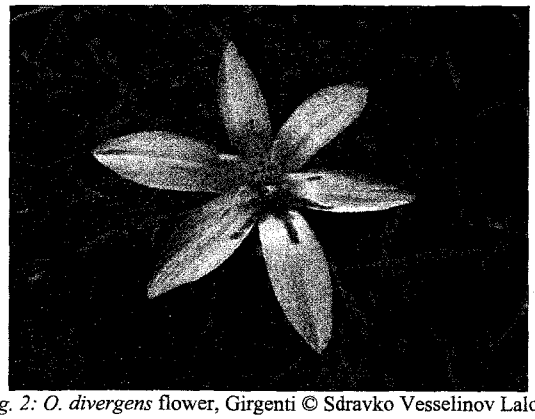

Fig. 2: O. divergens flower, Girgenti © Sdravko Vesselinov Lalov

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On the 7th April 2004 one of the authors (MP) discovered an *Ornitogalum divergens* specimen in a clearing at Buskett woodlands. On the 31th March 2005 two plants were present in the same location (MP&EL). In March 2006 15 individuals in flower were recorded in that area by TT and on the 30th March a single plant was found by AC in a different area of Buskett. On the 28th March 2006 a population consisting of seven individuals was discovered in abandoned fields at Girgenti by SVL. While this is the first record for the species from Girgenti the plants can be seen as a continuation of the, apparently widespread, Buskett population.

Since *Ornithogalum divergens* is not easily overlooked when in full bloom it is not clear why several populations were discovered in such a short period after the species had not been recorded for at least 77 years in the Maltese islands. When in flower the plant is conspicuous enough to attract even the attention of a casual observer and certainly that of a botanist. It flowers at a time of the year when most botanists and nature enthusiasts are roaming the countryside and at least the populations at Buskett grow in areas often visited by plant enthusiasts.
A recent reintroduction is improbable, especially in the quite remote area of Girgenti. It is possible that the species has been overlooked because each flower opens for a very short period. When all flowers are closed only the greenish abaxial side of the tepals is visible and the plants are extremely hard to find in dense vegetation, a fact which rendered a second count of the Girgenti population on April, 1 impossible (SVL). Another probable reason for the numerous new records could be an increase in population size or in the number of flowering individuals due to climatic or other reasons or possibly the greater number of people capable of identifying wild plants. Surveys carried out by one of the authors (SVL) at Wied Incita and Wied Qirda where the species had been recorded by Sommier & Caruana Gatto (1915) and Borg (1927) yielded negative results.

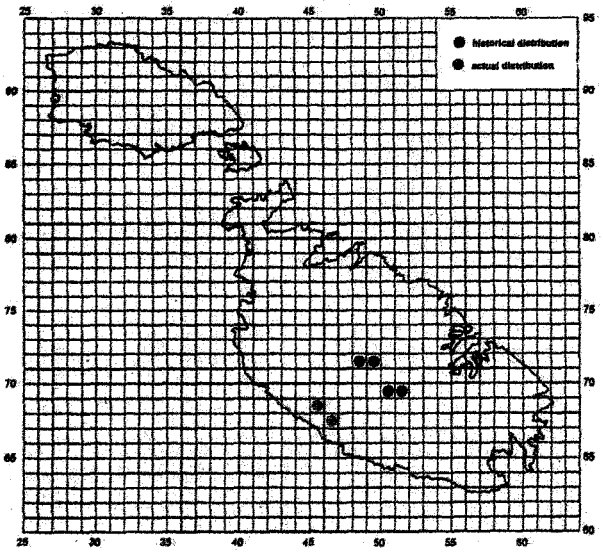

Fig.3: Distribution of *Ornithogalum divergens* in Malta (UTM, zone 33S, 1 km x 1 km grid)

Because of the overall small population size of *O. divergens* in Malta and because of its potential value as an ornamental *ex-situ* propagation measures could play an important part in its conservation. Propagation by bulbils or by seeds as well as micropropagation has been suggested. In *O. divergens* the bulb is surrounded by dormant bulbils (Tutin *et al.* 1980) which could be removed and cultivated. An attempt by SVL to check for seeds in the Girgenti population in June 2006 failed since the plants could not be located any more due to the dense vegetation. It is not clear if the species produces viable seeds in Malta or if it depends only on propagation by bulbils.

ACKNOWLEDGEMENTS

The authors are indebted to Denise-Ann Buhagiar and Joseph Buhagiar for their help with the Argotti herbarium and for the information about the species.

REFERENCES

Borg, J. (1927) *Descriptive Flora of the Maltese Islands.* Malta: Government Printing Office, 846pp

Caruana Gatto, A. (1890) Liliacee Maltesi – loro enumerazione – osservazioni e aggiunte. *Il Naturalista Maltese* **1**(2): 16-18. Malta

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NOTES ON THE IMPACT OF THE BLACK RAT (*RATTUS RATTUS* L.) ON THE FLORA AND FAUNA OF FUNGUS ROCK (MALTESE ISLANDS)

Arnold Sciberras [1] & Sdravko Vesselinov Lalov [2]

ABSTRACT

Recently the presence of the black rat *Rattus rattus* was reported from the island of Fungus Rock which houses a remarkable flora and fauna and has been a protected site for over 250 years. A preliminary account of the rat's impact on some Fungus Rock species is given and threats to the island's ecosystem are discussed.

INTRODUCTION

In the early 18th century the Island of Fungus Rock was made a protected site by the knights of St. John in order to guard the economically important species *Cynomorium coccineum* L., the Maltese Fungus. As early as 1800 the British authorities reconfirmed its protected status (Lanfranco 1961). Today Fungus Rock is a strictly protected nature reserve under Government Notice No. 223 of 2005 and access is only permitted for scientific purposes. Because of that protection and since access is extremely difficult the site has remained quite undisturbed for centuries. Apart from its archaeological and historical value this island houses a number of important and rare species, one of them endemic to Fungus Rock and some endemic to the Maltese islands. Among the most important are the largest population of *Cynomorium coccineum* in the Maltese islands, a population of *Helichrysum melitense* (Pignatti) Brullo, Pavone & Ronsisvalle which is endemic to the Dwejra and Fungus Rock area, populations of the Maltese endemics *Cremnophyton lanfrancoi* Brullo & P. Pavone and *Darniella melitensis* (Botsch.) Brullo, *Podarcis filfolensis generalensis* Gulia which is endemic to Fungus Rock, the Maltese endemics *Muticaria macrostoma oscitans* Charpentier and *Trochoidea spratti* Pfeiffer and a breeding colony of *Calonectris diomedea* Scopoli (www.mepa.org.mt).

The presence of the Black rat *Rattus rattus* L. on Fungus Rock and some damage caused by the rats to the avifauna of the island and to *Cynomorium coccineum* were reported for the first time by Borg & Sultana in 2003. Various species of rats are known to be among the exotics most damaging to island flora and fauna. Since island communities often lack mammalian predators and grazers, island species may succumb rapidly once such exotic species are introduced (Primack 1998). Being aware of the exceptional value of Fungus Rock and of the threat originating from the rats the authors decided to publish their own observations on the rat's impact on the island.

Fig. 1: C. coccineum destroyed by rats (June 2006) © SVL

Fig. 2: L. arborea heavily damaged by rats (March 2007) © SVL

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Impact upon the flora:

During a floristic survey of Fungus Rock in June 2006 traces of nibbling caused by rats were recorded from six plant species (Table 1). No other animal on the island leaves similar tooth marks. Animal damage to two other species (unattached leaves and little twigs in *Darniella melitensis* and holes in a stalk of *Orobanche* sp. with missing inflorescence) was noted but could not be attributed with certainty to a particular animal.

Table 1: Percentage of plants damaged and destroyed by rats on Fungus Rock (June 2006)

Species	**% of plants affected**	**% of plants destroyed**	**affected parts**
Allium commutatum Guss.	100	100	aboveground part completely consumed
Cynomorium coccineum	40	20	flowers/ fruit eaten
Darniella melitensis	5	0	unattached leaves/twigs
Daucus sp.	2	0	stems nibbled
Lavatera arborea L.	100	60	stems of medium age consumed
Lotus cytisoides L.	70	20	sometimes leaves, sometimes skin on stems eaten
Matthiola incana (L.) R. Br. ssp. *Melitensis* Brullo, Lanf., Pav. & Ronsisv.	1	0	leaves nibbled
Orobanche sp.	100	100	holes in stalk

In March 2007 animal damage caused by rats was recorded from 8 plant species (Table 2). Numerous holes in leaves of *Matthiola incana* ssp. *melitensis* and *Urginea pancration* Nym. were attributed to insects or snails. Also, a large number of dead *Matthiola incana* ssp. *melitensis* specimens was observed but could not be linked with the presence of rats on the island.

Table 2: Percentage of plants damaged and destroyed by rats on Fungus Rock (March 2007)

Species	**% of plants affected**	**% of plants destroyed**	**affected parts**
Allium commutatum	70	10	mostly leaves nibbled, in smaller plants often bulb consumed
Cynomorium coccineum	5	5	flowers/fruit eaten in two inflorescences which seem to have flowered out of season in autumn or winter, new inflorescences not affected
Desmazeria pignattii Brullo & Pavone	30	0	spikes removed and seeds extracted
Lavatera arborea	100	60	twigs of medium age eaten
Linaria pseudolaxiflora Lojac.	40	0	tips of stems and leaves eaten
Lotus cytisoides	30	0	sometimes all leaves of single branches eaten, sometimes indiscriminate foraging of exposed parts
Sonchus oleraceus L.	40	0	leaves and buds consumed
Sonchus tenerrimus L.	60	0	leaves and buds consumed

Impact upon the fauna:

During repeated faunistic surveys of the island no particular differences in populations or species numbers were noted. However, certain traces of nibbling on various specimens indicated the presence of rats. Traces of nibbling were recorded on species of Helicidae. While many empty shells from the latter were recorded in small pockets in the rock in an average of 50 specimens per pocket, only some of the shells that were found scattered contained bite marks of rats. From 14 pockets 37 shells were attacked. Five insect species were recorded with nibbling marks: Two specimens of *Anacridium aegyptium* L. contained teeth marks in the right side of the thorax, in the pronotum (the metazona area), near the wing attachment and the costal margin and in the first 3 segments of the abdomen while one hind leg was detached and the femur devoured. One specimen was still fresh when found. One fresh specimen of *Sphingonotus coerulans* L. was found with a missing abdomen and left hind

leg. Two specimens of *Blaps gigas* L., one of them still fresh were found with missing hind legs and the latter with clear bite marks on the wing case. One specimen of *Uthetheisa pulchella* L. and two specimens of *Vanessa cardui* L. were found without abdomen and these could also be linked with the predation of *Rattus rattus* from the bite marks they contained. Egg shells and bones of juvenile *Calonectris diomedea* Scopoli in the nesting holes also contained bite marks and the large amount of footprints and faeces indicates the presence of *Rattus rattus* around the nests.
The only natural predator of the mentioned species listed above excluding *Calonectris diomedea* and *Blaps gigas* on the island is *Podarcis filfolensis generalensis* Gulia whose population seems to be stable at present. The mode of feeding of the latter species differs completely from that of *Rattus rattus* because the leftovers of *Podarcis filfolensis generalensis* such as *Sphingonotus coerulans* wings are complete, not nibbled. Traces of Hymenoptera species were also found in rat faeces along with Coleoptera limbs possibly belonging to *Blaps gigas*. There is no indication of any impact of *Rattus rattus* on *Podarcis filfolensis generalensis* at present but past studies from nearby islands show that when the *Rattus rattus* population increases to a certain extent compared to the area of the island and possibly when other food sources are exhausted, *Rattus rattus* may have a devastating impact on the local herpterofauna.

DISCUSSION

The heavy impact upon the flora observed in 2006/7 is an argument against the theory of an early introduction of the rats on Fungus Rock. In our opinion the populations of *Cynomorium coccineum, Allium commutatum* and *Lavatera arborea* could not have sustained for a long period a damage to the extent observed without disappearing completely from the island.
From observations on Selmunett Island (Maltese islands) in a period of 10 years rats had a devastating effect on the population of the endemic *Podarcis filfolensis kieselbachi* Fejervary and also on other herpetofauna such as *Hemidactylus turcicus* L. While some species of flora were affected, too we are not in a position to estimate the extent of the damage since no such evaluation on Selmunett was ever taken.
Due to lack of a permit no survey of Fungus Rock could be undertaken in October 2006 and so the damage caused to perennial plant species during the summer could not be assessed. Such an assessment is particularly important in the case of *Cynomorium* since it is suspected that the rats destroy most of the *Cynomorium* inflorescences during summer. However, in March 2007 the *Cynomorium* inflorescences from spring 2006 were too decomposed to ascertain what percentage had been affected by rats.
While all *Allium* inflorescences and leaves were found destroyed in June 2006 thus preventing sexual reproduction of the species and accumulation of sufficient resources, the excavation of *Allium* bulbs observed in March 2007 demonstrates that even established *Allium* individuals are being destroyed.
Lavatera arborea was the species most severely affected. In June 2006 all *Lavatera* individuals on the island were heavily damaged but most still showed patches of live bark. In contrast, in March 2007 60% of the *Lavatera* plants on the island were found dead. Because the remaining stumps were bleached and in an advanced stage of decomposition it can be assumed that the plants died during summer 2006. While in June 2006 several *Lavatera* plants measuring 1-1.5 m were observed in sheltered places on Fungus Rock in March 2007 the typical size of the *Lavatera* individuals on the island was 20-40 cm and all of them featured a stunned bushy growth.
On Fungus Rock bushy growth and numerous severed branch tips due to foraging were also observed in *Lotus cytisoides* and to some extent in *Linaria pseudolaxiflora, Sonchus tenerrimus* and *Desmazeria pignatii.*
The South African invasive *Oxalis pes-caprae* L. which is the most common plant species in the Maltese islands could not be recorded on Fungus Rock. One possible reason is that the species which depends only on vegetative reproduction in the Mediterranean and thus on dispersal by humans was never introduced to the island. Or an existing population could have been eradicated by the rats which feed on the succulent tubers of *Oxalis* during summer months.
An open question is the possibly more vegetarian nature of *Rattus rattus* on Fungus Rock compared to the mainland. During a two hour survey of the Dweira coast close to Fungus Rock in June 2006 all plant species (except *Cynomorium* and *Linaria*) which were damaged by *Rattus rattus* on the island were encountered. During that survey several rats were seen but the plant species which were heavily damaged on Fungus Rock showed no damage which could be attributed to rats on the mainland. One *Daucus* plant on the mainland showed traces of nibbling but the plant was associated with numerous rabbit (*Oryctolagus cuniculus* L.) droppings so the damage was attributed to rabbits.
Even on Fungus Rock signs of different feeding habits for individual rats were encountered. While red rat droppings were always seen in the neighbourhood of nibbled *Cynomorium* which contains red pigments green ones were always associated with destroyed green *Lotus cytisoides* plants suggesting that some rats use to feed on one species, some on another.
From those preliminary results it is obvious that more research on Fungus Rock and a long-term monitoring program on the impact of *Rattus rattus* on its ecosystem are required. For that reason arrangements for further visits to the site have been made with MEPA. However, there is also an urgent need for immediate rat

extermination measures on Fungus Rock. Without waiting for the results from long-term studies rat extermination on the island should begin provided that no other of the species found there will be affected.

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REFERENCES

Borg, J. J. & Sultana, J. (2003) The presence of the black rat *Rattus rattus* on Fungus Rock (Maltese Islands). *The Central Mediterranean Naturalist* **4** (1): 105-106.

Lanfranco, G. (1961) *Cynomorum coccineum* Linn., a Maltese Historical Plant. *Melita Historica* **3**(1): 53-70

Primack, R. B. (1998) *Essentials of Conservation Biology.* Sunderland: Sinauer Associates, xii+660pp

Sciberras, A. & Schembri, P. J. (2003) Observations on the population of the Maltese Wall Lizard on Il-Gzejjer ta' Selmunett (*Podarcis filfolensis kieselbachi*). Unpublished MEPA Report.

Sciberras A. (2005) Observation on the endangered population of the Maltese wall lizard of Selmunett island (*Podarcis filfolensis kieselbachi*).Unpublished work, presented to the chamber of young scientists at 4- 10th April and to the Belgian Science expo on 26 April to 1 May.

Sciberras A. (2007) Lizards at Id-Dwejra. *Dwejra Heritage Park Gozo*. Dwejra Management Board: pp28-33

Natura 2000 standard data form Dweira-Qawra Area, inkluz Hagret il-General (http://www.mepa.org.mt/environment/index.htm?nature_protection/mainpage.htm&1) accessed 15-9-2007

(Accepted September 2007)

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THE REDISCOVERY OF *ASPLENIUM TRICHOMANES* L. (FAM. *ASPLENIACEAE*) IN THE MALTESE ISLANDS. (CENTRAL MEDITERRANEAN)

Timothy J Tabone[1]

ABSTRACT

Asplenium trichomanes, last recorded during the first 2 decades of the twentieth century and thereafter thought to be extinct, was rediscovered at Fuq tal-Gruwa, Ta' Cenc area, Gozo; 15 individuals were found. The accompanying garigue vegetation occuring at the site is described. The plants found belong to the subspecies *quadrivalens*.

Asplenium trichomanes L. was recorded in the past from: Mgarr ix-Xini, Gozo (Duthie 1875, later cited by Gulia 1909, Sommier & Caruana Gatto 1915, Borg 1927, Haslam et al.
1977); Wied Babu (Gulia 1872b, later cited by Gulia 1909, Sommier & Caruana Gatto 1915, Haslam et al. 1977); Ghajn Rihana (Borg in Sommier & Caruana Gatto 1915, later cited by Haslam et al. 1977); "Gebel Sornu near Ghajn Rihana" (Borg 1927). Thereafter the species was presumed extinct (Lanfranco 1989), as it was "not seen for at least 70 years".

On the 18th October 2005 the author discovered 10 individuals of *Asplenium trichomanes* at Fuq tal-Gruwa, Ta' Cenc area, Gozo. Another 5 specimens were found at the same site the following December, bringing the total population number to 15. The site in question is a Globigerina limestone escarpment (early Miocene) at an altitude of 122 - 130m, facing North and thus well shaded throughout most of the day. The karstic landscape consists of garigue vegetation with small patches of regenerating low maquis. *Rhamnus oleioides* L., *Teucrium fruticans* L. and *Asparagus aphyllus* L. dominate in different patches; *Thymbra capitata* (L.) Cavanilles is sub-dominant. Other important accompanying species are *Lobularia maritima*
(L.) Desvaux, *Ferula communis* L., *Foeniculum vulgare* L., *Smyrnium olusatrum* L., *Prasium majus* L. and *Asphodelus aestivus* Brotero. Also present are: *Clematis cirrhosa* L., *Ranunculus bullatus* L., *Parietaria judaica* L., *Silene colorata* Poiret, *Hypericum aegypticum* L., *Erica multiflora* L., *Euphorbia peplus* ssp. *peploides* (Gouan) Rouy, *Euphorbia pinea* L., *Sedum caeruleum* L., *Umbilicus* sp., *Anthyllis vulneraria* L., *Lotus cytisoides* L., *Lotus edulis* L., *Medicago* spp., *Ruta chalepensis* L., *Linum strictum* L., *Oxalis pes-caprae* L., *Daucus carota* ssp. *carota*, *Asperula aristata* L., *Valantia muralis* L., *Olea europaea* L., *Scabiosa maritima* L., *Cuscuta epithymum* L., *Satureja microphylla* (D'Urville) Bentham, *Satureja nepeta* (L) Scheele, *Teucrium flavum* L., *Plantago lagopus* L., *Campanula erinus* L., *Aetheorrhiza bulbosa* (L.) Cassini, *Bellis sylvestris* Cyrillo, *Carlina involucrata* Poiret, *Chiliadenus bocconei* Brullo, *Dittrichia viscosa* (L.) Greuter, *Galactites tomentosa* Moench, *Hyoseris radiata* L. *Leontodon tuberosus* L., *Reichardia picroides* (L.) Rothmaler, *Sonchus oleraceus* L., *Scilla autumnalis* L., *Urginea pancration* (Steinheil) Philippe, *Catapodium rigidum* (L.) Hubbard, *Arisarum vulgare* Targioni-Tozzetti; the lichens *Cladonia convoluta* (Lamarck) Anders, *Cladonia rangiformis* Hoffmansegg, *Rochella phycopsis* E. Acharius , *Squamarina cartilaginea* (W. Withering) P.James; the mosses *Scorpiurum circinnatum* (A. Bride) A. Fleischback , *Tortella* sp. Another 2 *Filicopsida* occur in close proximity: *Adiantum capillus-veneris* L. (common) and *Anogramma leptophylla* (L.) Link (infrequent).

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Past records of *Asplenium trichomanes* did not specify the subspecies occuring. One specimen collected from the site, now conserved in the private herbarium of Mr. E. Lanfranco, has been ascribed to the subspecies *quadrivalens* D.E.Meyer (Spore size: 50 um). Photographs have also been kept in the author's collection.

Asplenium trichomanes is critically endangered in the Maltese islands, the population found being only a few metres away from building development.

The other *Aspleniaceae* also recorded from the Maltese islands are: *Asplenium ceterach* L. (very rare), *Asplenium marinum* L. (extinct), *Asplenium sagittatum* (DC.) A.J.Bange (extinct) and *Asplenium scolopendrium* L. (unsubstantiated record).

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REFERENCES:

Borg, J. (1927) *Descriptive Flora of the Maltese Islands. - Malta*: Government Printing Office, 846 pp.

Duthie, J.F. (1875) On the Botany of the Maltese Islands in 1874, Part 2. pp. 36 - 42, in: *Journal of Botany British and Foreign 1875.*

Gulia, G. (1872b). Flora, Flora Maltese. pp.64 - 72, in : *Il compagno per Tutti ("Almanacco"). Malta* : Tipografia Anglo-Maltese.

Gulia, G. 1909 : Elenco delle Pteridofite Maltesi. pp. 220 - 222, in: *Bullettino della Societa botanica italiana* (Adunanza della Sede di Firenze dell' 11 Dicembre 1909).

Haslam, S.M., Sell, P.D. & Wolseley, P.D. (1977) *A Flora of the Maltese Islands.* - Msida, Malta : Malta University Press. lxxi + 560 pp.

Lanfranco, E. (1989) The Flora. pp. 5 - 70 in : Schembri, P.J. & Sultana, J. (ed.) : *Red Data Book for the Maltese Islands.* - Malta : Department of Information.

Lanfranco, E. (1997 - revised 2001) *Vascular flora of the Maltese Islands, draft check list.* 46 pp. (unpublished).

Pignatti, S. (1997) *Flora d' Italia. Vol. I.* - Bologna, Italy : Edagricole. 790 pp.

Sommier, S. & Caruana Gatto, A. (1915) *Flora Melitensis Nova.* - Firenze, Italy : Stab.Pellas. vii + 502 pp.

Stace, C. (1991) *New Flora of the British Isles.* - England : Cambridge University Press. xxx. + 1226 pp.

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2007

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Hyles tithymali deserticola (Staudinger, 1901) - first record for the Maltese Islands (Lepidoptera: Sphingidae)

A. Catania

Abstract

The presence of *Hyles tithymali deserticola* (Staudinger, 1901) is recorded for the first time from the Maltese archipelago.
KEYWORDS: Lepidoptera, Sphingidae, *H. tithymali deserticola*, new record, Malta.

Hyles tithymali deserticola **(Staudinger, 1901) - primera cita para Malta (Lepidoptera: Sphingidae)**

Resumen

Se cita por primera vez para Malta a *Hyles tithymali deserticola* (Staudinger, 1901).
PALABRAS CLAVE: Lepidoptera, Sphingidae, *H. tithymali deserticola*, nueva cita, Malta.

Introduction

The genus *Hyles* Hübner, 1819, in the Maltese Islands is represented by *Hyles livornica* (Esper, 1779), a notorious migratory species and which generally breeds here as well, and the endemic *Hyles sammuti* (Eitschberger, Danner & Surholt, 1998) (SAMMUT, 2000).

Material examined

MALTA, 1 ♀, Pembroke, 15-IV-2007, leg A. & C. Catania (in coll. Catania); 1 ♂, Dingli, Dingli Cliffs, 23-IV-2007, leg A. Catania (in coll. Catania); 1 ♂, Rabat, Dwejra, 25-IV-2007, leg. J. Agius (in coll. Agius).

All three specimens where recorded at UV light at about 10.00 pm. During the week that these specimens were recorded, the Maltese Islands witnessed a strong and sustained migration of *Hyles livornica*. A very small number of *Hyles sammuti* was also recorded at light. This is usual for the species in the Maltese Islands to produce a small brood from overwintering pupae, with majority of the pupae hatching during September-October.

Initial comparison of the three specimens with the very good illustrations in DANNER *et al.*, (1998) suggested that they belong to *Hyles tithymali deserticola.* Confirmation in this respect was done from digital images of the specimens by Mr. Tony Pittaway, Dr. Ian Kitching and Dr. Anna Hundsdoerfer.

Conclusion

The three specimens for *Hyles tithymali deserticola* recorded here must have reached the Maltese Islands with migrating *Hyles livornica* from the North African coast. This is suggested by the fact that

the three specimens where [a] recorded during a heavy and sustained migration of *Hyles livornica*, [b recorded from different and quite distant localities and [c] no early stages of the newly recorded sub species have ever been recorded.

According to Mr. Pittaway the taxon *Hyles sammuti* represents a fertile hybrid between *Hyle euphorbiae* (Linnaeus, 1758) and *Hyles tithymali* (Boisduval) (PITTAWAY, 1997-2007). This conclu sion is supported by mt DNA work of HUNDSDORFER *et al.* (2005), it is yet to be ascertained, if th population of the *Hyles euphorbiae*-complex (HEC) on Sicily is also classified as *Hyles sammuti*. Thi is only known from a single specimen taken from Zafferana. Hopefully, further genetic research wi help elucidate the relationships within the HEC.

However it should be noted at this stage that, except for the three specimens of *H. tithymali deser ticola, H. tithymali* or any of its subspecies have never been recorded from Malta. If hybridisation too place, when did this happen and did Malta have typical *H. euphorbiae*? It is important to note that sinc the 1850's, when Lepidoptera started being studied locally, no *H. tithymali* was ever recorded in Malt The zone of hybridization between these two species run along the Mediterranean from Crete, throug southern Italy, Sicily, Malta (Pittaway and Kitching pers. comm). Mr. Tony Pittaway's hypothesis i that with the effect of global warming the Mediterranean region is getting warmer and this hybrid zon is thus pushed further north. *Hyles tithymali* is a much more drought resistant and heat tolerant specie than *Hyles euphorbiae* .The overall effect would be that more desert species will eventually colonize the Mediterranean and the Maltese archipelago.

If *Hyles tithymali deserticola* becomes a regular visitor in larger numbers and eventually settles a a breeding resident species, *H. sammuti* and *H. t. deserticola* would interbreed with the result that *H. sammuti*, which is less heat tolerant, would be replaced by *H. t. deserticola*.

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I would like to thank Mr. Paul Sammut of Rabat, Malta for this comments and suggestions, M Jonathan Agius for allowing me to use the data of the specimen he recorded and to my father M Charles Catania of Pembroke, Malta for his constant encouragements and setting up a light trap. would also like to thank Mr. Tony Pittaway, Dr. Ian Kitching and Dr. Anna Hundsdoerfer for confirm ing the identity of the new subspecies and for their useful comments. Finally thanks also go to Dr. An tonio Vives for providing the Spanish translation.

BIBLIOGRAPHY

DANNER, F., EITSCHBERGER, U., & SURHOLT, B., 1998.– Die Schwärmer der westlichen Palaearktis.– *Her bipoliana*, **4**(1): 1-368; **4**(2): 1-772.

HUNDSDOERFER, A. K., KITCHING, I, J. & WINK, M., 2005.– The phylogeny of *Hyles euphorbiae* comple (Lepidoptera: Sphingidae). Molecular evidence from sequence data and ISSR-PCR fingerprints.– *Organism Diversity & Evolution*, **5**(3): 173-198. http://www.elsevier.de/ode. accessed 16th. July 2007.

PITTAWAY, A. R., 1993.– *The Moths of the Western Palaearctic*: 240 pp. Harley Books & Natural History Museun London.

PITTAWAY, A. R., 1997-2007.– *Sphingidae of the Western Palaearctic*. http://tpittaway.tripod.com/sphinx/list.htm Accessed 16th. July 2007.

SAMMUT, P., 2000.– *Kullana Kulturali 12 - Il-Lepidoptera*: X + 246 pp. Pubblikazzjoni Indipendenza, Malta.

A. C.
Rama-Rama Plot 2
Triq Mons. A. Cili
Zebbug ZBG 04
MALTA / *MALTA*

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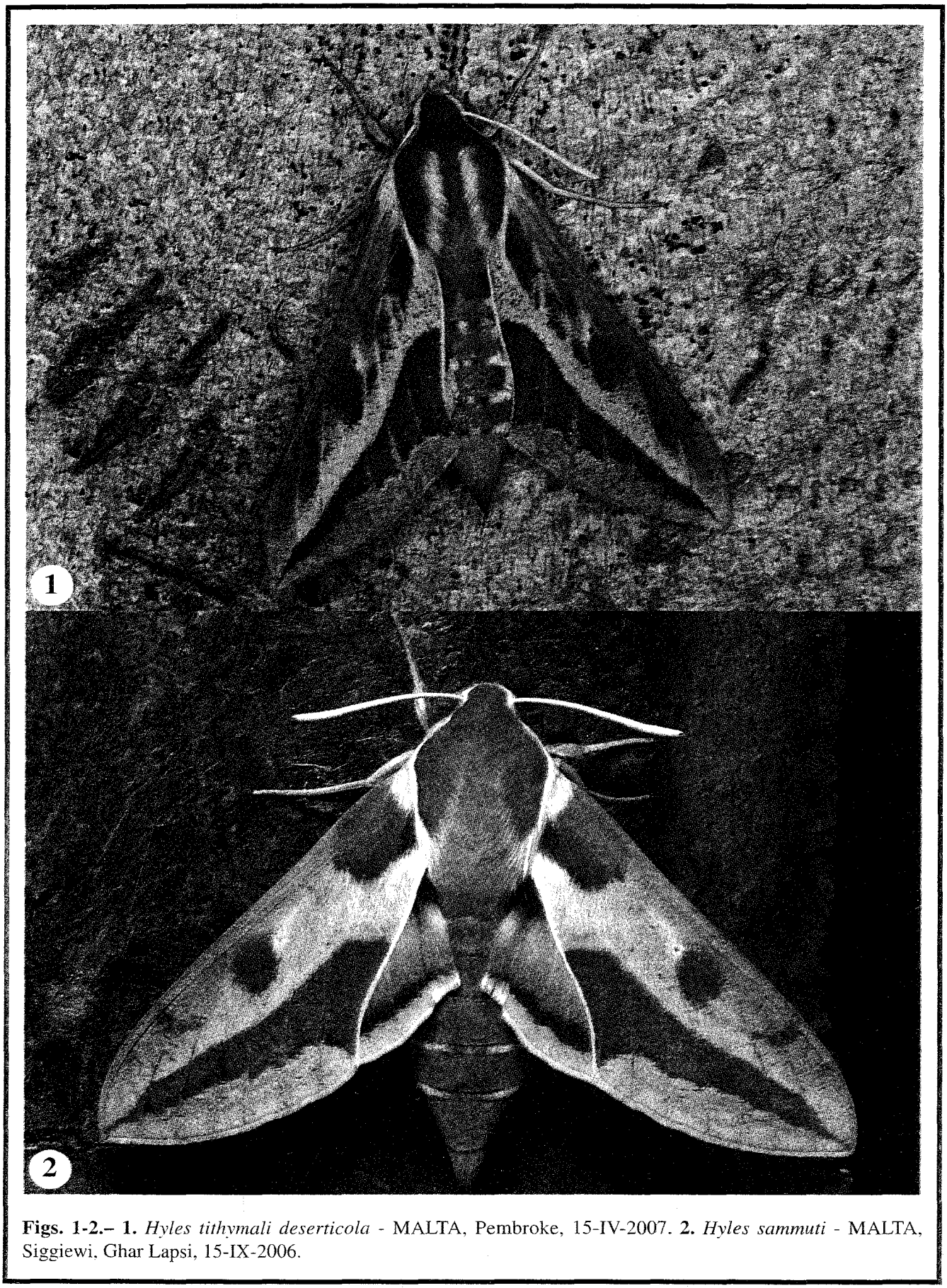

Figs. 1-2.– 1. *Hyles tithymali deserticola* - MALTA, Pembroke, 15-IV-2007. **2.** *Hyles sammuti* - MALTA, Siggiewi, Ghar Lapsi, 15-IX-2006.

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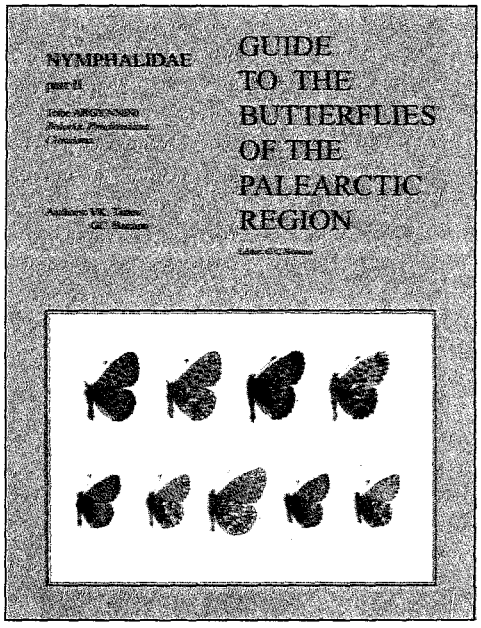
REVISION DE PUBLICACIONES
BOOK REVIEWS

V. K. Tuzov & G. C. Bozano
Guide to the Butterflies of the Palearctic Region: Nymphalidae II
72 páginas
Formato 29'5 x 21 cm
Omnes Artes, Milano, 2006
ISBN: 88-87989-07-9



Una nueva entrega de esta interesante serie conocida como *Guide to the Butterflies of the Palearctic Region* acaba de aparecer, concretamente se trata de la segunda parte de los Nymphalidae, estudiándose la Tribu Argynnini Duponchel, 1835 y dentro de ella los géneros *Boloria* Moore, [1900], *Proclossiana* Reuss, 1921 y *Clossiana* Reuss, 1920.

Se tratan dieciséis especies del género *Boloria*, a saber: *pales, pyrenesmiscens, alaskensis, eupales, napaea, altaica, frigidalis, purpurea, generator, palina, graeca, caucasica, sipora, aquilonaris, banghaasi, roddi* y *sifanica*. Una especie del género *Proclossiana*r: *eunomia* y veintiuna especies del género *Clossiana*: *selene, perryi, euphrosyne, iphigenia, selenis, oscarus, titania, chariclea, angarensis, thore, dia, erubescens, jerdoni, frigga, improba, freija, polaris, erda, tritonia, matveevi* y *gong*.

De todas y cada una de las especies, nos presentan la descripción original, así como de todas las sinonimias consideradas, al igual que ocurre, con las subespecies que los autores consideran como válidas en este trabajo. También nos encontramos con las principales características que nos permiten diagnosticarlas, datos sobre la morfología de la genitalia del macho, interesantes notas taxonómicas, datos sobre su distribución (que podemos ver en un mapa de la región Paleártica) y las principales referencias bibliográficas consideradas.

Es importente destacar, que se presentan excelentes fotografías de los ejemplares, no sólo de la especie original, sino de un gran número de subespecies consideradas, así como la genitalia masculina procedente de trabajos de diferentes autores.

Termina la obra con una muy detallada bibliografía específica, que recoge todas las referencias contempladas a lo largo del trabajo y que consideramos imprescindibles en su conjunto.

No podemos terminar estas líneas, sobre este excelente trabajo y de la que ya podemos considerar como una serie clásica sin felicitar al Editor por el gran esfuerzo de tan importante trabajo, así como a la Editorial una vez más, por su dedicación en publicar esta obra básica, que no debe de faltar en ninguna biblioteca que se precie, tanto institucional como particular.

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